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A Viscous/Potential Flow Interaction Analysis Method for Multi-Element Infinite Swept Wings

Volume II

By

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for

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APPENDIX IV

PROGRAM INPUT DESCRIPTION

DATA CARDS

Card Set	Input	Format
1.	Case Title	8A10
2.	XXFIND, XPHIL, TOLL1, TOLL2, XSOLVE, XGEM	7F10.0
3.	XFIND(1), XFIND(2) - - - - XFIND(NXFIND)	7F10.0
4.	RNB, TRIPUP, OPTION, SANGLE, TRMAX, REFC, UIN	7F10.0
5.	XPRINT, XSKIP, REFX, REFZ, CREF, PRINT, CASE	7F10.0
6.	NCMPT, NSLAT, NFLAP, NPU(1), NPL (1),NPU(NCMPT), NPL(NCMPT)	14I5
7.	XU(1) , XU(2) - - - XU(NPU(1)) ZU(1) , ZU(2) - - - ZU(NPU(1)) XL(1) , XL(2) - - - XL(NPL(1)) ZL(1) , ZL(2) - - - ZL(NPL(1))	7F10.0
	' ' ' ' ' '	
	XU(1) , XU(2) - - - XU(NPU(NCMPT)) ZU(1) , ZU(2) - - - ZU(NPU(NCMPT)) XL(1) , XL(2) - - - XL(NPL(NCMPT)) ZL(1) , ZL(2) - - - ZL(NPL(NCMPT))	7F10.0
8.	XPW(1) , ZPW(1) - - - XPW(NCMPT-1), ZPW(NCMPT-1)	7F10.0
9.	XPC(1) , ZPC(1) - - - XPC(NCMPT-1), ZPC(NCMPT-1)	7F10.0
10.	DELF(1) , - - - DELF(NCMPT-1)	7F10.0
11.	SIGMA	7F10.0
12.	MACH, ALPHA	7F10.0
13.	DX, DXMAX, Z, TRIP	7F10.0
14.	-1.	7F10.0
15.	6/7/8/9	

The input to Program VIP is described in the following section.

CARD 1:

Title card, all 80 characters may be used.

CARD 2:

Field 1-10: XXFIND, Number of print locations on flap upper surface. If XXFIND = 0. CARD 3 is not required.

Field 11-20: XPHIL, Iteration number on which flap boundary layer velocity distributions are printed.

Field 21--30; TOLL1, Convergence criterion tolerance on Lift coefficient, .005 < TOLL1 < .015.

Field 31-40: TOLL2, Convergence criterion tolerance for iterative matrix inversion method, TOLL2 = .01.

Field 41-50: XSOLVE, Specifies matrix solution technique, XSOLVE = 0., direct; XSOLVE = 1., iterative.

Field 51-60: XGEM, Geometry printout option, if XGEM = 0., a complete calculation is performed; if XGEM = 1., only the lofted geometry is printed and the calculation is terminated.

CARD 3:

XFIND(1), XFIND(2) etc, X coordinates of print stations for flap velocity distributions, input in flap coordinates. This card not required if XXFIND = 0.

CARD 4:

Field 1-10: RNB, Reynolds number based on Reference Chord and Free stream velocity $U_\infty C/\nu$ x (10^{-6}).

Field 11 - 20: TRIPUP, Trip location (x/c), Currently if tripping is desired, each surface of each element will be tripped at the same location. If tripping is not desired TRIPUP = 1.

Field 21 - 30: OPTION, Trip option, OPTION = 1., This deters the user from specifying a trip location where the boundary layer could not (because of the Reynolds number) become turbulent. If too early a trip location is specified, the location is repositioned to correspond to the point where R_θ exceeds 200.

Field 31 - 40: SANGLE, Sweep angle in degrees.

Field 41 - 50: TRMAX, Maximum number of iterations between potential flow and boundary layer modules. The convergence criterion in the program will reset this parameter to a smaller number if for the particular angle-of-attack convergence is achieved.

Field 51 - 60: REFC, Reference chord in inches. This is required for determination of surface arc distances in INSPAN.

Field 61 - 70: UIN, Free stream velocity in feet per second. This is required in INSPAN.

CARD 5:

Field 1 - 10: XPRINT, Print option for swept case, prints cross-flow integral thicknesses from IBL.

XPRINT = 0. printing suppressed

XPRINT = 1. extra printing

Field 11 - 20: XSKIP, Print option for IBL, XSKIP = 1., every integration step is printed; XSKIP = 5. (usual value) every fifth step is printed.

Field 21 - 30: REFX, Reference (x/c) location for calculation of moment coefficient.

Field 31 - 40: REFZ, Reference (z/c) location for calculation of moment coefficient.

Field 41 - 50: CREF, Reference chord for aerodynamic force calculations. If geometry input in percent then CREF = 100. Normally CREF = 1.

Field 51 - 60: PRINT, Optional diagnostic printing for potential flow routines
PRINT = 0. printing suppressed,
PRINT = 1. extra printing.

Field 61 - 70: CASE, specifies number of angle of attack or Mach number variations for a given geometry. Number of CARD Sets 12 and 13 must be repeated to coincide with the value of CASE. If NFLAP = 0, then CARD sets 11 and 13 are not required.

CARD 6

Field 1-5: NCMPT, number of components in configuration (i.e., slat, main element, double slotted flap, NCMPT = 4). If NCMPT = 1, Card sets 8, 9, 10, 11, and 13 are not required.

Field 6-10: NSLAT, number of slats in configuration.

Field 11-15: NFLAP, number of slotted flaps, currently the maximum allowed is 2. If NFLAP = 0, then Card sets 11 and 13 are not required.

Field 16-20: NPU(1), number of x,z coordinates describing the upper surface of component one. (Limit = 30)

Field 21-25: NPL(1), number of x,z coordinates describing the lower surface of component one. (Limit = 30)

Note: If more than one element is being considered, then the parameters NPU, and NPL are specified for each element in turn in the remaining fields 26 - 70.

CARD SET 7:

- XU(1), XU(2) - - - etc., coordinates x/c of upper surface of element number one (NPU(1) points)

- ZU(1), ZU(2) - - - etc., coordinates z/c of upper surface of element number one (NPU(1) points)

- XL(1), XL(2) - - - etc., coordinates x/c of lower surface of element number one (NPL(1) points)

- ZL(1), ZL(2) - - - etc., coordinates z/c of lower surface of element number one (NPL(1) points).

NOTE: This card set is repeated to correspond to the input of elements two, three and four if present.

CARD 8:

XPW(1), ZPW(1) etc., X and Z coordinates of flap or slat pivot points in wing coordinates. Points listed in order, i.e., slat first. If NCMPT = 1, this card is not required.

CARD 9:

XPC(1), ZPC(1), etc., X and Z coordinates of flap or slat pivot points in component coordinates. If NCMPT = 1, this card is not required.

CARD 10:

DELF(1), etc., flap or slat rotation angles in degrees; clockwise positive. If NCMPT = 1, this card is not required.

CARD 11:

SIGMA, tension factor in splines under tension routines. Suggest SIGMA = -10. If NFLAP = 0, this card is not required.

CARD 12:

Field 1 - 10: MACH, free stream Mach number.

Field 11 - 20: ALPHA, angle-of-attack in degrees. If CASE > 1. then CARD 12 must be repeated the number of times specified by CASE.

CARD 13:

Field 1 - 10: DX, initial Δx step size for solution of partial differential equation in INSPAN. Suggest Δx = .00015625.

Field 11 - 20: DXMAX, maximum Δx step size allowed in INSPAN. Suggest DXMAX $\leq$ .03.

Field 21 - 30: Z, Print parameter for velocity profile output in INSPAN. $25 \leq Z \leq 1000$, printout of first and last calculated profiles is a default option regardless of value of Z. If print option XPHIL is employed then Z should be set at 1500 to avoid excess printout.

Field 31 - 40: TRIP, trip location on flap upper surface (input option) TRIP specified in flap coordinates x/c.

NOTE: If NFLAP = 2, then CARD 13 must be repeated a second time to account for the second flap.

CARD 14:

Field 1 - 10: -1. Indicates end of data, program exits.

CARD 15:

6/7/8/9 card END-OF-JOB.

APPENDIX V

PROGRAM OUTPUT DESCRIPTION

A sample program output for an infinite swept wing calculation of a wing-slotted flap configuration is shown in the following pages. Briefly the output consists of the following in the order of its appearance;

-The configuration title followed by a summary table of the input and lofted geometry. If NFLAP > 0 the longitudinal radius of curvature for each flap upper surface is tablulated (R/C). This is followed by a summary of input conditions (Mach No., Angle of Attack, Sweep Angle, Iteration No.).

-The input airfoil geometry, calculated pressure coefficients and source strengths are tabulated for each surface of each component of the configuration.

-The incompressible boundary layer calculations for a particular surface are printed out, preceded by a summary giving the Reynolds No., Sweep Angle, Iteration No., and Surface. The printout includes the x/c coordinates, and arc length s/c which for a swept case is the streamwise distance measured from the stagnation point. The velocity U_s/U_∞ corresponds to the calculated s/c, as does the shape factor H, the boundary layer thickness δ, the momentum thickness θ, the angle β, the momentum thickness Reynolds No. R_θ, and the skin friction coefficient C_f in the resultant surface flow direction.

-If the turbulent boundary layer printout is preceeded by a laminar boundary layer summary table, the table includes all of the parameters in the turbulent printout with the exception of the parameters δ, β, and R_θ, and includes the additional parameter du/ds, the pressure gradient.

-If optional printing of the integral cross-flow thicknesses is requested, the printout includes x/c, s/c, du/ds, the angle α, (the angle between the normal chord and the projection of the external streamline on the surface) the integral thicknesses δ_2^*, θ_{12}, θ_{21} and θ_{22}, and the streamwise skin friction coefficient C_f.

-A summary table is printed at the end of each boundary layer printout, and includes the lift coefficient of the overall configuration, the skin friction drag, pressure drag and total profile drag of the particular surface, and the moment coefficient of the configuration. The boundary layer printout is repeated for successive surfaces.

-If NFLAP > 0, that portion of the integral boundary layer development in the slot region on the flap upper surface is also printed with the same format as for other component surfaces.

-The slot exit point, flap upper surface transition point and the flap boundary layer thickness s/c at the slot exit are displayed. The non-dimensional streamwise velocity profile U_s/U_∞ is also displayed for reference.

-The boundary layer development over the flap upper surface from the slot exit rearward is printed out at specified stations. The initial input to Program INSPAN is displayed as profile number one. The printout includes a summary list giving the current values of the arc length (x) measured from the stagnation point, as well as current values of the following parameters:

x step size Δx (DX)
boundary layer thickness δ (DELTA)
displacement thickness δ^* (DELS)
momentum thickness θ (THETA)
shape factor H
velocity defect U_d (UD)
local free stream velocity U
friction velocity U_τ (UTAU)
skin friction coefficient $C_f/2$ by three different calculations (CF2(1), CF2(2), CF2(3))
iteration number for implicit solution of finite difference equations (ITR)
profile number (PRF. NO.)
longitudinal radius of curvature (R(3))

The tabulated parameters spanwise velocity W/W_e, chordwise velocity U/U_e, linearized velocity UP, velocity gradient DU/DY, normal velocity V, eddy viscosity, EDDY, pressure gradient, P-GRAD and inviscid velocity, U-INVISCID are printed out as functions of the distance normal to the surface y/c. For swept wing cases a second tabulation is also presented. This table includes the resultant velocity UR, the angle BETA, the streamwise velocity US and the cross-flow velocity WC.

Other parameters also displayed include the surface value of angle β (CBETA), the skin friction components CFR in the resultant surface flow direction, CFS in the streamwise direction and CFC in the cross flow direction. Also printed out are the streamwise values of the shape factor H, the displacement thickness δ^* and the momentum thickness θ.

NOTE: The values of H, δ^* and θ displayed as part of the main summary table preceding the velocity profile printout are for the inner part of the velocity profile to U_{max}. These values are used in the calculation of the eddy viscosity profile.

Finally, for the last profile on the flap surface the values of H, δ^* and θ are given as are values of the lift and drag coefficients.

The printing procedure is repeated for each iteration with the exception that the integral boundary layer tables are deleted until the final iteration. At the end of the calculation a brief table summarizes the lift drag and moment coefficients as functions of the interation number.

***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

AIRFOIL GEOMETRY

COMPONENT = 1

UPPER SURFACE COORDINATES

INPUT		LOFTED	
X-IN	Z-IN	X-OUT	Z-OUT
-.00599	-.02224	-.00599	-.02224
-.00398	-.01758	-.00398	-.01758
-.00157	-.01385	-.00157	-.01385
.00216	-.00959	.00216	-.00959
.00599	-.00608	.00599	-.00608
.00972	-.00307	.00972	-.00307
.01883	.00307	.01883	.00307
.02793	.00981	.02793	.00881
.03716	.01385	.03716	.01385
.05585	.02319	.05585	.02319
.07469	.03175	.07469	.03175
.09357	.03933	.09357	.03933
.11270	.04635	.11270	.04635
.12120	.04911	.12120	.04911
.12984	.05000	.12984	.05000
.15018	.05483	.15018	.05483
.17023	.05775	.17023	.05775
.21027	.06261	.21027	.06261
.25023	.06647	.25023	.06647
.32980	.07113	.32980	.07113
.37006	.07203	.37006	.07203
.44982	.07128	.44982	.07128

.48983	.06958	.48983	.06958
.56924	.06439	.56924	.06439
.62706	.05922	.62706	.05922
.74952	.04439	.74952	.04439
.78939	.03857	.78939	.03857
.82473	.03325	.82473	.03325
.85820	.02783	.85820	.02783
.87004	.02582	.87004	.02582

LOWER SURFACE COORDINATES

INPUT		LOFTED	
X-IN	Z-IN	X-OUT	Z-OUT
-.00599	-.02224	-.00599	-.02224
-.00422	-.03142	-.00422	-.03142
-.00038	-.03483	-.00038	-.03483
.00412	-.03722	.00412	-.03722
.00886	-.03901	.00886	-.03901
.01340	-.04019	.01340	-.04019
.01842	-.04129	.01842	-.04129
.02708	-.04278	.02708	-.04278
.03746	-.04418	.03746	-.04418
.04809	-.04532	.04809	-.04532
.08880	-.04789	.08880	-.04789
.12982	-.04882	.12982	-.04882
.16995	-.05201	.16995	-.05201
.21000	-.05742	.21000	-.05742
.24986	-.06182	.24986	-.06182
.28986	-.06486	.28986	-.06486
.36992	-.06774	.36992	-.06774
.40998	-.06756	.40998	-.06756

.49016	-.06251	.49016	-.06251
.53029	-.05835	.53029	-.05835
.59296	-.05028	.59296	-.05028
.60978	-.02750	.60978	-.02750
.62852	-.01071	.62852	-.01071
.65868	.00478	.65868	.00478
.69150	.01482	.69150	.01482
.72402	.02117	.72402	.02117
.79118	.02597	.79118	.02597
.82601	.02561	.82601	.02561
.85978	.02388	.85978	.02388
.87004	.02304	.87004	.02304

COMPONENT = 2

UPPER SURFACE COORDINATES

INPUT		LOFTED	
X-IN	Z-IN	X-OUT	Z-OUT
0.00000	-.04147	.82704	-.01167
.00265	-.03517	.83248	-.00754
.01020	-.02561	.84380	-.00303
.01794	-.01747	.85458	.00014
.02780	-.00922	.86724	.00236
.03764	-.00275	.87900	.00304
.04843	.00258	.89101	.00226
.05935	.00661	.90248	.00029
.07115	.00958	.91418	-.00303
.08393	.01197	.92645	-.00735
.09492	.01392	.93694	-.01116
.11378	.01675	.95469	-.01814

.13926	.02006	.97841	-.02801
.17027	.02264	1.00655	-.04128
.20413	.02381	1.03646	-.05720
.24172	.02303	1.06863	-.07667
.28080	.02039	1.10115	-.09850
.31579	.01644	1.12948	-.11941
.35536	.00986	1.16046	-.14490
.37640	.00553	1.17651	-.15917
.39053	.00242	1.18719	-.16893
.40000	0.00000	1.19419	-.17576

LOWER SURFACE COORDINATES

INPUT		LOFTED	
X-IN	Z-IN	X-OUT	Z-OUT
0.00000	-.04147	.82704	-.01167
.00954	-.04778	.83215	-.02190
.03199	-.04447	.85324	-.03026
.05701	-.04094	.87668	-.03972
.08426	-.03686	.90232	-.04981
.11373	-.03261	.92996	-.06086
.14616	-.02803	.96034	-.07311
.19625	-.02161	1.00693	-.09260
.24192	-.01528	1.04964	-.10995
.29008	-.00967	1.09416	-.12917
.33604	-.00494	1.13632	-.14805
.36932	-.00211	1.16656	-.16224
.38828	-.00010	1.18399	-.16998
.40000	0.00000	1.19419	-.17576

RADIUS OF CURVATURE ON FLAP UPPER SURFACE

X-COORD	Z-COORD	RADIUS
.82704	-.01167	-5.5420E-02
.83248	-.00754	-6.1597E-02
.84320	-.00303	-8.4486E-02
.85458	.00014	-1.2142E-01
.86724	.00236	-1.0316E-01
.87900	.00304	-1.0120E-01
.89101	.00226	-1.0663E-01
.90248	.00029	-1.1916E-01
.91418	-.00303	-2.0918E-01
.92645	-.00735	-5.6886E-01
.93694	-.01116	-7.6421E-01
.95469	-.01814	-7.9884E-01
.97841	-.02801	-7.1299E-01
1.00655	-.04128	-6.4833E-01
1.03646	-.05720	-6.8934E-01
1.06863	-.07667	-7.9601E-01
1.10115	-.09850	-7.8355E-01
1.12948	-.11941	-7.8651E-01
1.16046	-.14490	-8.7719E-01
1.17651	-.15917	-7.4471E-01
1.18719	-.16893	-4.2277E-01
1.19419	-.17576	-2.6866E-01

AIRFOIL GEOMETRY AND SURFACE PRESSURE DISTRIBUTIONS

MACH NO. = .11500 ANGLE OF ATTACK = 5.60000 SWEEP ANGLE = 25.00000 ITERATION = 7

COMPONENT = 1 SURFACE = 1

X INPUT	Z INPUT	PRESSURE COEFFICIENT	SOURCE STRENGTH
.04809	-.04532	.99370	-.00488
.03746	-.04418	.97367	.00230
.02708	-.04278	.89911	.00098
.01842	-.04129	.75129	-.00011
.01340	-.04019	.51711	-.00008
.00886	-.03901	.11020	.00035
.00412	-.03722	-.72030	.00109
-.00038	-.03483	-2.71232	.00227
-.00422	-.03142	-6.08003	.00406
-.00599	-.02224	-9.87957	.00844
-.00398	-.01758	-9.95160	.00833
-.00157	-.01385	-8.60012	-.00110
.00216	-.00959	-7.55411	.00632
.00594	-.00608	-6.76042	.01672
.00972	-.00307	-5.92565	.01563
.01883	.00307	-5.08371	.01230
.02793	.00881	-4.60257	.01121
.03716	.01385	-4.19511	.00933
.05585	.02319	-3.84815	.00642
.07469	.03175	-3.70902	.00451
.09357	.03933	-3.69973	.00082
.11270	.04635	-4.03375	.00254
.12120	.04911	-4.03835	.01595
.12984	.05000	-3.47788	.01999
.15018	.05483	-3.22685	.00991
.17023	.05775	-2.99701	.00986
.21027	.06261	-2.63236	.00934
.25023	.06647	-2.37362	.00669
.32980	.07113	-2.17225	.00632
.37006	.07203	-2.01647	.00615
.44982	.07128	-1.87818	.00633
.48983	.06958	-1.75362	.00647
.56924	.06439	-1.63571	.00628
.62706	.05922	-1.49958	.00608
.74952	.04439	-1.37795	.00519
.78939	.03857	-1.32358	.00526
.82473	.03325	-1.29157	.00449
.85820	.02783	-1.26126	.00460
.87004	.02582	-1.25053	.00466

COMPONENT = 1 SURFACE = 2

X INPUT	Z INPUT	PRESSURE COEFFICIENT	SOURCE STRENGTH
.04809	-.04532	.99370	-.00638
.08880	-.04789	.96285	.00116
.12982	-.04882	.91213	.00057
.16995	-.05201	.86065	.00060

.21000	-.05742	.80029	-.00017
.24986	-.06182	.74040	.00076
.28986	-.06486	.68241	.00230
.36992	-.06774	.62198	-.00034
.40998	-.06756	.57955	.00355
.49016	-.06251	.56136	-.00325
.53029	-.05835	.50366	.01317
.59296	-.05028	.53553	.00742
.60978	-.02750	.73589	.02083
.62852	-.01071	.85826	.03274
.65868	.00478	.85761	.03274
.69150	.01482	.84138	.03274
.72402	.02117	.80553	.02669
.79118	.02597	.66928	.01441
.82601	.02561	.21879	.00805
.85978	.02388	-.55664	.00188
.87004	.02304	-.79224	.00000

COMPONENT = 2 SURFACE = 3

X INPUT	Z INPUT	PRESSURE COEFFICIENT	SOURCE STRENGTH
.85324	-.03026	.93457	.00053
.83215	-.02190	.92298	-.01528
.82704	-.01167	.40195	-.00131
.83249	-.00754	-.17074	.00395
.84380	-.00303	-.41703	.00366
.85458	.00014	-.87932	.00255
.86724	.00236	-1.46592	.00297
.87900	.00304	-1.98420	.00753
.89101	.00226	-2.28443	.01220
.90248	.00029	-2.31430	.01671
.91418	-.00303	-2.09169	.02142
.92645	-.00735	-1.82404	.02646
.93694	-.01116	-1.64000	.03079
.95469	-.01814	-1.48347	.03618
.97841	-.02801	-1.33169	.04814
1.00655	-.04128	-1.16406	.06020
1.03646	-.05720	-.96155	.07333
1.06863	-.07667	-.73663	.08790
1.10115	-.09850	-.52016	.10308
1.12948	-.11941	-.30370	.11673
1.16046	-.14490	-.09006	.13228
1.17651	-.15917	.07242	.14060
1.18719	-.16893	.21615	.14621
1.19419	-.17576	.31021	.15000

COMPONENT = 2 SURFACE = 4

X INPUT	Z INPUT	PRESSURE COEFFICIENT	SOURCE STRENGTH
.85324	-.03026	.93457	-.02012
.87668	-.03972	.84384	.00254
.90232	-.04981	.80092	.00156
.92996	-.06086	.76470	.00096
.96034	-.07311	.72408	.00202
1.00693	-.09260	.67814	.00083
1.04964	-.10995	.63542	.00073

1.09416	-.12917	.59001	-.00047
1.13632	-.14805	.53693	.00054
1.16656	-.16224	.49758	.00255
1.18399	-.16998	.48060	.00081
1.19419	-.17576	.47067	.00044

****

COMPONENT	LIFT COEFFICIENT	MOMENTUM COEFFICIENT
1	2.52657	-.23536
2	.60474	-.45314

****

LAMINAR SEPARATION

INCOMPRESSIBLE BOUNDARY LAYER CALCULATIONS

***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

RE	SWEEP ANGLE	ITERATION	SURFACE
3.800E+06	2.500E+01	7	1

LAMINAR BOUNDARY LAYER DEVELOPMENT

I	X	S	US	DU/DS	H	THETAS	CFS
1	.0481	0.0000	4.3001E-01	6.6657E-01	4.6440E+00	1.3245E-04	0.
6	.0240	.0586	5.6949E-01	9.3880E+00	2.1288E+00	6.8610E-05	5.8119E-03
11	.0009	.0864	1.8085E+00	1.1698E+02	2.2451E+00	1.6011E-05	6.8169E-03
16	-.0022	.1109	3.1798E+00	-3.0232E+01	3.2228E+00	2.6114E-05	4.0213E-04
17	.0009	.1158	3.0136E+00	-3.0799E+01	1.5416E+00	3.3204E-05	5.7090E-03

LAMINAR SEPARATION REATTACHMENT AS TURBULENT BOUNDARY LAYER

TURBULENT BOUNDARY LAYER DEVELOPMENT

I	X	S	US	H	DELTAS	THETAS	BETA	RTHETAS	CFS
17	.0009	.1158	1.014	1.542E+00	2.401E-04	3.320E-05	0.	3.802E+02	5.709E-03
22	.0200	.1404	2.490	1.600E+00	9.226E-04	1.337E-04	2.654E+00	1.265E+03	3.108E-03
27	.0411	.1651	2.302	1.566E+00	1.562E-03	2.206E-04	3.087E+00	1.930E+03	2.813E-03
32	.0629	.1898	2.230	1.520E+00	2.096E-03	2.839E-04	2.710E+00	2.406E+03	2.812E-03
37	.0852	.2145	2.210	1.478E+00	2.540E-03	3.288E-04	2.136E+00	2.761E+03	2.877E-03
42	.1079	.2392	2.264	1.418E+00	2.810E-03	3.362E-04	1.109E+00	2.893E+03	3.122E-03

47	.1313	.2640	2.154	1.468E+00	3.429E-03	4.381E-04	1.947E+00	3.585E+03	2.701E-03
52	.1550	.2887	2.085	1.491E+00	4.055E-03	5.332E-04	2.564E+00	4.225E+03	2.478E-03
57	.1791	.3135	2.023	1.506E+00	4.689E-03	6.260E-04	3.058E+00	4.813E+03	2.334E-03
62	.2032	.3384	1.968	1.517E+00	5.341E-03	7.213E-04	3.520E+00	5.395E+03	2.220E-03
67	.2273	.3633	1.923	1.522E+00	5.984E-03	8.126E-04	3.868E+00	5.939E+03	2.144E-03
72	.2515	.3882	1.884	1.525E+00	6.625E-03	9.021E-04	4.153E+00	6.458E+03	2.087E-03
77	.2757	.4131	1.847	1.512E+00	7.141E-03	9.592E-04	4.030E+00	6.807E+03	2.106E-03
82	.3000	.4380	1.851	1.501E+00	7.654E-03	1.017E-03	3.943E+00	7.153E+03	2.115E-03
87	.3242	.4629	1.834	1.494E+00	8.171E-03	1.077E-03	3.899E+00	7.508E+03	2.114E-03
92	.3485	.4879	1.811	1.495E+00	8.759E-03	1.156E-03	4.045E+00	7.953E+03	2.080E-03
97	.3727	.5129	1.786	1.498E+00	9.367E-03	1.240E-03	4.225E+00	8.415E+03	2.042E-03
102	.3970	.5379	1.774	1.490E+00	9.873E-03	1.297E-03	4.160E+00	8.742E+03	2.047E-03
107	.4213	.5629	1.762	1.485E+00	1.038E-02	1.354E-03	4.114E+00	9.069E+03	2.048E-03
112	.4456	.5879	1.750	1.480E+00	1.089E-02	1.414E-03	4.090E+00	9.403E+03	2.044E-03
117	.4698	.6129	1.730	1.484E+00	1.150E-02	1.500E-03	4.270E+00	9.861E+03	2.009E-03
122	.4941	.6379	1.711	1.488E+00	1.210E-02	1.589E-03	4.463E+00	1.033E+04	1.972E-03
127	.5183	.6630	1.700	1.485E+00	1.265E-02	1.650E-03	4.449E+00	1.066E+04	1.970E-03
132	.5425	.6881	1.689	1.482E+00	1.318E-02	1.713E-03	4.448E+00	1.100E+04	1.965E-03
137	.5667	.7132	1.679	1.479E+00	1.371E-02	1.778E-03	4.465E+00	1.134E+04	1.954E-03
142	.5909	.7382	1.662	1.483E+00	1.433E-02	1.867E-03	4.634E+00	1.179E+04	1.928E-03
147	.6151	.7634	1.645	1.488E+00	1.499E-02	1.964E-03	4.841E+00	1.227E+04	1.899E-03
152	.6392	.7885	1.633	1.488E+00	1.558E-02	2.042E-03	4.927E+00	1.267E+04	1.890E-03
157	.6633	.8136	1.625	1.484E+00	1.609E-02	2.099E-03	4.891E+00	1.297E+04	1.883E-03
162	.6874	.8388	1.618	1.481E+00	1.661E-02	2.158E-03	4.866E+00	1.327E+04	1.883E-03
167	.7115	.8639	1.611	1.478E+00	1.712E-02	2.218E-03	4.851E+00	1.357E+04	1.882E-03
172	.7356	.8891	1.603	1.476E+00	1.764E-02	2.279E-03	4.844E+00	1.388E+04	1.880E-03
177	.7597	.9143	1.595	1.475E+00	1.819E-02	2.348E-03	4.880E+00	1.423E+04	1.872E-03
182	.7837	.9394	1.584	1.476E+00	1.878E-02	2.428E-03	4.970E+00	1.461E+04	1.857E-03
187	.8077	.9646	1.577	1.475E+00	1.933E-02	2.494E-03	4.993E+00	1.494E+04	1.851E-03
192	.8317	.9898	1.570	1.474E+00	1.986E-02	2.558E-03	5.000E+00	1.526E+04	1.848E-03
197	.8557	1.0150	1.563	1.472E+00	2.039E-02	2.623E-03	5.014E+00	1.557E+04	1.843E-03
200	.8700	1.0302	1.559	1.472E+00	2.071E-02	2.662E-03	5.026E+00	1.577E+04	1.840E-03

LIFT COEFFICIENT = 3.131304
SKIN FRICTION DRAG = .001620
PRESSURE DRAG = .020763
PROFILE DRAG COEFFICIENT = .022383
MOMENT COEFFICIENT = -.688498

INCOMPRESSIBLE BOUNDARY LAYER CALCULATIONS

***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

RE	SWEEP ANGLE	ITERATION	SURFACE
3.800E+06	2.500E+01	7.	2

LAMINAR BOUNDARY LAYER DEVELOPMENT

I	X	S	US	DU/DS	H	THETAS	CFS
1	.0481	0.0000	4.3001E-01	9.4699E-02	3.4708E+01	1.3245E-04	0.
6	.0694	.0829	4.4476E-01	2.8043E-01	2.5020E+00	1.4161E-04	2.1515E-03
11	.0906	.1393	4.6642E-01	4.7478E-01	2.3588E+00	1.6646E-04	2.0617E-03
16	.1119	.1841	4.9162E-01	6.6991E-01	2.2519E+00	1.7214E-04	2.1428E-03
21	.1332	.2225	5.1996E-01	6.7467E-01	2.2585E+00	1.6968E-04	2.0403E-03
26	.1544	.2573	5.4466E-01	7.6515E-01	2.2209E+00	1.6893E-04	2.0373E-03
31	.1756	.2898	5.7085E-01	8.2739E-01	2.3203E+00	1.6593E-04	1.8977E-03

36	.1968	.3205	5.9762E-01	9.1442E-01	2.3053E+00	1.6233E-04	1.8882E-03
41	.2179	.3499	6.2413E-01	8.4832E-01	2.2263E+00	1.5917E-04	1.8763E-03
46	.2391	.3783	6.4900E-01	9.0191E-01	2.2133E+00	1.5732E-04	1.8505E-03
51	.2603	.4059	6.7285E-01	8.1733E-01	2.2505E+00	1.5619E-04	1.7282E-03
56	.2815	.4330	6.9542E-01	8.5113E-01	2.2396E+00	1.5575E-04	1.6969E-03
61	.3028	.4596	7.1705E-01	4.1439E-01	2.4069E+00	1.5958E-04	1.3371E-03
66	.3241	.4859	7.2206E-01	4.2122E-01	2.3885E+00	1.6548E-04	1.2966E-03
71	.3454	.5121	7.3316E-01	4.2780E-01	2.3720E+00	1.7045E-04	1.2626E-03
76	.3666	.5380	7.4435E-01	4.4974E-01	2.3494E+00	1.7466E-04	1.2454E-03
81	.3879	.5638	7.5858E-01	5.7863E-01	2.2813E+00	1.7624E-04	1.3124E-03
86	.4093	.5893	7.7347E-01	3.9438E-01	2.3731E+00	1.7710E-04	1.1505E-03
91	.4305	.6147	7.7697E-01	1.2166E-01	2.5348E+00	1.8536E-04	9.0732E-04
96	.4518	.6401	7.8006E-01	1.2206E-01	2.5259E+00	1.9330E-04	8.7514E-04
101	.4730	.6654	7.8315E-01	1.2246E-01	2.5174E+00	2.0069E-04	8.4745E-04
106	.4943	.6906	7.8931E-01	7.3867E-01	2.2344E+00	2.0523E-04	1.2345E-03
111	.5155	.7157	8.0822E-01	7.6096E-01	2.2408E+00	2.0001E-04	1.2275E-03
116	.5366	.7406	8.1955E-01	-2.6703E-01	2.8992E+00	2.0591E-04	4.2845E-04
121	.5578	.7655	8.1292E-01	-2.6544E-01	2.9504E+00	2.1938E-04	3.6919E-04
124	.5704	.7805	8.0895E-01	-2.6447E-01	1.4885E+00	2.2745E-04	4.6744E-03

NATURAL TRANSITION

TURBULENT BOUNDARY LAYER DEVELOPMENT

I	X	S	US	H	DELTAS	THETAS	BETA	RTHETAS	CFS
124	.5704	.7805	.809	1.488E+00	1.736E-03	2.274E-04	0.	6.992E+02	4.674E-03
129	.5916	.8055	.802	1.497E+00	2.245E-03	2.970E-04	8.269E-01	9.055E+02	4.147E-03
134	.6048	.8314	.705	1.754E+00	3.924E-03	6.228E-04	1.691E+01	1.667E+03	2.301E-03
136	.6099	.8424	.665	2.067E+00	-2.316E-03	8.418E-04	4.261E+01	-9.783E+02	9.358E-04

TURBULENT SEPARATION

LIFT COEFFICIENT	=	3.131304
SKIN FRICTION DRAG	=	.000931
PRESSURE DRAG	=	-.000533
PROFILE DRAG COEFFICIENT	=	.000398
MOMENT COEFFICIENT	=	-.688498

INCOMPRESSIBLE BOUNDARY LAYER CALCULATIONS

***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

RE	SWEEP ANGLE	ITERATION	SURFACE
3.800E+06	2.500E+01	7	4

LAMINAR BOUNDARY LAYER DEVELOPMENT

I	X	S	US	DU/DS	H	THETAS	CFS
1	.8532	0.0000	4.9400E-01	1.4985E+00	1.0214E+00	1.6178E-04	0.
6	.8619	.0166	5.2247E-01	1.9273E+00	2.4871E+00	5.7225E-05	4.6095E-03
11	.8705	.0316	5.5424E-01	2.3276E+00	2.3843E+00	7.1089E-05	3.9505E-03
16	.8792	.0454	5.8199E-01	8.7705E-01	2.5039E+00	7.9433E-05	2.9247E-03
21	.8878	.0588	5.9399E-01	9.1599E-01	2.4632E+00	9.0096E-05	2.6441E-03
26	.8965	.0719	6.0623E-01	9.5339E-01	2.4315E+00	9.8052E-05	2.4767E-03
31	.9052	.0847	6.1749E-01	6.9532E-01	2.4592E+00	1.0475E-04	2.1973E-03

36	.9138	.0974	6.2642E-01	7.1262E-01	2.4376E+00	1.1127E-04	2.0960E-03
41	.9225	.1099	6.3546E-01	7.2939E-01	2.4180E+00	1.1668E-04	2.0192E-03
46	.9311	.1223	6.4452E-01	7.0766E-01	2.4096E+00	1.2126E-04	1.9352E-03
51	.9398	.1346	6.5320E-01	7.1429E-01	2.3942E+00	1.2539E-04	1.8795E-03
56	.9484	.1467	6.6196E-01	7.2778E-01	2.3782E+00	1.2891E-04	1.8365E-03
61	.9571	.1588	6.7080E-01	7.4086E-01	2.3636E+00	1.3192E-04	1.7995E-03
66	.9657	.1707	6.7794E-01	5.0933E-01	2.4281E+00	1.3553E-04	1.6091E-03
71	.9743	.1826	6.8402E-01	5.1506E-01	2.4167E+00	1.3936E-04	1.5730E-03
76	.9829	.1944	6.9014E-01	5.2066E-01	2.4057E+00	1.4280E-04	1.5416E-03
81	.9915	.2062	6.9629E-01	5.2615E-01	2.3947E+00	1.4591E-04	1.5142E-03
86	1.0001	.2178	7.0247E-01	5.3151E-01	2.3844E+00	1.4872E-04	1.4897E-03
91	1.0087	.2295	7.0862E-01	5.1007E-01	2.3859E+00	1.5131E-04	1.4492E-03
96	1.0173	.2411	7.1455E-01	5.1472E-01	2.3766E+00	1.5380E-04	1.4284E-03
101	1.0259	.2526	7.2051E-01	5.1928E-01	2.3680E+00	1.5608E-04	1.4092E-03
106	1.0346	.2641	7.2649E-01	5.2374E-01	2.3598E+00	1.5816E-04	1.3916E-03
111	1.0432	.2755	7.3250E-01	5.2811E-01	2.3526E+00	1.6005E-04	1.3757E-03
116	1.0518	.2869	7.3846E-01	5.0642E-01	2.3570E+00	1.6183E-04	1.3423E-03
121	1.0603	.2982	7.4422E-01	5.1022E-01	2.3504E+00	1.6360E-04	1.3281E-03
126	1.0689	.3095	7.5001E-01	5.1395E-01	2.3442E+00	1.6523E-04	1.3147E-03
131	1.0775	.3207	7.5581E-01	5.1760E-01	2.3383E+00	1.6672E-04	1.3020E-03
136	1.0860	.3320	7.6164E-01	5.2118E-01	2.3326E+00	1.6809E-04	1.2900E-03
141	1.0946	.3431	7.6752E-01	5.7530E-01	2.3041E+00	1.6933E-04	1.3141E-03
146	1.1031	.3543	7.7430E-01	6.1090E-01	2.2865E+00	1.6989E-04	1.3257E-03
151	1.1116	.3654	7.8111E-01	6.1539E-01	2.2829E+00	1.7039E-04	1.3158E-03
156	1.1201	.3764	7.8793E-01	6.1978E-01	2.2795E+00	1.7083E-04	1.3061E-03
161	1.1286	.3874	7.9478E-01	6.2407E-01	2.2763E+00	1.7121E-04	1.2967E-03
166	1.1371	.3984	8.0164E-01	6.1688E-01	2.2785E+00	1.7154E-04	1.2799E-03
171	1.1455	.4094	8.0837E-01	6.1642E-01	2.2774E+00	1.7193E-04	1.2680E-03
176	1.1539	.4203	8.1512E-01	6.2024E-01	2.2746E+00	1.7226E-04	1.2591E-03
181	1.1624	.4311	8.2188E-01	6.2397E-01	2.2719E+00	1.7255E-04	1.2505E-03
186	1.1709	.4420	8.2776E-01	4.6060E-01	2.3473E+00	1.7336E-04	1.1311E-03
191	1.1794	.4528	8.3275E-01	4.6254E-01	2.3429E+00	1.7465E-04	1.1219E-03
196	1.1877	.4636	8.3762E-01	4.3649E-01	2.3528E+00	1.7595E-04	1.0940E-03
200	1.1942	.4722	8.4139E-01	4.3783E-01	2.3494E+00	1.7702E-04	1.0870E-03

BOUNDARY LAYER DEVELOPMENT ON FLAP UPPER SURFACE IN SLOT REGION

INCOMPRESSIBLE BOUNDARY LAYER CALCULATIONS

***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

RE	SWEEP ANGLE	ITERATION	SURFACE
3.800E+06	2.500E+01	7	3

TURBULENT BOUNDARY LAYER DEVELOPMENT

I	X	S	US	H	DELTAS	THETAS	BETA	RTHETAS	CFS
1	.8532	0.0000	.494	1.410E+00	4.508E-03	5.327E-04	0.	1.000E+03	4.556E-03
6	.8426	.0218	.500	1.402E+00	4.568E-03	5.327E-04	-1.574E+00	1.012E+03	4.596E-03
11	.8320	.0428	.512	1.343E+00	3.826E-03	4.018E-04	-6.808E+00	7.787E+02	5.603E-03
16	.8273	.0573	.893	1.140E+00	1.462E-03	8.280E-05	-1.024E+01	2.808E+02	1.180E-02
21	.8371	.0697	1.203	1.199E+00	1.137E-03	8.114E-05	-8.598E+00	3.708E+02	9.519E-03
26	.8478	.0819	1.327	1.260E+00	1.152E-03	9.948E-05	-7.704E+00	5.017E+02	7.615E-03
31	.8590	.0939	1.501	1.275E+00	1.129E-03	1.016E-04	-6.864E+00	5.795E+02	6.990E-03

36	.8703	.1058	1.666	1.288E+00	1.134E-03	1.054E-04	-6.085E+00	6.673E+02	6.464E-03
41	.8818	.1176	1.797	1.305E+00	1.181E-03	1.143E-04	-5.367E+00	7.807E+02	5.909E-03
46	.8932	.1294	1.862	1.333E+00	1.289E-03	1.326E-04	-4.657E+00	9.386E+02	5.269E-03
51	.9044	.1412	1.859	1.372E+00	1.469E-03	1.629E-04	-3.853E+00	1.150E+03	4.595E-03
56	.9154	.1530	1.801	1.422E+00	1.733E-03	2.084E-04	-2.803E+00	1.426E+03	3.927E-03
61	.9263	.1648	1.734	1.467E+00	2.042E-03	2.610E-04	-1.636E+00	1.720E+03	3.420E-03
66	.9371	.1766	1.679	1.499E+00	2.364E-03	3.133E-04	-5.684E-01	1.999E+03	3.090E-03
71	.9477	.1885	1.650	1.505E+00	2.645E-03	3.529E-04	4.747E-02	2.213E+03	2.956E-03
76	.9584	.2004	1.624	1.508E+00	2.924E-03	3.916E-04	5.532E-01	2.417E+03	2.856E-03
81	.9690	.2123	1.603	1.508E+00	3.197E-03	4.280E-04	9.348E-01	2.607E+03	2.788E-03
86	.9795	.2242	1.582	1.510E+00	3.475E-03	4.659E-04	1.302E+00	2.801E+03	2.721E-03
91	.9899	.2361	1.562	1.511E+00	3.758E-03	5.044E-04	1.642E+00	2.995E+03	2.659E-03
96	1.0003	.2480	1.543	1.513E+00	4.048E-03	5.448E-04	1.984E+00	3.193E+03	2.597E-03
100	1.0085	.2576	1.526	1.517E+00	4.291E-03	5.793E-04	2.280E+00	3.360E+03	2.544F-03

TIME = 241.04300
TIME = 241.65300

S-START	FLAP-TRANSITION
5.95754	0.00000

BOUNDARY LAYER THICKNESS ON FLAP AT S-START = .00115

INITIAL STREAMWISE VELOCITY PROFILE AT SLOT

0.00000	.10680	.21360	.31608	.40102	.52733	.61525	.67908	.72673	.79065
.83041	.86129	.90852	.94421	.97290	1.01751	1.05168	1.07939	1.11624	1.11624
1.11624	1.11610	1.11483	1.11356	1.11103	1.10850	1.10596	1.10343	1.09732	1.08898
1.08063	1.06431	1.05289	1.02285	.95013	.80891	.55286	.64888	.72235	.79027
.90837	.98482	1.00027	1.00000						

CALCULATED VELOCITY FIELD FOR FLAP UPPER SURFACE

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***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

AT X = 5.95754066 | AT X = 5.95754066

DX = 1.563E-04
DELTA = 2.898E+00
DELS = 5.905E-03
THETA = 3.848E-03
H = 1.535E+00
UD = 8.272E+01
U = 1.934E+02

UTAU = 1.218E+01
CF2(1)= 3.093E-03
CF2(2)= 3.135E-03
CF2(3)= 3.137E-03
ITER = 1
PRF NO= 1
R(3) = 6.773E+00

Y	X = 5.95738441 W	X = 5.95754066 U	X = 5.95754066 UP	DU/DY	V	EDDY	P-GRAD	U-INVISCID
0.00000	0.	0.	0.	7.994E+05	-0.	0.	-5.090E+04	2.185E+02
.00000	9.253E-02	1.076E-01	2.082E+01	6.661E+04	-2.332E-04	4.109E-07	-5.090E+04	2.185E+02
.00001	1.851E-01	2.153E-01	4.163E+01	6.526E+04	-4.664E-04	5.989E-06	-5.090E+04	2.185E+02
.00001	2.738E-01	3.185E-01	6.161E+01	5.845E+04	-6.995E-04	2.528E-05	-5.089E+04	2.185E+02
.00002	3.474E-01	4.041E-01	7.816E+01	4.892E+04	-9.327E-04	6.231E-05	-5.089E+04	2.185E+02
.00003	4.569E-01	5.314E-01	1.028E+02	3.340E+04	-1.399E-03	1.877E-04	-5.088E+04	2.185E+02
.00004	5.330E-01	6.200E-01	1.199E+02	2.366E+04	-1.865E-03	3.680E-04	-5.087E+04	2.185E+02
.00005	5.883E-01	6.844E-01	1.324E+02	1.738E+04	-2.332E-03	5.803E-04	-5.086E+04	2.185E+02

.00006	6.296E-01	7.324E-01
.00007	6.850E-01	7.968E-01
.00009	7.195E-01	8.369E-01
.00011	7.462E-01	8.680E-01
.00015	7.871E-01	9.156E-01
.00019	8.180E-01	9.516E-01
.00022	8.429E-01	9.805E-01
.00030	8.815E-01	1.025E+00
.00037	9.112E-01	1.060E+00
.00045	9.352E-01	1.088E+00
.00060	9.671E-01	1.125E+00
.00075	9.671E-01	1.125E+00
.00090	9.671E-01	1.125E+00
.00120	9.670E-01	1.124E+00
.00149	9.659E-01	1.123E+00
.00179	9.648E-01	1.122E+00
.00239	9.626E-01	1.119E+00
.00299	9.604E-01	1.116E+00
.00359	9.582E-01	1.114E+00
.00418	9.560E-01	1.111E+00
.00538	9.507E-01	1.104E+00
.00657	9.435E-01	1.095E+00
.00777	9.362E-01	1.087E+00
.01016	9.221E-01	1.069E+00
.01255	9.122E-01	1.057E+00
.01494	8.862E-01	1.031E+00
.01733	8.232E-01	9.575E-01
.01972	7.008E-01	8.152E-01
.02211	4.790E-01	5.572E-01
.02450	5.622E-01	6.539E-01
.02689	6.258E-01	7.280E-01
.02928	6.847E-01	7.964E-01
.03407	7.870E-01	9.154E-01
.03885	8.532E-01	9.925E-01
.04363	8.666E-01	1.004E+00
.04841	1.000E+00	1.000E+00

1.416E+02	1.160E+04	-2.798E-03	7.090E-04	-5.085E+04	2.185E+02
1.541E+02	8.083E+03	-3.731E-03	1.232E-03	-5.083E+04	2.185E+02
1.619E+02	5.508E+03	-4.664E-03	1.642E-03	-5.082E+04	2.184E+02
1.679E+02	4.060E+03	-5.596E-03	2.039E-03	-5.080E+04	2.184E+02
1.771E+02	3.232E+03	-7.462E-03	3.515E-03	-5.076E+04	2.184E+02
1.840E+02	2.509E+03	-9.327E-03	4.248E-03	-5.073E+04	2.184E+02
1.896E+02	1.905E+03	-1.119E-02	4.248E-03	-5.069E+04	2.183E+02
1.983E+02	1.536E+03	-1.492E-02	3.843E-03	-5.062E+04	2.183E+02
2.050E+02	1.206E+03	-1.865E-02	2.781E-03	-5.055E+04	2.182E+02
2.104E+02	8.389E+02	-2.238E-02	1.468E-03	-5.048E+04	2.181E+02
2.176E+02	3.591E+02	-2.985E-02	0.	-5.034E+04	2.180E+02
2.176E+02	0.	-3.731E-02	0.	-5.020E+04	2.179E+02
2.176E+02	-2.889E+00	-4.477E-02	0.	-5.006E+04	2.177E+02
2.175E+02	-8.712E+00	-5.969E-02	0.	-4.978E+04	2.175E+02
2.173E+02	-1.309E+01	-7.462E-02	0.	-4.950E+04	2.172E+02
2.170E+02	-1.309E+01	-8.954E-02	0.	-4.922E+04	2.170E+02
2.166E+02	-1.309E+01	-1.194E-01	0.	-4.866E+04	2.164E+02
2.161E+02	-1.309E+01	-1.492E-01	0.	-4.810E+04	2.159E+02
2.156E+02	-1.309E+01	-1.791E-01	0.	-4.754E+04	2.154E+02
2.151E+02	-1.489E+01	-2.089E-01	0.	-4.698E+04	2.149E+02
2.139E+02	-1.869E+01	-2.686E-01	0.	-4.602E+04	2.136E+02
2.123E+02	-2.159E+01	-3.283E-01	0.	-4.544E+04	2.114E+02
2.106E+02	-2.129E+01	-3.880E-01	0.	-4.486E+04	2.101E+02
2.074E+02	-1.797E+01	-5.074E-01	0.	-4.366E+04	2.068E+02
2.052E+02	-2.312E+01	-6.268E-01	0.	-4.180E+04	2.044E+02
1.994E+02	-6.002E+01	-7.462E-01	2.960E-02	-3.995E+04	2.020E+02
1.852E+02	-1.303E+02	-8.655E-01	1.010E-01	-3.747E+04	2.005E+02
1.577E+02	-2.420E+02	-9.849E-01	1.725E-01	-3.498E+04	1.989E+02
1.078E+02	-9.747E+01	-1.104E+00	2.021E-01	-3.183E+04	1.980E+02
1.265E+02	1.032E+02	-1.224E+00	2.018E-01	-2.859E+04	1.972E+02
1.408E+02	8.612E+01	-1.343E+00	2.011E-01	-2.525E+04	1.966E+02
1.540E+02	7.554E+01	-1.462E+00	1.989E-01	-2.188E+04	1.962E+02
1.771E+02	5.925E+01	-1.701E+00	1.820E-01	-1.642E+04	1.955E+02
1.920E+02	2.666E+01	-1.940E+00	1.336E-01	-1.214E+04	1.948E+02
1.950E+02	0.	-2.179E+00	6.571E-02	-9.007E+03	1.941E+02
1.934E+02	0.	-2.418E+00	1.878E-02	-6.652E+03	1.934E+02

J	UR	BETA	US	WC
1	0.	-6.6224E-03	0.	0.
2	2.1396E+01	-6.6224E-03	2.1396E+01	-1.4169E-01
3	4.2792E+01	-6.6224E-03	4.2792E+01	-2.8339E-01
4	6.3322E+01	-6.6224E-03	6.3321E+01	-4.1934E-01
5	8.0340E+01	-6.6224E-03	8.0339E+01	-5.3204E-01
6	1.0564E+02	-6.6224E-03	1.0564E+02	-6.9961E-01
7	1.2326E+02	-6.6224E-03	1.2326E+02	-8.1625E-01
8	1.3605E+02	-6.6224E-03	1.3604E+02	-9.0094E-01
9	1.4559E+02	-6.6224E-03	1.4559E+02	-9.6416E-01
10	1.5840E+02	-6.6224E-03	1.5839E+02	-1.0490E+00
11	1.6636E+02	-6.6224E-03	1.6636E+02	-1.1017E+00
12	1.7255E+02	-6.6224E-03	1.7255E+02	-1.1427E+00
13	1.8201E+02	-6.6224E-03	1.8201E+02	-1.2053E+00
14	1.8916E+02	-6.6224E-03	1.8916E+02	-1.2527E+00
15	1.9491E+02	-6.6224E-03	1.9490E+02	-1.2907E+00
16	2.0385E+02	-6.6224E-03	2.0384E+02	-1.3499E+00
17	2.1069E+02	-6.6224E-03	2.1069E+02	-1.3953E+00
18	2.1624E+02	-6.6224E-03	2.1624E+02	-1.4320E+00
19	2.2363E+02	-6.6224E-03	2.2362E+02	-1.4809E+00
20	2.2363E+02	-6.6224E-03	2.2362E+02	-1.4809E+00
21	2.2363E+02	-6.6224E-03	2.2362E+02	-1.4809E+00
22	2.2354E+02	-6.5615E-03	2.2353E+02	-1.4667E+00

23	2.2327E+02	-6.5460E-03	2.2327E+02	-1.4615E+00
24	2.2300E+02	-6.5305E-03	2.2300E+02	-1.4563E+00
25	2.2247E+02	-6.4993E-03	2.2246E+02	-1.4459E+00
26	2.2193E+02	-6.4679E-03	2.2192E+02	-1.4354E+00
27	2.2139E+02	-6.4362E-03	2.2139E+02	-1.4249E+00
28	2.2086E+02	-6.4043E-03	2.2085E+02	-1.4144E+00
29	2.1956E+02	-6.3265E-03	2.1956E+02	-1.3891E+00
30	2.1779E+02	-6.2179E-03	2.1779E+02	-1.3542E+00
31	2.1602E+02	-6.1066E-03	2.1602E+02	-1.3192E+00
32	2.1256E+02	-5.8809E-03	2.1255E+02	-1.2500E+00
33	2.1013E+02	-5.7162E-03	2.1013E+02	-1.2011E+00
34	2.0492E+02	-6.6224E-03	2.0491E+02	-1.3570E+00
35	1.9035E+02	-6.6224E-03	1.9034E+02	-1.2605E+00
36	1.6206E+02	-6.6224E-03	1.6205E+02	-1.0732E+00
37	1.1076E+02	-6.6224E-03	1.1076E+02	-7.3348E-01
38	1.3000E+02	-6.6224E-03	1.2999E+02	-8.6087E-01
39	1.4471E+02	-6.6224E-03	1.4471E+02	-9.5834E-01
40	1.5832E+02	-6.6224E-03	1.5832E+02	-1.0485E+00
41	1.8198E+02	-6.6224E-03	1.8198E+02	-1.2051E+00
42	1.9730E+02	-6.6224E-03	1.9729E+02	-1.3066E+00
43	1.9956E+02	-5.6350E-03	1.9956E+02	-1.1245E+00
44	2.0066E+02	2.9756E-02	2.0057E+02	5.9698E+00

X	CBETA	CF2(3)	CFR	CFS	CFC	W8(3)	ALPAN
5.9575	-.3794	3.1366E-03	3.2240E-03	3.2239E-03	-2.1350E-05	5.3461E+01	1.3747E+01

H	DELTA-STAR	THETA
1.6098	2.2715E-01	1.4110E-01

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***** RAE2215(FOSTER) DROOPED LEADING EDGE-30 DEG FLAP *****

AT X = 30.58633949

DX = 3.000E-02
DELTA = 8.316E+00
DELS = 1.100E-01
THETA = 8.347E-02
H = 1.318E+00
UO = 1.990E+01
U = 1.279E+02

AT X = 30.58633949

UTAU = 4.574E+00
CF2(1)= 1.941E-03
CF2(2)= 1.941E-03
CF2(3)= 1.931E-03
ITER = 1
PRF NO=1048
R(3) = 1.756E+01

Y	X = 30.55633949 W	X = 30.58633949 U	X = 30.58633949 UP	DU/DY	V	EDDY	P-GRAD	U-INVISCID
0.00000	0.	0.	0.	1.133E+05	0.	0.	1.357E+04	1.048E+02
.00000	3.550E-02	2.308E-02	2.952E+00	9.452E+03	1.001E-04	8.777E-09	1.357E+04	1.048E+02
.00001	7.099E-02	4.620E-02	5.908E+00	9.466E+03	4.005E-04	1.394E-07	1.358E+04	1.048E+02
.00001	1.065E-01	6.935E-02	8.868E+00	9.478E+03	9.010E-04	7.002E-07	1.358E+04	1.048E+02
.00002	1.420E-01	9.252E-02	1.183E+01	9.480E+03	1.601E-03	2.192E-06	1.358E+04	1.048E+02
.00003	2.127E-01	1.389E-01	1.776E+01	9.458E+03	3.598E-03	1.084E-05	1.358E+04	1.048E+02
.00004	2.829E-01	1.850E-01	2.365E+01	9.368E+03	6.381E-03	3.316E-05	1.358E+04	1.048E+02
.00005	3.519E-01	2.304E-01	2.947E+01	9.235E+03	9.926E-03	7.786E-05	1.358E+04	1.048E+02
.00006	4.198E-01	2.752E-01	3.520E+01	6.035E+03	1.420E-02	1.027E-04	1.358E+04	1.048E+02

8	3.4962E+01	9.6505E-02	3.4799E+01	3.3687E+00
9	4.1743E+01	9.5859E-02	4.1551E+01	3.9953E+00

.00007	4.856E-01	3.189E-01	4.078E+01	4.307E+03	2.415E-02	2.187E-04	1.359E+04	1.048E+02
.00009	5.460E-01	3.594E-01	4.596E+01	4.019E+03	3.532E-02	4.677E-04	1.359E+04	1.048E+02
.00011	6.024E-01	3.975E-01	5.083E+01	2.495E+03	4.757E-02	5.624E-04	1.360E+04	1.048E+02
.00015	6.536E-01	4.326E-01	5.532E+01	1.644E+03	7.390E-02	1.010E-03	1.360E+04	1.048E+02
.00019	6.950E-01	4.617E-01	5.905E+01	1.420E+03	1.017E-01	1.818E-03	1.361E+04	1.048E+02
.00022	7.318E-01	4.881E-01	6.242E+01	8.642E+02	1.307E-01	1.945E-03	1.362E+04	1.048E+02
.00030	7.645E-01	5.124E-01	6.553E+01	5.681E+02	1.908E-01	2.884E-03	1.363E+04	1.049E+02
.00037	7.900E-01	5.325E-01	6.810E+01	4.983E+02	2.526E-01	4.442E-03	1.365E+04	1.049E+02
.00045	8.130E-01	5.514E-01	7.052E+01	3.222E+02	3.158E-01	4.372E-03	1.366E+04	1.049E+02
.00060	8.344E-01	5.703E-01	7.294E+01	2.282E+02	4.448E-01	5.709E-03	1.369E+04	1.050E+02
.00075	8.514E-01	5.871E-01	7.508E+01	2.127E+02	5.760E-01	8.363E-03	1.372E+04	1.050E+02
.00090	8.669E-01	6.036E-01	7.719E+01	1.446E+02	7.089E-01	8.193E-03	1.375E+04	1.051E+02
.00120	8.816E-01	6.210E-01	7.942E+01	1.067E+02	9.776E-01	1.075E-02	1.381E+04	1.051E+02
.00149	8.930E-01	6.370E-01	8.146E+01	1.023E+02	1.249E+00	1.611E-02	1.387E+04	1.052E+02
.00179	9.034E-01	6.530E-01	8.351E+01	7.091E+01	1.521E+00	1.608E-02	1.393E+04	1.053E+02
.00239	9.131E-01	6.702E-01	8.571E+01	5.339E+01	2.069E+00	2.152E-02	1.405E+04	1.055E+02
.00299	9.205E-01	6.864E-01	8.778E+01	4.916E+01	2.619E+00	3.096E-02	1.417E+04	1.057E+02
.00359	9.263E-01	7.010E-01	8.964E+01	4.727E+01	3.167E+00	4.286E-02	1.429E+04	1.059E+02
.00418	9.315E-01	7.160E-01	9.156E+01	3.430E+01	3.714E+00	4.234E-02	1.441E+04	1.061E+02
.00538	9.364E-01	7.332E-01	9.376E+01	2.982E+01	4.795E+00	5.354E-02	1.416E+04	1.065E+02
.00657	9.399E-01	7.533E-01	9.634E+01	3.473E+01	5.826E+00	5.389E-02	1.288E+04	1.073E+02
.00777	9.423E-01	7.766E-01	9.932E+01	2.576E+01	6.760E+00	5.495E-02	1.160E+04	1.081E+02
.01016	9.417E-01	8.016E-01	1.025E+02	1.468E+01	8.329E+00	5.914E-02	9.145E+03	1.096E+02
.01255	9.370E-01	8.134E-01	1.040E+02	4.892E+00	9.585E+00	6.599E-02	8.092E+03	1.106E+02
.01494	9.282E-01	8.139E-01	1.041E+02	-4.528E+00	1.058E+01	7.528E-02	7.039E+03	1.117E+02
.01733	9.160E-01	8.021E-01	1.026E+02	-1.316E+01	1.135E+01	8.674E-02	6.490E+03	1.125E+02
.01972	9.014E-01	7.810E-01	9.987E+01	-1.964E+01	1.193E+01	1.000E-01	5.953E+03	1.134E+02
.02211	8.852E-01	7.529E-01	9.628E+01	-2.417E+01	1.233E+01	1.147E-01	5.607E+03	1.141E+02
.02450	8.682E-01	7.205E-01	9.213E+01	-2.767E+01	1.262E+01	1.303E-01	5.286E+03	1.148E+02
.02689	8.501E-01	6.837E-01	8.743E+01	-3.303E+01	1.281E+01	1.465E-01	5.048E+03	1.154E+02
.02928	8.281E-01	6.378E-01	8.156E+01	-2.436E+01	1.298E+01	1.626E-01	4.831E+03	1.160E+02
.03407	8.059E-01	5.923E-01	7.574E+01	-1.505E+01	1.337E+01	1.929E-01	4.493E+03	1.171E+02
.03885	7.896E-01	5.625E-01	7.193E+01	-8.992E+00	1.392E+01	2.177E-01	4.227E+03	1.181E+02
.04363	7.783E-01	5.472E-01	6.998E+01	-3.443E+00	1.469E+01	2.338E-01	4.007E+03	1.189E+02
.04841	7.715E-01	5.453E-01	6.973E+01	1.719E+00	1.571E+01	2.394E-01	3.820E+03	1.197E+02
.05319	7.690E-01	5.559E-01	7.108E+01	6.478E+00	1.702E+01	2.394E-01	3.656E+03	1.205E+02
.05797	7.709E-01	5.777E-01	7.388E+01	1.059E+01	1.863E+01	2.394E-01	3.510E+03	1.212E+02
.06275	7.773E-01	6.088E-01	7.786E+01	1.379E+01	2.050E+01	2.394E-01	3.379E+03	1.218E+02
.06753	7.885E-01	6.467E-01	8.270E+01	1.584E+01	2.258E+01	2.393E-01	3.258E+03	1.224E+02
.07232	8.043E-01	6.881E-01	8.799E+01	1.683E+01	2.479E+01	2.390E-01	3.148E+03	1.230E+02
.07710	8.251E-01	7.309E-01	9.347E+01	1.733E+01	2.704E+01	2.383E-01	3.045E+03	1.235E+02
.08188	8.518E-01	7.748E-01	9.909E+01	1.734E+01	2.930E+01	2.368E-01	2.948E+03	1.240E+02
.08666	8.838E-01	8.177E-01	1.046E+02	1.630E+01	3.150E+01	2.338E-01	2.858E+03	1.245E+02
.09144	9.175E-01	8.564E-01	1.095E+02	1.427E+01	3.351E+01	2.284E-01	2.773E+03	1.249E+02
.09622	9.481E-01	8.891E-01	1.137E+02	1.192E+01	3.520E+01	2.194E-01	2.691E+03	1.253E+02
.10100	9.719E-01	9.161E-01	1.172E+02	9.859E+00	3.659E+01	2.058E-01	2.609E+03	1.258E+02
.10578	9.876E-01	9.385E-01	1.200E+02	8.283E+00	3.774E+01	1.870E-01	2.528E+03	1.262E+02
.11056	9.961E-01	9.575E-01	1.225E+02	7.138E+00	3.871E+01	1.633E-01	2.446E+03	1.266E+02
.11535	9.997E-01	9.742E-01	1.246E+02	6.383E+00	3.954E+01	1.359E-01	2.364E+03	1.270E+02
.12013	1.001E+00	9.895E-01	1.265E+02	5.159E+00	4.025E+01	1.071E-01	2.283E+03	1.275E+02
.12491	1.000E+00	1.000E+00	1.279E+02	0.	4.051E+01	7.938E-02	2.201E+03	1.279E+02

J	UR	BETA	US	WC
1	0.	1.0005E-01	0.	0.
2	3.5090E+00	9.9885E-02	3.4916E+00	3.4922E-01
3	7.0218E+00	9.9319E-02	6.9872E+00	6.9826E-01
	1.0538E+01	9.8455E-02	1.0488E+01	1.0481E+00

8	3.4962E+01	9.6505E-02	3.4799E+01	3.3687E+00
9	4.1743E+01	9.5859E-02	4.1551E+01	3.9953E+00
10	4.8344E+01	9.5090E-02	4.8125E+01	4.5901E+00
11	5.4450E+01	9.4076E-02	5.4210E+01	5.1149E+00
12	6.0173E+01	9.2970E-02	5.9913E+01	5.5862E+00
13	6.5431E+01	9.1596E-02	6.5156E+01	5.9848E+00
14	6.9767E+01	8.9925E-02	6.9485E+01	6.2654E+00
15	7.3666E+01	8.8133E-02	7.3380E+01	6.4840E+00
16	7.7232E+01	8.5932E-02	7.6947E+01	6.6285E+00
17	8.0134E+01	8.3401E-02	7.9856E+01	6.6755E+00
18	8.2833E+01	8.0644E-02	8.2563E+01	6.6727E+00
19	8.5493E+01	7.7185E-02	8.5239E+01	6.5923E+00
20	8.7798E+01	7.3263E-02	8.7563E+01	6.4266E+00
21	9.0033E+01	6.9014E-02	8.9818E+01	6.2086E+00
22	9.2347E+01	6.3852E-02	9.2159E+01	5.8925E+00
23	9.4414E+01	5.8375E-02	9.4254E+01	5.5083E+00
24	9.6469E+01	5.2605E-02	9.6336E+01	5.0724E+00
25	9.8636E+01	4.5977E-02	9.8532E+01	4.5334E+00
26	1.0063E+02	3.9232E-02	1.0056E+02	3.9470E+00
27	1.0241E+02	3.2945E-02	1.0236E+02	3.3733E+00
28	1.0423E+02	2.6408E-02	1.0419E+02	2.7522E+00
29	1.0629E+02	1.8675E-02	1.0627E+02	1.9848E+00
30	1.0865E+02	9.0347E-03	1.0865E+02	9.8161E-01
31	1.1136E+02	-2.3442E-03	1.1136E+02	-2.6105E-01
32	1.1421E+02	-1.5221E-02	1.1420E+02	-1.7384E+00
33	1.1545E+02	-2.2947E-02	1.1542E+02	-2.6489E+00
34	1.1530E+02	-2.6847E-02	1.1526E+02	-3.0952E+00
35	1.1366E+02	-2.6286E-02	1.1362E+02	-2.9873E+00
36	1.1089E+02	-2.2184E-02	1.1086E+02	-2.4596E+00
37	1.0728E+02	-1.4910E-02	1.0727E+02	-1.5995E+00
38	1.0317E+02	-5.0786E-03	1.0317E+02	-5.2394E-01
39	9.8535E+01	7.6248E-03	9.8532E+01	7.5130E-01
40	9.2807E+01	2.5561E-02	9.2776E+01	2.3719E+00
41	8.7134E+01	4.5473E-02	8.7044E+01	3.9608E+00
42	8.3406E+01	5.8942E-02	8.3261E+01	4.9133E+00
43	8.1419E+01	6.4697E-02	8.1248E+01	5.2639E+00
44	8.1016E+01	6.2403E-02	8.0859E+01	5.0524E+00
45	8.2115E+01	5.2614E-02	8.2001E+01	4.3184E+00
46	8.4595E+01	3.7112E-02	8.4537E+01	3.1387E+00
47	8.8255E+01	1.8546E-02	8.8239E+01	1.6366E+00
48	9.2826E+01	-3.4463E-04	9.2826E+01	-3.1991E-02
49	9.7940E+01	-1.7192E-02	9.7926E+01	-1.6837E+00
50	1.0336E+02	-3.0815E-02	1.0331E+02	-3.1845E+00
51	1.0905E+02	-4.0929E-02	1.0896E+02	-4.4621E+00
52	1.1475E+02	-4.7333E-02	1.1462E+02	-5.4294E+00
53	1.2000E+02	-5.0653E-02	1.1985E+02	-6.0760E+00
54	1.2449E+02	-5.2404E-02	1.2431E+02	-6.5205E+00
55	1.2816E+02	-5.4272E-02	1.2797E+02	-6.9518E+00
56	1.3111E+02	-5.7270E-02	1.3090E+02	-7.5046E+00
57	1.3353E+02	-6.1536E-02	1.3328E+02	-8.2116E+00
58	1.3556E+02	-6.6489E-02	1.3526E+02	-9.0065E+00
59	1.3738E+02	-7.1717E-02	1.3703E+02	-9.8441E+00
60	1.3861E+02	-7.5766E-02	1.3821E+02	-1.0491E+01

X	CBETA	CF2(3)	CFR	CFS	CFC	WB(3)	ALPAN
30.5863	5.7325	1.9313E-03	2.2966E-03	2.2851E-03	2.2939E-04	5.3461E+01	2.7029E+01

H	DELTA-STAR	THETA
1.4482	1.9380E+00	1.3382E+00

VALUES OF DISPLACEMENT THICKNESS, MOMENTUM THICKNESS,
AND SHAPE FACTOR FOR THE WHOLE BOUNDARY LAYER (LAST PROFILE).

DELS = 2.602E+00 THETA = 1.192E+00 H = 2.182E+00.

LIFT COEFFICIENT PROFILE DRAG COEFFICIENT

CL = 3.131E+00 CD = 5.369E-02

LIFT DRAG AND MOMENT SUMMARY TABLE

ITERATION	LIFT COEFFICIENT	MOMENTUM COEFFICIENT	DRAG COEFFICIENT
1	3.40395	-.78079	.05163
2	3.29825	-.73431	.05485
3	3.21873	-.71122	.05843
4	3.17688	-.69957	.05885
5	3.15483	-.69363	.05382
6	3.13692	-.69026	.05382
7	3.13130	-.68850	.05388

APPENDIX VI

PROGRAM LISTING

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                OVERLAY(FRI5,0,0)                                          VIP.3
      PROGRAM     VIP(INPUT=1001,TAPE5=INPUT,OUTPUT=1001,TAPE6=OUTPUT,     VIP.4
     1TAPE1=1001,TAPE3=1001,TAPE7=1001,TAPE8=1001,TAPE9=1001,              VIP.5
     2TAPE10=1001,TAPE11=1001,TAPE12=1001)                                 VIP.6
C                                                                          VIP.7
C  INFINITE SPAN THREE DIMENSIONAL HIGH LIFT VISCOUS/POTENTIAL FLOW        VIP.8
C  INTERACTION PROGRAM                                                     VIP.9
C                                                                          VIP.10
      COMMON/NXT/NXT                                                       VIP.11
      COMMON/NBL/NBL                                                       VIP.12
      COMMON /ANGLE/ ANGLE                                                 VIP.13
      COMMON /CL/ CL,CDT,CDF,CDP,DUD(2),CM                                 VIP.14
      COMMON /CPS/ CPS(600)                                                VIP.15
      COMMON/GAMM/GA(600),Q(600)                                           VIP.16
      COMMON/GRID/ ZCP(20),CPI(20,30),YGAP                                 VIP.17
      COMMON/SLOT/HSS(100),TSS(100),DSS(100),CSS(100),USS(100),DTSS(100)   VIP.18
      COMMON/CURVES/ R(30,2)                                               VIP.19
      COMMON/XGEM/ IGEM                                                    VIP.20
      COMMON/CLCM/ CLX(4),CMX(4)                                           VIP.21
      COMMON/PHIL/IPHIL                                                    VIP.22
      COMMON/XFND/XFIND(20),NXFIND                                         VIP.23
      COMMON/ARC/ TOLL1,TOLL2                                              VIP.24
      COMMON /NUS/ NUS                                                     VIP.25
      COMMON /NPT/ NPT                                                     VIP.26
      COMMON/SWEEP/ HH1,RRTH1,KSW                                          VIP.27
      COMMON/TQTQ/CONS,GNEQK,XGNQ                                          VIP.28
      COMMON/NANGLE/NANGLE                                                 VIP.29
      COMMON/KPRINT/KPRINT                                                 VIP.30
      COMMON /NSIDE/ NSIDE                                                 VIP.31
      COMMON /ITR/ ITR,ITRMAX                                              VIP.32
      COMMON /IPRINT/ IPRINT,XSKIP                                         VIP.33
      COMMON/INSTB/ INSTB,ITRAN                                            VIP.34
      COMMON/MTRAN/ MTRAN                                                  VIP.35
      COMMON/XTRIP/ KCODE,TRIP                                             VIP.36
      COMMON/GAP/ ZGAP(2),SXU(2)                                           VIP.37
      COMMON/XSOLVE/ISOLVE                                                 VIP.38
      COMMON /JMAX/ JMAX                                                   VIP.39
      COMMON /PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UIN,REFX,REFZ,CREF         VIP.40
      COMMON/FSTART/ CFI,HI,THETAI,UTE                                     VIP.41
      COMMON /SANGLE/ SANGLE                                               VIP.42
      COMMON/SEG/NCMPT,NFLAP,NF,NC(4),TE(12),NPU(4),NPL(4),DUM(42)         VIP.43
      COMMON /SIG/ SIG(200),SIGMAD(200),SIGMA(8,100)                       VIP.44
      COMMON /RNB/    RNB                                                  VIP.45
      COMMON /XIN/    XIN(100),ZIN(100),CPIN(100),SU(100)                  VIP.46
      COMMON /TRIPUL/ TRIPUP,TRIPOP                                        VIP.47
      COMMON/DENSE/SSS(200),USD(200)                                       VIP.48
      COMMON /TITLE/ TITLE(8)                                              VIP.49
      COMMON /VELCOM/ NPOINT,NPART,IMAX,EX,PRINT                           VIP.50
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),        VIP.51
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),HI(200),    VIP.52
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),        VIP.53
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),     VIP.54
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMY(6400),       VIP.55
     5XIP(8,100),ZIP(8,100),CPIP(8,100),NPP(8),DUMMY(192)                  VIP.56
      DIMENSION CPU(200),CPL(100)                                          VIP.57
      DIMENSION CLS(8),CMS(8),CDS(8)                                       VIP.58
      REAL MACH                                                            VIP.59
C                                                                          VIP.60
      DATA FRI5/4HFRI5/                                                    VIP.61
      MTRAN = 1                                                            VIP.62
      READ(5,5200) (TITLE(I),I=1,8)                                        VIP.63
      WRITE(6,6200)(TITLE(I),I=1,8)                                        VIP.64
 6200 FORMAT(1H1,40X,8A10//)                                               VIP.65
      READ(5,6700) XXFIND,XPHIL,TOLL1,TOLL2,XSOLVE,XGEM                    VIP.66
      NXFIND = INT(XXFIND)                                                 VIP.67
      IPHIL = INT(XPHIL)                                                   VIP.68
      ISOLVE = INT(XSOLVE)                                                 VIP.69
      IGEM = INT(XGEM)
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      IF(NXFIND.EQ.0) GO TO 30                                          VIP.70
      READ(5,6700)(XFIND(I),I=1,NXFIND)                                 VIP.71
      IF(NXFIND.GT.20) STOP 7777                                        VIP.72
 6700 FORMAT(8F10.0)                                                    VIP.73
   30 CONTINUE                                                          VIP.74
      READ(5,5000) RNB,TRIPUP,TRIPOP,SANGLE,TRMAX,REFC,UIN              VIP.75
      IF(REFC.EQ.0.) REFC=1.0                                           VIP.76
      READ(5,5000) XPRINT,XSKIP,REFX,REFZ,CREF,PRINT,CASE               VIP.77
      MCASE = INT(CASE)                                                 VIP.78
      KPRINT = INT(PRINT)                                               VIP.79
      IF(MCASE.EQ.0) MCASE = 1                                          VIP.80
      NANGLE = 1                                                        VIP.81
      DO 40 NSIDE = 1,8                                                 VIP.82
      DO 40 I =1,100                                                    VIP.83
   40 SIGMA(NSIDE,I) = 0.                                               VIP.84
      RNB=RNB*1.0E06                                                    VIP.85
      ITR = 1                                                           VIP.86
      ITRMAX=INT(TRMAX)                                                 VIP.87
      KAMAX = ITRMAX                                                    VIP.88
      IPRINT=INT(XPRINT)                                                VIP.89
      KSKIP=INT(XSKIP)                                                  VIP.90
C                                                                       VIP.91
C   INPUT INITIAL GEOMETRY AND CALCULATE THE POTENTIAL FLOW             VIP.92
C                                                                       VIP.93
  100 CONTINUE                                                          VIP.94
      CALL OVERLAY(FRIS,1,0)                                            VIP.95
      IF(MACH.LT.0.) CALL EXIT                                          VIP.96
      CLS(ITR) = CL                                                     VIP.97
      CMS(ITR) = CM                                                     VIP.98
      IF(ITR.LE.2) GO TO 101                                            VIP.99
      ERR = ABS(CLS(ITR)-CLS(ITR-1))/ABS(CLS(ITR))                      VIP.100
      IF(ERR.LT.TOLL) ITRMAX = ITR                                      VIP.101
      IF(IPHIL.GT.ITRMAX) IPHIL = ITRMAX                                VIP.102
  101 CONTINUE                                                          VIP.103
      NSIDE = 0                                                         VIP.104
      WRITE(6,7000)                                                     VIP.105
      WRITE(6,7400) MACH,ALPHA,SANGLE,ITR                               VIP.106
      DO 60 N=1,NCMPT                                                   VIP.107
      DO 50 NS=1,2                                                      VIP.108
      NSIDE = NSIDE+1                                                   VIP.109
      IMAX = NPP(NSIDE)                                                 VIP.110
      WRITE(6,7100) N,NSIDE                                             VIP.111
      WRITE(6,7200)                                                     VIP.112
      WRITE(6,7300)(XIP(NSIDE,I),ZIP(NSIDE,I),CPIP(NSIDE,I),SIGMA(NSIDE,VIP.113
     1I),I=1,IMAX)                                                      VIP.114
   50 CONTINUE                                                          VIP.115
   60 CONTINUE                                                          VIP.116
      WRITE(6,7500)                                                     VIP.117
      WRITE(6,7900)                                                     VIP.118
      WRITE(6,8000) (N,CLX(N),CMX(N),N=1,NCMPT)                         VIP.119
      WRITE(6,7500)                                                     VIP.120
      NSIDE=0                                                           VIP.121
      NSEG=NCMPT                                                        VIP.122
      NF=NFLAP                                                          VIP.123
      GO TO(1,2,3,4),NSEG                                               VIP.124
    1 KSEG = NSEG + 1                                                   VIP.125
      GO TO 5                                                           VIP.126
    2 KSEG = NSEG + 2                                                   VIP.127
      IF(NFLAP.EQ.1) KSEG = 3                                           VIP.128
      GO TO 5                                                           VIP.129
    3 KSEG = NSEG + 3                                                   VIP.130
      IF(NFLAP.EQ.1) KSEG = 5                                           VIP.131
      IF(NFLAP.EQ.2) KSEG = 3                                           VIP.132
      GO TO 5                                                           VIP.133
    4 KSEG = NSEG + 1                                                   VIP.134
    5 CONTINUE                                                          VIP.135
      LSEG=KSEG                                                         VIP.136
C                                                                       VIP.137
```

```
C  CALCULATE BOUNDARY LAYER DEVELOPMENT ON ALL LOWER SURFACES AND        VIP.138
C  UPPER SURFACES OF SLAT AND MAIN WING                                  VIP.139
C                                                                        VIP.140
C                                                                        VIP.141
   6   IF(LSEG) 8,8,7                                                    VIP.142
     7 CONTINUE                                                         VIP.143
       NBL = 200                                                        VIP.144
       NSIDE=NSIDE+1                                                    VIP.145
       IF(NF.EQ.0) GO TO 14                                             VIP.146
       IF(NSIDE.EQ.KSEG) NSIDE=NSIDE+1                                  VIP.147
       IF(NSIDE.LE.3) GO TO 16                                          VIP.148
       IF(NSEG.GE.3.AND.NFLAP.EQ.2) GO TO 15                            VIP.149
       GO TO 16                                                         VIP.150
    15 CONTINUE                                                         VIP.151
       IF(NCMPT.EQ.3.AND.NSIDE.EQ.6) GO TO 16                           VIP.152
       IF(NCMPT.EQ.4.AND.NSIDE.EQ.4) GO TO 16                           VIP.153
       IF(NSIDE.EQ.8) GO TO 16                                          VIP.154
       KSEG = KSEG + 2                                                  VIP.155
       LSEG = LSEG + 1                                                  VIP.156
    16 CONTINUE                                                         VIP.157
    14 CONTINUE                                                         VIP.158
       NPT=NPP(NSIDE)                                                   VIP.159
       DO 200 N=1,NPT                                                   VIP.160
       XIN(N)=XIP(NSIDE,N)                                              VIP.161
       ZIN(N)=ZIP(NSIDE,N)                                              VIP.162
       CPIN(N)=CPIP(NSIDE,N)                                            VIP.163
   200 CONTINUE                                                         VIP.164
       CALL OVERLAY(FRIS,2,0)                                           VIP.165
C  CALCULATE SOURCE DISTRIBUTION FOR EACH SEGMENT                       VIP.166
       LLL = 2*(NCMPT-NFLAP)-1                                          VIP.167
       IF(NSIDE.EQ.LLL) GO TO 12                                        VIP.168
       GO TO 13                                                         VIP.169
    12 CONTINUE                                                         VIP.170
       IF(H(NBL).GT.2.5) NBL=NBL-2                                      VIP.171
       CFI = CF(NBL)                                                    VIP.172
       HI = H(NBL)                                                      VIP.173
       THETAI = THT(NBL)                                                VIP.174
       UTE = U(NBL)                                                     VIP.175
    13 CONTINUE                                                         VIP.176
       CALL SOURCE                                                      VIP.177
       IF(NCMPT.EQ.2.AND.NFLAP.EQ.0.AND.NSIDE.EQ.4) CDS(ITR) = CDI+CDT  VIP.178
       IF(NCMPT.EQ.1.AND.NSIDE.EQ.2) CDS(ITR) = CDI+CDT                 VIP.179
       CDI = CDT                                                        VIP.180
       LSEG=LSEG-1                                                      VIP.181
       GO TO 6                                                          VIP.182
    8  CONTINUE                                                         VIP.183
       IF(NSEG.GE.3.AND.NFLAP.EQ.2) KSEG = KSEG - 2                     VIP.184
C                                                                       VIP.185
C  CALCULATE FLAP BOUNDARY LAYER DEVELOPMENT                            VIP.186
C                                                                       VIP.187
       NSIDE = KSEG                                                     VIP.188
       REWIND 3                                                         VIP.189
    9  IF(NF) 11,11,10                                                  VIP.190
    10 CONTINUE                                                         VIP.191
       NPT=NPP(NSIDE)                                                   VIP.192
       DO 300 N=1,NPT                                                   VIP.193
       XIN(N)=XIP(NSIDE,N)                                              VIP.194
       ZIN(N)=ZIP(NSIDE,N)                                              VIP.195
   300 CPIN(N)=CPIP(NSIDE,N)                                            VIP.196
       MTRAN = 2                                                        VIP.197
       WRITE(6,8100)                                                    VIP.198
       CALL OVERLAY(FRIS,2,0)                                           VIP.199
       MTRAN = 2                                                        VIP.200
       TRIP = SUD(ITRAN)                                                VIP.201
       CALL OVERLAY(FRIS,4,0)                                           VIP.202
       CALL OVERLAY(FRIS,3,0)                                           VIP.203
       DO 20 I=1,200                                                    VIP.204
       SUD(I) = SSS(I)                                                  VIP.205
       UUD(I) = USD(I)
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                                                                      VIP.206
  20  CONTINUE                                                        VIP.207
      CALL SOURCE                                                     VIP.208
      NF=NF-1                                                         VIP.209
      NSIDE = NSIDE + 2                                               VIP.210
      GO TO 9                                                         VIP.211
  11  CONTINUE                                                        VIP.212
      IF(NFLAP.GT.0) CDS(ITR) = CDT + CDI                             VIP.213
      REWIND 3                                                        VIP.214
      MTRAN = 1                                                       VIP.215
C                                                                     VIP.216
      IF(ITR-ITRMAX) 900,1000,1000                                    VIP.217
  900 ITR = ITR + 1                                                   VIP.218
      GO TO 100                                                       VIP.219
 1000 CONTINUE                                                        VIP.220
      WRITE(6,7500)                                                   VIP.221
      WRITE(6,7600)                                                   VIP.222
      WRITE(6,7700)                                                   VIP.223
      WRITE(6,7800) (ITR,CLS(ITR),CMS(ITR),CDS(ITR), ITR=1,ITRMAX)    VIP.224
      WRITE(6,7500)                                                   VIP.225
      ITRMAX = KAMAX                                                  VIP.226
      NANGLE = NANGLE+1                                               VIP.227
      ITR = 1                                                         VIP.228
      MCASE = MCASE-1                                                 VIP.229
      IF(MCASE.GT.0) GO TO 100                                        VIP.230
      CALL EXIT                                                       VIP.231
  600 FORMAT(1H ,10F10.5)                                             VIP.232
  601 FORMAT(1H ,3I5)                                                 VIP.233
 5000 FORMAT(8F10.0)                                                  VIP.234
 5200 FORMAT(8A10)                                                    VIP.235
 7000 FORMAT(1H0,20X,*AIRFOIL GEOMETRY AND SURFACE PRESSURE DISTRIBUTIONVIP.236
     1S*/)                                                            VIP.237
 7100 FORMAT(1H0,20X,*COMPONENT =*,I3,5X,*SURFACE =*,I3/)             VIP.238
 7200 FORMAT(1H0,20X,*X INPUT* 15X *Z INPUT* 10X *PRESSURE COEFFICIENT* VIP.239
     1 10X *SOURCE STRENGTH*/)                                        VIP.240
 7300 FORMAT(1H ,18X,F10.5,13X,F10.5,10X,F10.5,20X,F10.5)             VIP.241
 7400 FORMAT(1H0,20X,*MACH NO. =*,F10.5,5X,*ANGLE OF ATTACK =*,F10.5, VIP.242
     1 5X,*SWEEP ANGLE =*,F10.5,5X,*ITERATION =*,I3/)                 VIP.243
 7500 FORMAT(1H0/1H0,15X,100(1H*)//)                                  VIP.244
 7600 FORMAT(1H0,20X,*LIFT DRAG AND MOMENT SUMMARY TABLE*/)           VIP.245
 7700 FORMAT(1H0,22X,*ITERATION* 13X *LIFT COEFFICIENT* 10X *MOMENTUM COVIP.246
     1EFFICIENT* 12X *DRAG COEFFICIENT*/)                             VIP.247
 7800 FORMAT(1H0,22X,I5,18X,F10.5,18X,F10.5,18X,F10.5)                VIP.248
 7900 FORMAT(1H0,20X,*COMPONENT* 10X *LIFT COEFFICIENT* 10X *MOMENTUM COVIP.249
     1EFFICIENT*/)                                                    VIP.250
 8000 FORMAT(1H0,18X,I5,18X,F10.5,18X,F10.5)                          VIP.251
 8100 FORMAT(1H0,20X,*BOUNDARY LAYER DEVELOPMENT ON FLAP UPPER SURFACE VIP.252
     1IN SLOT REGION*)                                                VIP.253
      END
```

```
      SUBROUTINE SOURCE                                                 SOURCE.2
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),     SOURCE.3
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),H1(200), SOURCE.4
     2PK(200),RDEL(200),RINST8(200),RTRAN(200),PKBAR(200),RTH(200),     SOURCE.5
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),  SOURCE.6
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),               SOURCE.7
     5XIP(8,100),ZIP(8,100),CPIP(8,100),NPP(8),DUMMY(192)               SOURCE.8
      COMMON /SIG/ SIG(200),SIGMAD(200),SIGMA(8,100)                    SOURCE.9
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                SOURCE.10
      COMMON/NPT/NPT                                                    SOURCE.11
      COMMON/NBL/ NBL                                                   SOURCE.12
      COMMON/ITR/ITR,ITRMAX                                             SOURCE.13
      COMMON/NUS/NUS                                                    SOURCE.14
      COMMON /NSIDE/ NSIDE                                              SOURCE.15
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),TE(4)                          SOURCE.16
      FACTOR = ITR-1                                                    SOURCE.17
      SIGNPT = .115-.01*FACTOR                                          SOURCE.18
      IF(NFLAP.GT.0) SIGNPT = .15                                       SOURCE.19
      DO 5 I=1,NUS                                                      SOURCE.20
      IF(H(I).GE.3.) H(I) = 3.                                          SOURCE.21
    5 CONTINUE                                                          SOURCE.22
      DO 10 I = 1,NUS                                                   SOURCE.23
      SIG(I) = H(I)*THT(I)*UUD(I)                                       SOURCE.24
   10 CONTINUE                                                          SOURCE.25
      CALL DCPDX(SIG,SUD,SIGMAD,NUS)                                    SOURCE.26
      K=NSIDE                                                           SOURCE.27
      B = SIGNPT                                                        SOURCE.28
      C = -SIGNPT                                                       SOURCE.29
      DO 20 I = 1,NPT                                                   SOURCE.30
      SIGMA(K,I) = TBLU1(SU(I),SUD,SIGMAD,1,NUS)                        SOURCE.31
      IF(SIGMA(K,I).GE.B) GO TO 70                                      SOURCE.32
      IF(SIGMA(K,I).LE.C) GO TO 60                                      SOURCE.33
   20 CONTINUE                                                          SOURCE.34
      GO TO 50                                                          SOURCE.35
   60 CONTINUE                                                          SOURCE.36
      SIGNPT = C                                                        SOURCE.37
   70 CONTINUE                                                          SOURCE.38
      IS = I - 1                                                        SOURCE.39
      IF(I.EQ.1) IS = 1                                                 SOURCE.40
      SLOPE = (SIGNPT - SIGMA(K,IS))/(SU(NPT) - SU(IS))                 SOURCE.41
      ISS = IS + 1                                                      SOURCE.42
      DO 40 I = ISS,NPT                                                 SOURCE.43
      SIGMA(K,I) = SIGMA(K,IS) + SLOPE*(SU(I) - SU(IS))                 SOURCE.44
   40 CONTINUE                                                          SOURCE.45
      IF(NCMPT.EQ.1.OR.NFLAP.EQ.0) GO TO 50                             SOURCE.46
      MAIN = NCMPT-NFLAP                                                SOURCE.47
      KK = MAIN + MAIN                                                  SOURCE.48
      IF(NFLAP.EQ.2.AND.NFP.EQ.1)  KK = KK + 2                          SOURCE.49
      IF(K.NE.KK) GO TO 50                                              SOURCE.50
      SS = SUD(NBL)                                                     SOURCE.51
      DO 30 I=1,NPT                                                     SOURCE.52
      IF(SU(I).GE.SS) GO TO 90                                          SOURCE.53
   30 CONTINUE                                                          SOURCE.54
   90 CONTINUE                                                          SOURCE.55
      ISS = I+3                                                         SOURCE.56
      IT = I+2                                                          SOURCE.57
      IF(ISS.GE.NPT) GO TO 50                                           SOURCE.58
      SIGMA(K,I+1) = SIGMA(K,I)                                         SOURCE.59
      SIGMA(K,I+2) = SIGMA(K,I)                                         SOURCE.60
      SLOPE =        -SIGMA(K,IT)/(SU(NPT)-SU(IT))                      SOURCE.61
      DO 80 I=ISS,NPT                                                   SOURCE.62
      SIGMA(K,I) = SIGMA(K,IT) + SLOPE*(SU(I)-SU(IT))                   SOURCE.63
   80 CONTINUE                                                          SOURCE.64
   50 CONTINUE                                                          SOURCE.65
      RETURN                                                            SOURCE.66
      END                                                               SOURCE.67
```

```
      SUBROUTINE DCPDX(U,X,DU,N)                                        DCPDX.2
      DIMENSION U(1),X(1),DU(1)                                         DCPDX.3
      DO 10 I = 1,N                                                     DCPDX.4
      IF(I.GT.1) GO TO 1                                                DCPDX.5
      DX1 = X(I+1) - X(I)                                               DCPDX.6
      DX2 = X(I+2) - X(I+1)                                             DCPDX.7
      DX = DX1 + DX2                                                    DCPDX.8
      DU1 = U(I+1) - U(I)                                               DCPDX.9
      DU2 = U(I+2) - U(I+1)                                             DCPDX.10
      A = DU1*(DX2/DX1 + 2.)                                            DCPDX.11
      B = DU2*(DX1/DX2)                                                 DCPDX.12
      DU(I) = (A-B)/DX                                                  DCPDX.13
      GO TO 10                                                          DCPDX.14
    1 IF(I.EQ.N) GO TO 2                                                DCPDX.15
      DX1 = X(I) - X(I-1)                                               DCPDX.16
      DX2 = X(I+1) - X(I)                                               DCPDX.17
      DX = DX1 + DX2                                                    DCPDX.18
      DU1 = U(I) - U(I-1)                                               DCPDX.19
      DU2 = U(I+1) - U(I)                                               DCPDX.20
      A = DU2*DX1/DX2                                                   DCPDX.21
      B = DU1*DX2/DX1                                                   DCPDX.22
      DU(I) = (A+B)/DX                                                  DCPDX.23
      GO TO 10                                                          DCPDX.24
    2 CONTINUE                                                          DCPDX.25
      DX1 = X(I-1) - X(I-2)                                             DCPDX.26
      DX2 = X(I) - X(I-1)                                               DCPDX.27
      DX = DX1 + DX2                                                    DCPDX.28
      DU1 = U(I-1) -U(I-2)                                              DCPDX.29
      DU2 = U(I) - U(I-1)                                               DCPDX.30
      A = DU2*(DX1/DX2 +2.)                                             DCPDX.31
      B = DU1*(DX2/DX1)                                                 DCPDX.32
      DU(I) = (A-B)/DX                                                  DCPDX.33
   10 CONTINUE                                                          DCPDX.34
      RETURN                                                            DCPDX.35
      END                                                               DCPDX.36
```

```
      INTEGER FUNCTION INSERT(Z,X,ND,M,IS)                              INSERT.2
      DIMENSION X(1)                                                    INSERT.3
      IHALF(I) = (I + 1)/2                                              INSERT.4
      N=IABS(M)                                                         INSERT.5
      INSERT = 1                                                        INSERT.6
      I=1                                                               INSERT.7
      IF(N.LE.1) GO TO 24                                               INSERT.8
      ND=MIN0(ND,N-1)                                                   INSERT.9
      IF(M .GE. 0) GO TO 445                                            INSERT.10
      IF(ABS(Z+Z-X(1)-X(N)) .LE. ABS(X(1)-X(N))) GO TO 445              INSERT.11
      IF(X(N).GT.X(1).AND.Z.GT.X(N)) I=N                                INSERT.12
      IF(X(N).LT.X(1).AND.Z.LT.X(N)) I=N                                INSERT.13
      GO TO 24                                                          INSERT.14
  445 IGO=1                                                             INSERT.15
      IF(X(1) .GT. X(2))IGO=0                                           INSERT.16
      I=IHALF(N)                                                        INSERT.17
      IDLT=I                                                            INSERT.18
    5 IDLT=IHALF(IDLT)                                                  INSERT.19
      DIF=X(I)-Z                                                        INSERT.20
      IF(IGO.EQ.0) DIF=-DIF                                             INSERT.21
      IF(DIF) 30,24,20                                                  INSERT.22
   24 IS=I                                                              INSERT.23
      GO TO 52                                                          INSERT.24
   20 IF(I-1) 40,40,21                                                  INSERT.25
   21 IF(I-IDLT) 22,22,23                                               INSERT.26
   22 IDLT=IHALF(IDLT)                                                  INSERT.27
   23 I=I-IDLT                                                          INSERT.28
      I=MAX0(I,1)                                                       INSERT.29
      GO TO 5                                                           INSERT.30
   30 IF(I-N) 31,40,40                                                  INSERT.31
```

```
   31 DIF=X(I+1)-Z                                                      INSERT.32
      IF(IGO.EQ.0) DIF=-DIF                                             INSERT.33
      IF(DIF) 34,36,40                                                  INSERT.34
   36 IS=I+1                                                            INSERT.35
      GO TO 52                                                          INSERT.36
   34 I=I+IDLT                                                          INSERT.37
      IF(I-N) 5,5,35                                                    INSERT.38
   35 I=I-IDLT                                                          INSERT.39
      IDLT=IHALF(IDLT)                                                  INSERT.40
      GO TO 34                                                          INSERT.41
   40 IF(ND) 44,44,43                                                   INSERT.42
   44 IF(I.EQ.N) GO TO 24                                               INSERT.43
      IF(ABS(Z-X(I)) .LE. ABS(Z-X(I+1))) GO TO 24                       INSERT.44
      GO TO 36                                                          INSERT.45
   43 I=MINO(MAXO(1,I-(ND-1)/2), N-ND)                                  INSERT.46
      IS=I                                                              INSERT.47
      INSERT = 0                                                        INSERT.48
   52 RETURN                                                            INSERT.49
      END                                                               INSERT.50
      SUBROUTINE SMLN(XC,CC,B,N)                                        SMLN.2
      DIMENSION XC(4,4), B(4), CC(4)                                    SMLN.3
C ROUTINE TO SOLVE A SET OF LINEAR SIMULTANEOUS EQUATIONS.              SMLN.4
      NP = N+1                                                          SMLN.5
      NM = N-1                                                          SMLN.6
C TRIANGULARIZATION                                                     SMLN.7
      DO 100 K=1,NM                                                     SMLN.8
      KP = K+1                                                          SMLN.9
      R = 1./XC(K,K)                                                    SMLN.10
      DO 50 J=KP,N                                                      SMLN.11
   50 XC(K,J)= R*XC(K,J)                                                SMLN.12
      B(K) = R*B(K)                                                     SMLN.13
      DO100 I=KP,N                                                      SMLN.14
      S =XC(I,K)                                                        SMLN.15
      B(I) = B(I)-S*B(K)                                                SMLN.16
      DO100 J=KP,N                                                      SMLN.17
      XC(I,J)=XC(I,J)-S*XC(K,J)                                         SMLN.18
  100 CONTINUE                                                          SMLN.19
C BACK SUBSTITUTION.                                                    SMLN.20
      CC(N) =  B(N)/XC(N,N)                                             SMLN.21
      DO 200 I=1,NM                                                     SMLN.22
      K = N-I                                                           SMLN.23
      KP = K+1                                                          SMLN.24
      S = B(K)                                                          SMLN.25
      DO 150 J=KP,N                                                     SMLN.26
      S = S-XC(K,J)*CC(J)                                               SMLN.27
  150 CONTINUE                                                          SMLN.28
      CC(K)= S                                                          SMLN.29
  200 CONTINUE                                                          SMLN.30
      RETURN                                                            SMLN.31
      END                                                               SMLN.32
      FUNCTION TBLU1(XX,X,Y,MD,N)                                       TBLU1.2
      DIMENSION X(1), Y(1)                                              TBLU1.3
      ND=MD                                                             TBLU1.4
      IF(INSERT(XX,X,NC,N,I) .EQ. 0) GO TO 43                           TBLU1.5
      TBLU1=Y(I)                                                        TBLU1.6
      GO TO 51                                                          TBLU1.7
   43 CONTINUE                                                          TBLU1.8
      M=I+ND                                                            TBLU1.9
      TERP1=0.                                                          TBLU1.10
      DO 50 J=I,M                                                       TBLU1.11
      PX=1.                                                             TBLU1.12
      DO 42 K=I,M                                                       TBLU1.13
      IF(K .EQ. J) GO TO 42                                             TBLU1.14
      PX=(PX/(X(J)-X(K)))*(XX-X(K))                                     TBLU1.15
   42 CONTINUE                                                          TBLU1.16
   50 TERP1=TERP1+PX*Y(J)                                               TBLU1.17
      TBLU1=TERP1                                                       TBLU1.18
   51 RETURN                                                            TBLU1.19
      END                                                               TBLU1.20
```

```
      OVERLAY(FRIS,1,0)                                                  POTFLOW.3
      PROGRAM POTFLOW                                                    POTFLOW.4
      COMMON/ ANGLE / ANGLE                                              POTFLOW.5
      COMMON/ NPT / NPT                                                  POTFLOW.6
      COMMON /ITR/ ITR,ITRMAX                                            POTFLOW.7
      COMMON /JMAX/ JMAX                                                 POTFLOW.8
      COMMON/NANGLE/NANGLE                                               POTFLOW.9
      COMMON /XIN/ XIN(100),ZIN(100),CPIN(100)                           POTFLOW.10
      COMMON /PARAM/ MACH,ALPHA,REFA,MATIN                               POTFLOW.11
      COMMON /VELCOM/ NPOINT,NPART,IMAX,EX,PRINT                         POTFLOW.12
      COMMON/POINT/ARRAY(4950)                                           POTFLOW.13
      COMMON/GAMM/GA(600),Q                                              POTFLOW.14
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(12),NPU(4),NPL(4),ISTG(4) POTFLOW.15
     1,UCU(4),UCL(4),WCU(4),WCL(4),XTE(4),ZTE(4),DELZ(3),NG(3),NPG(4)    POTFLOW.16
     2,THKTE(4)                                                          POTFLOW.17
      COMMON /SCRAT/  SINBD(600),COSBD(600),TANBD(600),UL(600),WL(600),  POTFLOW.18
     1UCJ(2),WCJ(2),ULJ(2),WLJ(2),UC(600),WC(600),AC(600),AS(100)        POTFLOW.19
     2,H(100),DUM(10192)                                                 POTFLOW.20
      COMMON/GAP/ ZGAP(2),SXU(2)                                         POTFLOW.21
      COMMON/CURVES/ R(30,2)                                             POTFLOW.22
      COMMON/XGEM/ IGEM                                                  POTFLOW.23
      COMMON/XSOLVE/ ISOLVE                                              POTFLOW.24
      DIMENSION DELTA(600),THET(600),CHORD(600),XPT(600),ZPT(600),       POTFLOW.25
     1XU(30,4),ZU(30,4),XL(30,4),ZL(30,4),XCOR(600),ZCOR(600),          POTFLOW.26
     2XGRID(30,3),ZGRID(30,3),DZDX(30,3),Q(600)                         POTFLOW.27
      EQUIVALENCE (ARRAY,DELTA),(ARRAY(601),THET),(ARRAY(1201),CHORD),   POTFLOW.28
     1(ARRAY(1801),XPT),(ARRAY(2401),ZPT),                               POTFLOW.29
     2(ARRAY(3001),XU),(ARRAY(3121),XL),                                 POTFLOW.30
     3(ARRAY(3241),ZU),(ARRAY(3361),ZL),                                 POTFLOW.31
     4(ARRAY(3481),XGRID),(ARRAY(3571),ZGRID),(ARRAY(3661),DZDX),        POTFLOW.32
     5(ARRAY(3751),XCOR),(ARRAY(4351),ZCOR)                              POTFLOW.33
      DATA FRIS/4HFRIS/                                                  POTFLOW.34
      REAL MACH                                                          POTFLOW.35
      EPS=1.0E-6                                                         POTFLOW.36
      KTE = 0                                                            POTFLOW.37
      EM=-1.0                                                            POTFLOW.38
      PI=3.14159265                                                      POTFLOW.39
      REFA=1.0                                                           POTFLOW.40
      REWIND 3                                                           POTFLOW.41
      REWIND 7                                                           POTFLOW.42
      REWIND 8                                                           POTFLOW.43
      REWIND 9                                                           POTFLOW.44
      REWIND 10                                                          POTFLOW.45
      IF(ITR.EQ.1.AND.NANGLE.GT.1) GO TO 45                              POTFLOW.46
      IF(ITR.GT.2) GO TO 350                                             POTFLOW.47
      IF(ITR.GT.1) GO TO 11                                              POTFLOW.48
    5 CONTINUE                                                           POTFLOW.49
      NPASS=0                                                            POTFLOW.50
      CALL ROTATE(XU,ZU,XL,ZL)                                           POTFLOW.51
      IF(IGEM.GE.1) STOP 7000                                            POTFLOW.52
      NF=0                                                               POTFLOW.53
      NP=0                                                               POTFLOW.54
      NX = NCMPT - NFLAP                                                 POTFLOW.55
      DO 12 N=1,NCMPT                                                    POTFLOW.56
      IF(N.LE.NX) NPG(N) = 0                                             POTFLOW.57
      IF(N.LE.NX) GO TO 12                                               POTFLOW.58
      NF=NF+1                                                            POTFLOW.59
      LPL = NPL(N-1)                                                     POTFLOW.60
      XTE(NF) = XL(LPL,N-1)                                              POTFLOW.61
      ZTE(NF) = ZL(LPL,N-1)                                              POTFLOW.62
   12 CONTINUE                                                           POTFLOW.63
      IF(NFLAP.EQ.0) GO TO 21                                            POTFLOW.64
      DO 22 NX=1,NFLAP                                                   POTFLOW.65
      N = NCMPT-NFLAP+NX                                                 POTFLOW.66
      LPU = NPU(N)                                                       POTFLOW.67
      DO 23 L=1,LPU                                                      POTFLOW.68
      H(L) = SQRT((XTE(NX)-XU(L,N))**2 + (ZTE(NX)-ZU(L,N))**2)           POTFLOW.69
      IF(L.EQ.1) GO TO 23                                                POTFLOW.70
      IF(H(L).LE.H(L-1)) GO TO 23                                        POTFLOW.71
      IF(H(L).LE.H(L-2)) GO TO 24                                        POTFLOW.72
      KGAP = L-1
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      GO TO 25                                                                  POTFLOW.73
   24 CONTINUE                                                                  POTFLOW.74
      KGAP = L                                                                  POTFLOW.75
      GO TO 25                                                                  POTFLOW.76
   23 CONTINUE                                                                  POTFLOW.77
   25 CONTINUE                                                                  POTFLOW.78
      H1 = H(KGAP-1)                                                            POTFLOW.79
      H2 = H(KGAP)                                                              POTFLOW.80
      H3 = SQRT((XU(KGAP,N)-XU(KGAP-1,N))**2 + (ZU(KGAP,N)-ZU(KGAP-1,N))POTFLOW.81
     1**2)                                                                      POTFLOW.82
      SA = (H1**2 - H2**2 + H3**2)/2.*H3                                        POTFLOW.83
      ZGAP(NX) = SQRT(H1**2 - SA**2)                                            POTFLOW.84
      IF(SA.LT.0.) KGAP = KGAP-1                                                POTFLOW.85
      NPG(N) = KGAP                                                             POTFLOW.86
      SXU(NX) = SA                                                              POTFLOW.87
   22 CONTINUE                                                                  POTFLOW.88
   21 CONTINUE                                                                  POTFLOW.89
      NF = 0                                                                    POTFLOW.90
      DO 40 N=1,NCMPT                                                           POTFLOW.91
      IF(N.EQ.1.OR.NPG(N).EQ.0) GO TO 26                                        POTFLOW.92
      NF = NF + 1                                                               POTFLOW.93
   26 CONTINUE                                                                  POTFLOW.94
      DO 30 NSIDE=1,2                                                           POTFLOW.95
      IF(NSIDE.EQ.1) NL=NPU(N)-1                                                POTFLOW.96
      IF(NSIDE.EQ.2) NL=NPL(N)-1                                                POTFLOW.97
      DO 20 L=1,NL                                                              POTFLOW.98
      NP=NP+1                                                                   POTFLOW.99
      IF(NSIDE.EQ.2) GO TO 15                                                   POTFLOW.100
      XPT(NP)=(XU(L+1,N)+XU(L,N))/2.                                            POTFLOW.101
      ZPT(NP)=(ZU(L+1,N)+ZU(L,N))/2.                                            POTFLOW.102
      XC=XU(L+1,N)-XU(L,N)                                                      POTFLOW.103
      ZC=ZU(L+1,N)-ZU(L,N)                                                      POTFLOW.104
      XCOR(NP)=XU(L,N)                                                          POTFLOW.105
      ZCOR(NP)=ZU(L,N)                                                          POTFLOW.106
      GO TO 18                                                                  POTFLOW.107
   15 CONTINUE                                                                  POTFLOW.108
      XPT(NP)=(XL(L+1,N)+XL(L,N))/2.                                            POTFLOW.109
      ZPT(NP)=(ZL(L+1,N)+ZL(L,N))/2.                                            POTFLOW.110
      XC=XL(L+1,N)-XL(L,N)                                                      POTFLOW.111
      ZC=ZL(L+1,N)-ZL(L,N)                                                      POTFLOW.112
      XCOR(NP)=XL(L+1,N)                                                        POTFLOW.113
      ZCOR(NP)=ZL(L+1,N)                                                        POTFLOW.114
   18 CHORD(NP)=SQRT(XC*XC+ZC*ZC)                                               POTFLOW.115
      Q(NP) = 0.                                                                POTFLOW.116
      THET(NP)=0.                                                               POTFLOW.117
      DELTA(NP)=0.                                                              POTFLOW.118
      IF(ZC.NE.0.) DELTA(NP)=ATAN2(ZC,XC)                                       POTFLOW.119
      IF(L.LT.NL) GO TO 19                                                      POTFLOW.120
      IF(NSIDE.EQ.1) TU=DELTA(NP)                                               POTFLOW.121
      IF(NSIDE.EQ.2) TL=DELTA(NP)                                               POTFLOW.122
      LUP = NPU(N)                                                              POTFLOW.123
      IF(NSIDE.EQ.1) ZTEU=ZU(LUP,N)                                             POTFLOW.124
      LUL = NPL(N)                                                              POTFLOW.125
      IF(NSIDE.EQ.2) ZTEL=ZL(LUL,N)                                             POTFLOW.126
   19 IF(NSIDE.EQ.2.OR.NPG(N).EQ.0) GO TO 20                                    POTFLOW.127
      LG=L+1-NPG(N)                                                             POTFLOW.128
      IF(L.EQ.NL) NG(NF) = LG + 1                                               POTFLOW.129
      IF(LG.LT.1) GO TO 20                                                      POTFLOW.130
      XGRID(LG,NF)=XU(L,N)                                                      POTFLOW.131
      ZGRID(LG,NF)=ZU(L,N)                                                      POTFLOW.132
      DZDX(LG,NF)=ZC/XC                                                         POTFLOW.133
      IF(L.LT.NL) GO TO 20                                                      POTFLOW.134
      LL = NPU(N)                                                               POTFLOW.135
      XGRID(LG+1,NF) = XU(LL,N)                                                 POTFLOW.136
      ZGRID(LG+1,NF) = ZU(LL,N)                                                 POTFLOW.137
      DZDX(LG+1,NF) = DZDX(LG,NF)                                               POTFLOW.138
   20 CONTINUE                                                                  POTFLOW.139
   30 CONTINUE                                                                  POTFLOW.140
      THETE(N)=TL-TU                                                            POTFLOW.141
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      THKTE(N)=ZTEU-ZTEL                                                POTFLOW.142
      IF(ABS(THKTE(N)).LE.EPS) THKTE(N)=0.                              POTFLOW.143
   40 CONTINUE                                                          POTFLOW.144
      WRITE(7) ARRAY                                                    POTFLOW.145
      REWIND 7                                                          POTFLOW.146
      NPOINT=NP                                                         POTFLOW.147
   45 READ(5,501) MACH,ALPHA                                            POTFLOW.148
      GO TO 13                                                          POTFLOW.149
   11 CONTINUE                                                          POTFLOW.150
      DO 1 N =1,NCMPT                                                   POTFLOW.151
      IF(THKTE(N).GT.0.) KTE = 1                                        POTFLOW.152
    1 CONTINUE                                                          POTFLOW.153
      IF(KTE.EQ.0)  GO TO 350                                           POTFLOW.154
      IF(ITR.GT.1) READ(7) ARRAY                                        POTFLOW.155
      REWIND 7                                                          POTFLOW.156
   13 CONTINUE                                                          POTFLOW.157
      ANGLE=ALPHA                                                       POTFLOW.158
      IF(MACH.LT.0.) RETURN                                             POTFLOW.159
      IF(MACH.EQ.EM) GO TO 325                                          POTFLOW.160
      EM=MACH                                                           POTFLOW.161
      MATIN=0                                                           POTFLOW.162
      IF(ITR.EQ.1.AND.NANGLE.GT.1) READ(7) ARRAY                        POTFLOW.163
      REWIND 7                                                          POTFLOW.164
      NPASS=NPASS+1                                                     POTFLOW.165
      BT2=1.-MACH*MACH                                                  POTFLOW.166
      BETA=SQRT(BT2)                                                    POTFLOW.167
      CON=1./(2.*PI)                                                    POTFLOW.168
      BCON=BETA*CON                                                     POTFLOW.169
      DO 50 N=1,NPOINT                                                  POTFLOW.170
      BD=BETA*TAN(DELTA(N))                                             POTFLOW.171
      TANBD(N)=BD                                                       POTFLOW.172
      COSBD(N)=1./SQRT(1.+BD*BD)                                        POTFLOW.173
   50 SINBD(N)=BD*COSBD(N)                                              POTFLOW.174
      DO 300 I=1,NPOINT                                                 POTFLOW.175
      XI=XPT(I)                                                         POTFLOW.176
      ZI=ZPT(I)                                                         POTFLOW.177
      DI=TANBD(I)                                                       POTFLOW.178
      DB=DI/BT2                                                         POTFLOW.179
      I2=0                                                              POTFLOW.180
      J=0                                                               POTFLOW.181
      JMAX=0                                                            POTFLOW.182
      JL=0                                                              POTFLOW.183
      JT=0                                                              POTFLOW.184
      K=0                                                               POTFLOW.185
      DO 275 N=1,NCMPT                                                  POTFLOW.186
      JL=JT+1                                                           POTFLOW.187
      JT=JT+NC(N)-2                                                     POTFLOW.188
      JMAX=JMAX+NC(N)                                                   POTFLOW.189
      I1=I2+1                                                           POTFLOW.190
      I2=I1-3+NC(N)                                                     POTFLOW.191
      IT=I1+NPU(N)-2                                                    POTFLOW.192
      IL=IT+1                                                           POTFLOW.193
      UCJT=0.                                                           POTFLOW.194
      WCJT=0.                                                           POTFLOW.195
      ACJT=0.                                                           POTFLOW.196
      DO 250 NSIDE=1,2                                                  POTFLOW.197
      IF(NSIDE.EQ.1) NL=NPU(N)-1                                        POTFLOW.198
      IF(NSIDE.EQ.2) NL=NPL(N)-1                                        POTFLOW.199
      NL1=NL+1                                                          POTFLOW.200
      DO 225 L=1,NL                                                     POTFLOW.201
      J=J+1                                                             POTFLOW.202
      K=K+1                                                             POTFLOW.203
      IF(I.GT.1) GO TO 58                                               POTFLOW.204
      IF(NSIDE.EQ.2) GO TO 55                                           POTFLOW.205
      XC=XU(L+1,N)-XU(L,N)                                              POTFLOW.206
      ZC=ZU(L+1,N)-ZU(L,N)                                              POTFLOW.207
      GO TO 56                                                          POTFLOW.208
   55 XC=XL(L+1,N)-XL(L,N)                                              POTFLOW.209
      ZC=ZL(L+1,N)-ZL(L,N)                                              POTFLOW.210
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 56 CHORD(K)=SQRT(XC*XC+BT2*ZC*ZC)                                    POTFLOW.211
 58 DO 100 M=1,2                                                      POTFLOW.212
    L1=L+M-1                                                          POTFLOW.213
    IF(NSIDE.EQ.2) GO TO 60                                           POTFLOW.214
    DX=XI-XU(L1,N)                                                    POTFLOW.215
    DZ=(ZI-ZU(L1,N))*BETA                                             POTFLOW.216
    GO TO 80                                                          POTFLOW.217
 60 DX=XI-XL(L1,N)                                                    POTFLOW.218
    DZ=(ZI-ZL(L1,N))*BETA                                             POTFLOW.219
 80 XPM=DX*COSBD(K)+DZ*SINBD(K)                                       POTFLOW.220
    ZPM=DZ*COSBD(K)-DX*SINBD(K)                                       POTFLOW.221
    IF(ABS(XPM).LE.EPS) XPM=0.                                        POTFLOW.222
    IF(ABS(ZPM).LE.EPS) ZPM=0.                                        POTFLOW.223
    RPM2=XPM*XPM+ZPM*ZPM                                              POTFLOW.224
    RPM=0.                                                            POTFLOW.225
    IF(RPM2.GT.0.) RPM=SQRT(RPM2)                                     POTFLOW.226
    G=0.                                                              POTFLOW.227
    IF(RPM.GT.0.) G=ALOG(RPM)                                         POTFLOW.228
    F=PI/2.                                                           POTFLOW.229
    IF(XPM.EQ.0..AND.ZPM.EQ.0.) GO TO 90                              POTFLOW.230
    F=ATAN2(ZPM,XPM)                                                  POTFLOW.231
 90 CONTINUE                                                          POTFLOW.232
    IF(NSIDE.EQ.2.AND.ZPM.EQ.0.) F=-F                                 POTFLOW.233
    UCJ(M)=-F                                                         POTFLOW.234
    WCJ(M)=-G                                                         POTFLOW.235
    ULJ(M)=-(XPM*F+ZPM*G)/CHORD(K)                                    POTFLOW.236
    WLJ(M)= (ZPM*F+XPM*(1.-G))/CHORD(K)                               POTFLOW.237
100 CONTINUE                                                          POTFLOW.238
    UCPM=UCJ(1)-ULJ(1)+ULJ(2)                                         POTFLOW.239
    WCPM=WCJ(1)-WLJ(1)+WLJ(2)                                         POTFLOW.240
    ULPM=ULJ(1)-ULJ(2)-UCJ(2)                                         POTFLOW.241
    WLPM=WLJ(1)-WLJ(2)-WCJ(2)                                         POTFLOW.242
    USPM=WCJ(2)-WCJ(1)                                                POTFLOW.243
    WSPM=UCJ(1)-UCJ(2)                                                POTFLOW.244
    UC(J)=(UCPM*COSBD(K)-WCPM*SINBD(K))*CON                           POTFLOW.245
    WC(J)=(WCPM*COSBD(K)+UCPM*SINBD(K))*BCON                          POTFLOW.246
    UL(J)=(ULPM*COSBD(K)-WLPM*SINBD(K))*CON                           POTFLOW.247
    WL(J)=(WLPM*COSBD(K)+ULPM*SINBD(K))*BCON                          POTFLOW.248
    USJ=(USPM*COSBD(K)-WSPM*SINBD(K))*BCON                            POTFLOW.249
    WSJ=(WSPM*COSBD(K)+USPM*SINBD(K))*CON                             POTFLOW.250
    UCJT=UCJT+USJ                                                     POTFLOW.251
    WCJT=WCJT+WSJ                                                     POTFLOW.252
    ACJT=ACJT+WSJ-DB*USJ                                              POTFLOW.253
    IF(NSIDE.EQ.2.AND.L.EQ.1 ) GO TO 160                              POTFLOW.254
    IF(L.GT.1) UC(J)=UC(J)+UL(J-1)                                    POTFLOW.255
    IF(L.GT.1) WC(J)=WC(J)+WL(J-1)                                    POTFLOW.256
    GO TO 200                                                         POTFLOW.257
160 AS(L)=UC(J)+DB*WC(J)                                              POTFLOW.258
    UC(JL)=UC(JL)+UC(J)                                               POTFLOW.259
    WC(JL)=WC(JL)+WC(J)                                               POTFLOW.260
    AC(JL)=WC(JL)-DI*UC(JL)                                           POTFLOW.261
    UL(J-1)=UL(J)                                                     POTFLOW.262
    WL(J-1)=WL(J)                                                     POTFLOW.263
    J=J-1                                                             POTFLOW.264
    GO TO 225                                                         POTFLOW.265
200 AC(J)=WC(J)-DI*UC(J)                                              POTFLOW.266
    AS(L)=UC(J)+DB*WC(J)                                              POTFLOW.267
    IF(L.LT.NL) GO TO 225                                             POTFLOW.268
    IF(NSIDE.EQ.2) GO TO 220                                          POTFLOW.269
    UCU(N)=UL(J)                                                      POTFLOW.270
    WCU(N)=WL(J)                                                      POTFLOW.271
    ACU=WCU(N)-DI*UCU(N)                                              POTFLOW.272
    AS(NL1)=UCU(N)+DB*WCU(N)                                          POTFLOW.273
    IF(I.LT.I1.OR.I.GT.IT) GO TO 215                                  POTFLOW.274
    II=I-I1+1                                                         POTFLOW.275
    DO 210 LL=1,NL                                                    POTFLOW.276
    IF(LL.NE.II) GO TO 210                                            POTFLOW.277
    AS(LL)=-AS(LL)                                                    POTFLOW.278
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      AS(LL+1)=-AS(LL+1)                                                POTFLOW.279
  210 CONTINUE                                                          POTFLOW.280
  215 WRITE(1) ACU,(AS(LL),LL=1,NL1)                                    POTFLOW.281
      GO TO 225                                                         POTFLOW.282
  220 UCL(N)=UL(J)                                                      POTFLOW.283
      WCL(N)=WL(J)                                                      POTFLOW.284
      ACL=WCL(N)-DI*UCL(N)                                              POTFLOW.285
      AS(NL1)=UCL(N)+D8*WCL(N)                                          POTFLOW.286
      IF(I.LT.IL.OR.I.GT.I2) GO TO 224                                  POTFLOW.287
      II=I-IL+1                                                         POTFLOW.288
      DO 222 LL=1,NL                                                    POTFLOW.289
      IF(LL.NE.II) GO TO 222                                            POTFLOW.290
      AS(LL)=-AS(LL)                                                    POTFLOW.291
      AS(LL+1)=-AS(LL+1)                                                POTFLOW.292
  222 CONTINUE                                                          POTFLOW.293
  224 WRITE(1) ACL,(AS(LL),LL=1,NL1)                                    POTFLOW.294
  225 CONTINUE                                                          POTFLOW.295
  250 CONTINUE                                                          POTFLOW.296
      UC(JT)=UCJT                                                       POTFLOW.297
      WC(JT)=WCJT                                                       POTFLOW.298
      AC(JT)=ACJT                                                       POTFLOW.299
      IF(THKTE(N).EQ.0..OR.ITR.GT.1) GO TO 255                          POTFLOW.300
      UC(JT)=0.                                                         POTFLOW.301
      WC(JT)=0.                                                         POTFLOW.302
      AC(JT)=ACU-ACL                                                    POTFLOW.303
  255 CONTINUE                                                          POTFLOW.304
      J=J+1                                                             POTFLOW.305
      IF(NCMPT.EQ.1.OR.ISOLVE.EQ.0) GO TO 275                           POTFLOW.306
      IF(I.LT.I1.OR.I.GT.I2) GO TO 275                                  POTFLOW.307
      WRITE(3) (AC(II+I1-1),II=1,JT)                                    POTFLOW.308
      DO 260 II=1,JT                                                    POTFLOW.309
  260 AC(II+I1-1)=0.                                                    POTFLOW.310
  275 CONTINUE                                                          POTFLOW.311
      J=0                                                               POTFLOW.312.
      K=0                                                               POTFLOW.313
      DO 290 N=1,NCMPT                                                  POTFLOW.314
      J2=NC(N)                                                          POTFLOW.315
      J1=J2-1                                                           POTFLOW.316
      JT=J2-2                                                           POTFLOW.317
      DO 290 JJ=1,J2                                                    POTFLOW.318
      J=J+1                                                             POTFLOW.319
      IF(JJ.GT.JT) GO TO 285                                            POTFLOW.320
      K=K+1                                                             POTFLOW.321
      UL(J)=UC(K)                                                       POTFLOW.322
      WL(J)=WC(K)                                                       POTFLOW.323
      GO TO 290                                                         POTFLOW.324
  285 IF(JJ.EQ.J2) GO TO 286                                            POTFLOW.325
      UL(J)=UCU(N)                                                      POTFLOW.326
      WL(J)=WCU(N)                                                      POTFLOW.327
      GO TO 290                                                         POTFLOW.328
  286 UL(J)=UCL(N)                                                      POTFLOW.329
      WL(J)=WCL(N)                                                      POTFLOW.330
  290 CONTINUE                                                          POTFLOW.331
      WRITE(8) (UL(J),WL(J),J=1,JMAX)                                   POTFLOW.332
      WRITE(9) (AC(J),J=1,NPOINT)                                       POTFLOW.333
  300 CONTINUE                                                          POTFLOW.334
  325 REWIND 8                                                          POTFLOW.335
      REWIND 9                                                          POTFLOW.336
      REWIND 1                                                          POTFLOW.337
      REWIND 3                                                          POTFLOW.338
  350 IF(ITR.GE.2) READ(7) ARRAY                                        POTFLOW.339
      REWIND 7                                                          POTFLOW.340
      CALL SOLVE                                                        POTFLOW.341
  400 RETURN                                                            POTFLOW.342
  500 FORMAT(14I5)                                                      POTFLOW.343
  501 FORMAT(7F10.0)                                                    POTFLOW.344
  601 FORMAT(1H ,10F10.5)                                               POTFLOW.345
  660 FORMAT(7I5,9F10.5)                                                POTFLOW.346
      END                                                               POTFLOW.347
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      SUBROUTINE ROTATE(XU,ZU,XL,ZL)                                    SAPR.111
      COMMON/DZDX/ DDX(30),DDZ(30),DS(30)                               SAPR.112
      COMMON/XFND/ XFIND(20),NXFIND                                     SAPR.113
      COMMON/SCRAT/  XXS(30),ZZS(30),TS(30),XR(30),ZR(30),TEMP(30),     SAPR.114
     1RAD(30),XXU(30,4),ZZU(30,4),XXL(30,4),ZZL(30,4),XPW(3),XPC(3),    SAPR.115
     2ZPW(3),ZPC(3),DELF(3),XK(30),ZK(30),DUMMY(8035)                   SAPR.116
      COMMON/SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(12),NPU(4),NPL(4),        SAPR.117
     1DUM(28),DELZ(3),DUMM(11)                                          SAPR.118
      COMMON/CURVES/ R(30,2)                                            SAPR.119
      DIMENSION XU(30,4),ZU(30,4),XL(30,4),ZL(30,4)                     SAPR.120
      READ(5,500) NCMPT,NSLAT,NFLAP,(NPU(N),NPL(N),N=1,NCMPT)           SAPR.121
      NF = 0                                                            SAPR.122
      DO 10 N = 1, NCMPT                                                SAPR.123
      LPU = NPU(N)                                                      SAPR.124
      LPL = NPL(N)                                                      SAPR.125
      NC(N) = LPU+LPL                                                   SAPR.126
      READ(5,501) (XXU(L,N),L=1,LPU)                                    SAPR.127
      READ(5,501) (ZZU(L,N),L=1,LPU)                                    SAPR.128
      READ(5,501) (XXL(L,N),L=1,LPL)                                    SAPR.129
      READ(5,501) (ZZL(L,N),L=1,LPL)                                    SAPR.130
      NMM = NCMPT - NFLAP                                               SAPR.131
      IF(N.LE.NMM) GO TO 10                                             SAPR.132
      NF = NF + 1                                                       SAPR.133
      DELZ(NF) = .005                                                   SAPR.134
   10 CONTINUE                                                          SAPR.135
      IM = 1                                                            SAPR.136
      NPIVOT = NCMPT - 1                                                SAPR.137
      IF(NPIVOT.EQ.0) GO TO 101                                         SAPR.138
C     PIVOT POINTS IN WING COORDINATES                                  SAPR.139
      READ(5,501) (XPW(N),ZPW(N),N=1,NPIVOT)                            SAPR.140
C     PIVOT POINTS IN COMPONENT COORDINATES                             SAPR.141
      READ(5,501) (XPC(N),ZPC(N),N=1,NPIVOT)                            SAPR.142
C     FLAP DEFLECTIONS                                                  SAPR.143
      READ(5,501) (DELF(N),N=1,NPIVOT)                                  SAPR.144
      N=1                                                               SAPR.145
      NPIVOT =1                                                         SAPR.146
      IF(NSLAT.EQ.0) N=2                                                SAPR.147
  102 CONTINUE                                                          SAPR.148
      IF(N.EQ.2) IM=1                                                   SAPR.149
      IF(NSLAT.EQ.1) IM=2                                               SAPR.150
      I = NPIVOT                                                        SAPR.151
      DX = XPW(I) - XPC(I)                                              SAPR.152
      DZ = ZPW(I) - ZPC(I)                                              SAPR.153
      TH = DELF(I)/57.2957795                                           SAPR.154
      DO 104 NSIDE =1,2                                                 SAPR.155
      IF(NSIDE.EQ.1) NL = NPU(N)                                        SAPR.156
      IF(NSIDE.EQ.2) NL = NPL(N)                                        SAPR.157
      DO 103 L=1,NL                                                     SAPR.158
      IF(NSIDE.EQ.2) GO TO 105                                          SAPR.159
      XPP = XXU(L,N)                                                    SAPR.160
      ZPP = ZZU(L,N)                                                    SAPR.161
      GO TO 106                                                         SAPR.162
  105 CONTINUE                                                          SAPR.163
      XPP = XXL(L,N)                                                    SAPR.164
      ZPP = ZZL(L,N)                                                    SAPR.165
  106 CONTINUE                                                          SAPR.166
      CALL ROTAN(XPP,ZPP,TH,XPC(I),ZPC(I),DX,DZ,XX,ZZ)                  SAPR.167
      IF(NSIDE.EQ.2) GO TO 107                                          SAPR.168
      XU(L,N) = XX                                                      SAPR.169
      ZU(L,N) = ZZ                                                      SAPR.170
      GO TO 108                                                         SAPR.171
  107 CONTINUE                                                          SAPR.172
      XL(L,N) = XX                                                      SAPR.173
      ZL(L,N) = ZZ                                                      SAPR.174
  108 CONTINUE                                                          SAPR.175
  103 CONTINUE                                                          SAPR.176
  104 CONTINUE                                                          SAPR.177
      IF(N.EQ.1.AND.NSLAT.EQ.1) N=N+1                                   SAPR.178
      N = N+1                                                           SAPR.179
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      NPIVOT = NPIVOT +1                                                SAPR.180
      IF(N.GT.NCMPT) GO TO 101                                          SAPR.181
      GO TO 102                                                         SAPR.182
  101 CONTINUE                                                          SAPR.183
      N = IM                                                            SAPR.184
      DO 110 NSIDE = 1,2                                                SAPR.185
      IF(NSIDE.EQ.1) NL = NPU(N)                                        SAPR.186
      IF(NSIDE.EQ.2) NL = NPL(N)                                        SAPR.187
      DO 109 L =1,NL                                                    SAPR.188
      IF(NSIDE.EQ.2) GO TO 111                                          SAPR.189
      XU(L,N) = XXU(L,N)                                                SAPR.190
      ZU(L,N) = ZZU(L,N)                                                SAPR.191
      GO TO 112                                                         SAPR.192
  111 CONTINUE                                                          SAPR.193
      XL(L,N) = XXL(L,N)                                                SAPR.194
      ZL(L,N) = ZZL(L,N)                                                SAPR.195
  112 CONTINUE                                                          SAPR.196
  109 CONTINUE                                                          SAPR.197
  110 CONTINUE                                                          SAPR.198
      WRITE(6,602)                                                      SAPR.199
      DO 113 N =1,NCMPT                                                 SAPR.200
      WRITE(6,603) N                                                    SAPR.201
      LPU = NPU(N)                                                      SAPR.202
      LPL = NPL(N)                                                      SAPR.203
      WRITE(6,604)                                                      SAPR.204
      WRITE(6,606)                                                      SAPR.205
      WRITE(6,608)                                                      SAPR.206
      WRITE(6,607) (XXU(L,N),ZZU(L,N),XU(L,N),ZU(L,N),L=1,LPU)          SAPR.207
      WRITE(6,605)                                                      SAPR.208
      WRITE(6,606)                                                      SAPR.209
      WRITE(6,608)                                                      SAPR.210
      WRITE(6,607) (XXL(L,N),ZZL(L,N),XL(L,N),ZL(L,N),L=1,LPL)          SAPR.211
  113 CONTINUE                                                          SAPR.212
      IF(NFLAP.EQ.0) GO TO 120                                          SAPR.213
      READ(5,501) SIGMA                                                 SAPR.214
      DO 114 NX =1,NFLAP                                                SAPR.215
      N = NCMPT-NFLAP+NX                                                SAPR.216
      LPU = NPU(N)                                                      SAPR.217
      SLP1 = 0.                                                         SAPR.218
      SLPN = 0.                                                         SAPR.219
      DO 116 L=1,LPU                                                    SAPR.220
      XK(L) = XU(L,N)                                                   SAPR.221
      ZK(L) = ZU(L,N)                                                   SAPR.222
      TEMP(L) = XXU(L,N)                                                SAPR.223
  116 CONTINUE                                                          SAPR.224
      IF(NXFIND.EQ.0) GO TO 121                                         SAPR.225
      IF(NX.GT.1) GO TO 121                                             SAPR.226
      DO 119 I=1,NXFIND                                                 SAPR.227
      XFIND(I) = TBLU1(XFIND(I),TEMP,XK,1,LPU)                          SAPR.228
  119 CONTINUE                                                          SAPR.229
      WRITE(6,601) (XFIND(I),I=1,NXFIND)                                SAPR.230
  121 CONTINUE                                                          SAPR.231
      CALL KURV1(LPU,XK,ZK,SLP1,SLPN,XR,ZR,TEMP,S,SIGMA)                SAPR.232
      T = 0.                                                            SAPR.233
      DO 117 L =1,LPU                                                   SAPR.234
      CALL KURV20(T,XS,ZS,LPU,XK,ZK,XR,ZR,S,SIGMA)                      SAPR.235
      T = -T                                                            SAPR.236
      XXS(L) = XS                                                       SAPR.237
      ZZS(L) = ZS                                                       SAPR.238
      TS(L) = T                                                         SAPR.239
      T = T + DS(L)/S                                                   SAPR.240
      T = -T                                                            SAPR.241
  117 CONTINUE                                                          SAPR.242
      XXS(1) = (XXS(2)/DS(1) + XXS(2)/DS(2) - XXS(3)/DS(2))*DS(1)       SAPR.243
      ZZS(1) = (ZZS(2)/DS(1) + ZZS(2)/DS(2) - ZZS(3)/DS(2))*DS(1)       SAPR.244
      SLP1 = 0.                                                         SAPR.245
      SLPN = 0.                                                         SAPR.246
      CALL CURV1(LPU,TS,XXS,SLP1,SLPN,XR,TEMP,SIGMA)                    SAPR.247
      SLP1 = 0.                                                         SAPR.248
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      SLPN = 0.                                                          SAPR.249
      CALL CURV1(LPU,TS,ZZS,SLP1,SLPN,ZR,TEMP,SIGMA)                     SAPR.250
                                                                         SAPR.251
      IT = 1                                                             SAPR.252
      DO 118 L=1,LPU                                                     SAPR.253
      T = TS(L)                                                          SAPR.254
      DDX(L) = CURVD(T,LPU,TS,XXS,XR,SIGMA,IT)                           SAPR.255
      DDZ(L) = CURVD(T,LPU,TS,ZZS,ZR,SIGMA,IT)                           SAPR.256
      IT = 2                                                             SAPR.257
  118 CONTINUE                                                           SAPR.258
      DDX(1) = (DDX(2)/DS(1) + DDX(2)/DS(2) - DDX(3)/DS(2))*DS(1)        SAPR.259
      DDZ(1) = (DDZ(2)/DS(1) + DDZ(2)/DS(2) - DDZ(3)/DS(2))*DS(1)        SAPR.260
      DO 115 L =1,LPU                                                    SAPR.261
      XNUM = (XXS(L)**2 + ZZS(L)**2)**1.5                                SAPR.262
      DENOM = XXS(L)*DDZ(L) - ZZS(L)*DDX(L)                              SAPR.263
      R(L,NX) =(XNUM/DENOM)*S                                            SAPR.264
  115 CONTINUE                                                           SAPR.265
      WRITE(6,704)                                                       SAPR.266
      WRITE(6,701)                                                       SAPR.267
      WRITE(6,702)                                                       SAPR.268
      WRITE(6,703) (XK(L),ZK(L),R(L,NX),L=1,LPU)                         SAPR.269
      WRITE(6,704)                                                       SAPR.270
  114 CONTINUE                                                           SAPR.271
  120 CONTINUE                                                           SAPR.272
  500 FORMAT(1415)                                                       SAPR.273
  501 FORMAT(7F10.0)                                                     SAPR.274
  601 FORMAT(1H0,10F10.5)                                                SAPR.275
  602 FORMAT(1H0,40X,*AIRFOIL GEOMETRY*/)                               SAPR.276
  603 FORMAT(1H0,40X,*COMPONENT =*,I3/)                                  SAPR.277
  604 FORMAT(1H0,30X,*UPPER SURFACE COORDINATES*/)                       SAPR.278
  605 FORMAT(1H0,30X,*LOWER SURFACE COORDINATES*/)                       SAPR.279
  606 FORMAT(1H0,20X,*INPUT*,45X,*LOFTED*/)                             SAPR.280
  607 FORMAT(1H0,5X,F10.5,10X,F10.5,20X,F10.5,10X,F10.5)                 SAPR.281
  608 FORMAT(1H0,10X,*X-IN*,15X,*Z-IN*,26X,*X-OUT*,15X,*Z-OUT*/)         SAPR.282
  701 FORMAT(1H0,40X,*RADIUS OF CURVATURE ON FLAP UPPER SURFACE*/)       SAPR.283
  702 FORMAT(1H0,10X,*X-COORD* 14X *Z-COORD* 10X *RADIUS*/)              SAPR.284
  703 FORMAT(1H0,5X,F10.5,12X,F10.5,8X,E12.4)                            SAPR.285
  704 FORMAT(1H0/1H0,15X,100(1H*)//)                                     SAPR.286
      RETURN                                                             SAPR.287
      END
```

```
      SUBROUTINE ROTAN(X,Z,TH,XO,ZO,DX,DZ,XX,ZZ)                         SAPR.289
C     X,Z      INPUT COORDINATES                                         SAPR.290
C     TH       FLAP OR SLAT DEFLECTION ANLGE - RADIANS (CLOCKWISE POSITIVSAPR.291
C     XO,ZO    PIVOT POINT (INPUT COORDINATES)                           SAPR.292
C     DX,DZ    TRANSLATION TO MAIN AIRFOIL COORDINATES                   SAPR.293
C     XX,ZZ    OUTPUT CCORDINATES                                        SAPR.294
      XB = X-XO                                                          SAPR.295
      ZB = Z-ZO                                                          SAPR.296
      XB1 = XB*COS(TH)  + ZB*SIN(TH)                                     SAPR.297
      ZB1 = XB*(-1)*SIN(TH) + ZB*COS(TH)                                 SAPR.298
      XX = XB1 + XO + DX                                                 SAPR.299
      ZZ = ZB1 + ZO + DZ                                                 SAPR.300
      RETURN                                                             SAPR.301
      END                                                                SAPR.302
```

```
      SUBROUTINE KURV1 (N,X,Y,SLP1,SLPN,XP,YP,TEMP,S,SIGMA)                 SAPR.304
C     THIS SUBROUTINE DETERMINES THE PARAMETERS NECESSARY TO                SAPR.305
C     COMPUTE A SPLINE UNDER TENSION PASSING THROUGH A SEQUENCE             SAPR.306
C     OF PAIRS  (X(1),Y(1)),...,(X(N),Y(N)) IN THE PLANE. THE               SAPR.307
C     SLOPES AT THE TWO ENDS OF THE CURVE MAY BE SPECIFIED OR               SAPR.308
C     OMITTED. FOR ACTUAL COMPUTATION OF POINTS ON THE CURVE IT             SAPR.309
C     IS NECESSARY TO CALL THE SUBROUTINE KURV2.                            SAPR.310
C     COMMON/DZDX/ DX(30),DY(30),DS(30)                                     SAPR.311
      INTEGER N                                                             SAPR.312
      REAL X(N),Y(N),XP(N),YP(N),TEMP(N),S,SIGMA                            SAPR.313
      DEGRAD=3.1415926535897932/180.                                        SAPR.314
      NM1=N-1                                                               SAPR.315
      NP1=N+1                                                               SAPR.316
      DELX1=X(2)-X(1)                                                       SAPR.317
      DELY1=Y(2)-Y(1)                                                       SAPR.318
      DELS1=SQRT(DELX1*DELX1+DELY1*DELY1)                                   SAPR.319
      DX1=DELX1/DELS1                                                       SAPR.320
      DY1=DELY1/DELS1                                                       SAPR.321
C                                                                           SAPR.322
C     DETERMINE SLOPES IF NECESSARY                                         SAPR.323
C                                                                           SAPR.324
      IF (SIGMA.LT.0.) GO TO 70                                             SAPR.325
      SLPP1=SLP1*DEGRAD                                                     SAPR.326
      SLPPN=SLPN*DEGRAD                                                     SAPR.327
C                                                                           SAPR.328
C     SET UP RIGHT HAND SIDES OF TRIDIAGONAL LINEAR SYSTEM FOR XP           SAPR.329
C     AND YP                                                                SAPR.330
C                                                                           SAPR.331
10    XP(1)=DX1-COS(SLPP1)                                                  SAPR.332
      YP(1)=DY1-SIN(SLPP1)                                                  SAPR.333
      TEMP(1)=DELS1                                                         SAPR.334
      DS(1) = TEMP(1)                                                       SAPR.335
      S=DELS1                                                               SAPR.336
      DX(1) = COS(SLPP1)                                                    SAPR.337
      DY(1) = SIN(SLPP1)                                                    SAPR.338
      IF (N.EQ.2) GO TO 30                                                  SAPR.339
      DO 20 I=2,NM1                                                         SAPR.340
      DELX2=X(I+1)-X(I)                                                     SAPR.341
      DELY2=Y(I+1)-Y(I)                                                     SAPR.342
      DELS2=SQRT(DELX2*DELX2+DELY2*DELY2)                                   SAPR.343
      DX2=DELX2/DELS2                                                       SAPR.344
      DY2=DELY2/DELS2                                                       SAPR.345
      XP(I)=DX2-DX1                                                         SAPR.346
      YP(I)=DY2-DY1                                                         SAPR.347
      TEMP(I)=DELS2                                                         SAPR.348
      DS(I) = TEMP(I)                                                       SAPR.349
      DELX1=DELX2                                                           SAPR.350
      DELY1=DELY2                                                           SAPR.351
      DELS1=DELS2                                                           SAPR.352
      A = DY2*DX1/DX2                                                       SAPR.353
      B = DY1*DX2/DX1                                                       SAPR.354
      DX(I) = .5*(DX1 + DX2)                                                SAPR.355
      DY(I) = .5*(A + B)                                                    SAPR.356
      DX1=DX2                                                               SAPR.357
      DY1=DY2                                                               SAPR.358
C                                                                           SAPR.359
C     ACCUMULATE POLYGONAL ARCLENGTH                                        SAPR.360
C                                                                           SAPR.361
20    S=S+DELS1                                                             SAPR.362
30    XP(N)=COS(SLPPN)-DX1                                                  SAPR.363
      YP(N)=SIN(SLPPN)-DY1                                                  SAPR.364
      DX(N) = COS(SLPPN)                                                    SAPR.365
      DY(N) = SIN(SLPPN)                                                    SAPR.366
      DS(N) = DS(N-1)                                                       SAPR.367
C                                                                           SAPR.368
C     DENORMALIZE TENSION FACTOR                                            SAPR.369
C                                                                           SAPR.370
      SIGMAP=ABS(SIGMA)*FLOAT(N-1)/S                                        SAPR.371
C                                                                           SAPR.372
```

```
C     PERFORM FORWARD ELIMINATION ON TRIDIAGONAL SYSTEM                  SAPR.373
C                                                                        SAPR.374
      DELS=SIGMAP*TEMP(1)                                                SAPR.375
      EXPS=EXP(DELS)                                                     SAPR.376
      SINHS=.5*(EXPS-1./EXPS)                                            SAPR.377
      SINHIN=1./(TEMP(1)*SINHS)                                          SAPR.378
      DIAG1=SINHIN*(DELS*.5*(EXPS+1./EXPS)-SINHS)                        SAPR.379
      DIAGIN=1./DIAG1                                                    SAPR.380
      XP(1)=DIAGIN*XP(1)                                                 SAPR.381
      YP(1)=DIAGIN*YP(1)                                                 SAPR.382
      SPDIAG=SINHIN*(SINHS-DELS)                                         SAPR.383
      TEMP(1)=DIAGIN*SPDIAG                                              SAPR.384
      IF (N.EQ.2) GO TO 50                                               SAPR.385
      DO 40 I=2,NM1                                                      SAPR.386
      DELS=SIGMAP*TEMP(I)                                                SAPR.387
      EXPS=EXP(DELS)                                                     SAPR.388
      SINHS=.5*(EXPS-1./EXPS)                                            SAPR.389
      SINHIN=1./(TEMP(I)*SINHS)                                          SAPR.390
      DIAG2=SINHIN*(DELS*(.5*(EXPS+1./EXPS))-SINHS)                      SAPR.391
      DIAGIN=1./(DIAG1+DIAG2-SPDIAG*TEMP(I-1))                           SAPR.392
      XP(I)=DIAGIN*(XP(I)-SPDIAG*XP(I-1))                                SAPR.393
      YP(I)=DIAGIN*(YP(I)-SPDIAG*YP(I-1))                                SAPR.394
      SPDIAG=SINHIN*(SINHS-DELS)                                         SAPR.395
      TEMP(I)=DIAGIN*SPDIAG                                              SAPR.396
40    DIAG1=DIAG2                                                        SAPR.397
50    DIAGIN=1./(DIAG1-SPDIAG*TEMP(NM1))                                 SAPR.398
      XP(N)=DIAGIN*(XP(N)-SPDIAG*XP(NM1))                                SAPR.399
      YP(N)=DIAGIN*(YP(N)-SPDIAG*YP(NM1))                                SAPR.400
C                                                                        SAPR.401
C     PERFORM BACK SUBSTITUTION                                          SAPR.402
C                                                                        SAPR.403
      DO 60 I=2,N                                                        SAPR.404
      IBAK=NP1-I                                                         SAPR.405
      XP(IBAK)=XP(IBAK)-TEMP(IBAK)*XP(IBAK+1)                            SAPR.406
60    YP(IBAK)=YP(IBAK)-TEMP(IBAK)*YP(IBAK+1)                            SAPR.407
      RETURN                                                             SAPR.408
70    IF (N.EQ.2) GO TO 80                                               SAPR.409
C                                                                        SAPR.410
C     IF NO SLOPES ARE GIVEN, USE SECOND ORDER INTERPOLATION ON          SAPR.411
C     INPUT DATA FOR SLOPES AT ENDPOINTS                                 SAPR.412
C                                                                        SAPR.413
      DELS2=SQRT((X(3)-X(2))**2+(Y(3)-Y(2))**2)                          SAPR.414
      DELS12=DELS1+DELS2                                                 SAPR.415
      C1=-(DELS12+DELS1)/DELS12/DELS1                                    SAPR.416
      C2=DELS12/DELS1/DELS2                                              SAPR.417
      C3=-DELS1/DELS12/DELS2                                             SAPR.418
      SX=C1*X(1)+C2*X(2)+C3*X(3)                                         SAPR.419
      SY=C1*Y(1)+C2*Y(2)+C3*Y(3)                                         SAPR.420
      SLPP1=ATAN2(SY,SX)                                                 SAPR.421
      DELNM1=SQRT((X(N-2)-X(NM1))**2+(Y(N-2)-Y(NM1))**2)                 SAPR.422
      DELN=SQRT((X(NM1)-X(N))**2+(Y(NM1)-Y(N))**2)                       SAPR.423
      DELNN=DELNM1+DELN                                                  SAPR.424
      C1=(DELNN+DELN)/DELNN/DELN                                         SAPR.425
      C2=-DELNN/DELN/DELNM1                                              SAPR.426
      C3=DELN/DELNN/DELNM1                                               SAPR.427
      SX=C3*X(N-2)+C2*X(NM1)+C1*X(N)                                     SAPR.428
      SY=C3*Y(N-2)+C2*Y(NM1)+C1*Y(N)                                     SAPR.429
      SLPPN=ATAN2(SY,SX)                                                 SAPR.430
      GO TO 10                                                           SAPR.431
C                                                                        SAPR.432
C     IF ONLY TWO POINTS AND NO SLOPES ARE GIVEN, USE STRAIGHT           SAPR.433
C     LINE SEGMENT FOR CURVE                                             SAPR.434
C                                                                        SAPR.435
80    XP(1)=0.                                                           SAPR.436
      XP(2)=0.                                                           SAPR.437
      YP(1)=0.                                                           SAPR.438
      YP(2)=0.                                                           SAPR.439
      RETURN                                                             SAPR.440
      END                                                                SAPR.441
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```
      SUBROUTINE KURV2C(T,XS,YS,N,X,Y,XP,YP,S,SIGMA)                    5APR.443
      INTEGER N                                                         5APR.444
      REAL T,XS,YS,X(N),Y(N),XP(N),YP(N),S,SIGMA                        5APR.445
C                                                                       5APR.446
C     DENORMALIZE SIGMA                                                 5APR.447
C                                                                       5APR.448
      SIGMAP=ABS(SIGMA)*FLOAT(N-1)/S                                    5APR.449
C                                                                       5APR.450
C     STRETCH UNIT INTERVAL INTO ARCLENGTH DISTANCE                     5APR.451
C                                                                       5APR.452
      TN=ABS(T*S)                                                       5APR.453
C                                                                       5APR.454
C     FOR NEGATIVE T START SEARCH WHERE PREVIOUSLY TERMINATED,          5APR.455
C     OTHERWISE STARY FROM BEGINNING                                    5APR.456
C                                                                       5APR.457
      IF (T.LT.0.) GO TO 10                                             5APR.458
      I1=2                                                              5APR.459
      XS=X(1)                                                           5APR.460
      YS=Y(1)                                                           5APR.461
      SUM=0.                                                            5APR.462
      IF (T.LE.0.) RETURN                                               5APR.463
10    CONTINUE                                                          5APR.464
C                                                                       5APR.465
C     DETERMINE INTO WHICH SEGMENT TN IS MAPPED                         5APR.466
C                                                                       5APR.467
      DO 20 I=I1,N                                                      5APR.468
      DELX=X(I)-X(I-1)                                                  5APR.469
      DELY=Y(I)-Y(I-1)                                                  5APR.470
      DELS=SQRT(DELX*DELX+DELY*DELY)                                    5APR.471
      IF (SUM+DELS-TN) 20,30,30                                         5APR.472
20    SUM=SUM+DELS                                                      5APR.473
C                                                                       5APR.474
C     IF ABS(T) IS GREATER THAN 1., RETURN TERMINAL POINT ON            5APR.475
C     CURVE                                                             5APR.476
C                                                                       5APR.477
      XS=X(N)                                                           5APR.478
      YS=Y(N)                                                           5APR.479
      RETURN                                                            5APR.480
C                                                                       5APR.481
C     SET UP AND PERFORM INTERPOLATION                                  5APR.482
C                                                                       5APR.483
30    DEL1=TN-SUM                                                       5APR.484
      DEL2=DELS-DEL1                                                    5APR.485
      EXPS1=EXP(SIGMAP*DEL1)                                            5APR.486
      COSHD1 = .5*(EXPS1 + 1./EXPS1)                                    5APR.487
      EXPS=EXP(SIGMAP*DEL2)                                             5APR.488
      COSHD2 = .5*(EXPS + 1./EXPS)                                      5APR.489
      EXPS=EXPS1*EXPS                                                   5APR.490
      SINHS=.5*(EXPS-1./EXPS)/SIGMAP                                    5APR.491
      XS = (XP(I)*COSHD1-XP(I-1)*COSHD2)/SINHS +                        5APR.492
     1((X(I)-XP(I))-(X(I-1)-XP(I-1)))/DELS                              5APR.493
      YS = (YP(I)*COSHD1 -YP(I-1)*COSHD2)/SINHS +                       5APR.494
     1((Y(I)-YP(I))-(Y(I-1)-YP(I-1)))/DELS                              5APR.495
      I1=I                                                              5APR.496
      RETURN                                                            5APR.497
      END                                                               5APR.498
```

```
      SUBROUTINE CURV1 (N,X,Y,SLP1,SLPN,YP,TEMP,SIGMA)                  5APR.500
C     THIS SUBROUTINE DETERMINES THE PARAMETERS NECESSARY TO            5APR.501
C     COMPUTE AN INTERPOLATORY SPLINE UNDER TENSION THROUGH             5APR.502
C     A SEQUENCE OF FUNCTIONAL VALUES. THE SLOPES AT THE TWO            5APR.503
C     ENDS OF THE CURVE MAY BE SPECIFIED OR OMITTED. FOR ACTUAL         5APR.504
C     COMPUTATION OF POINTS ON THE CURVE IT IS NECESSARY TO CALL        5APR.505
C     THE FUNCTION CURV2.                                               5APR.506
      INTEGER N                                                         5APR.507
      REAL X(N),Y(N),SLP1,SLPN,YP(N),TEMP(N),SIGMA                      5APR.508
      NM1=N-1                                                           5APR.509
      NP1=N+1                                                           5APR.510
      DELX1=X(2)-X(1)                                                   5APR.511
      DX1=(Y(2)-Y(1))/DELX1                                             5APR.512
C                                                                       5APR.513
C     DETERMINE SLOPES IF NECESSARY                                     5APR.514
C                                                                       5APR.515
      IF (SIGMA.LT.0.) GO TO 50                                         5APR.516
      SLPP1=SLP1                                                        5APR.517
      SLPPN=SLPN                                                        5APR.518
C                                                                       5APR.519
C     DENORMALIZE TENSION FACTOR                                        5APR.520
C                                                                       5APR.521
10    SIGMAP=ABS(SIGMA)*FLOAT(N-1)/(X(N)-X(1))                          5APR.522
C                                                                       5APR.523
C     SET UP RIGHT HAND SIDE AND TRIDIAGONAL SYSTEM FOR YP AND          5APR.524
C     PERFORM FORWARD ELIMINATION                                       5APR.525
C                                                                       5APR.526
      DELS=SIGMAP*DELX1                                                 5APR.527
      EXPS=EXP(DELS)                                                    5APR.528
      SINHS=.5*(EXPS-1./EXPS)                                           5APR.529
      SINHIN=1./(DELX1*SINHS)                                           5APR.530
      DIAG1=SINHIN*(DELS*.5*(EXPS+1./EXPS)-SINHS)                       5APR.531
      DIAGIN=1./DIAG1                                                   5APR.532
      YP(1)=DIAGIN*(DX1-SLPP1)                                          5APR.533
      SPDIAG=SINHIN*(SINHS-DELS)                                        5APR.534
      TEMP(1)=DIAGIN*SPDIAG                                             5APR.535
      IF (N.EQ.2) GO TO 30                                              5APR.536
      DO 20 I=2,NM1                                                     5APR.537
      DELX2=X(I+1)-X(I)                                                 5APR.538
      DX2=(Y(I+1)-Y(I))/DELX2                                           5APR.539
      DELS=SIGMAP*DELX2                                                 5APR.540
      EXPS=EXP(DELS)                                                    5APR.541
      SINHS=.5*(EXPS-1./EXPS)                                           5APR.542
      SINHIN=1./(DELX2*SINHS)                                           5APR.543
      DIAG2=SINHIN*(DELS*(.5*(EXPS+1./EXPS))-SINHS)                     5APR.544
      DIAGIN=1./(DIAG1+DIAG2-SPDIAG*TEMP(I-1))                          5APR.545
      YP(I)=DIAGIN*(DX2-DX1-SPDIAG*YP(I-1))                             5APR.546
      SPDIAG=SINHIN*(SINHS-DELS)                                        5APR.547
      TEMP(I)=DIAGIN*SPDIAG                                             5APR.548
      DX1=DX2                                                           5APR.549
20    DIAG1=DIAG2                                                       5APR.550
30    DIAGIN=1./(DIAG1-SPDIAG*TEMP(NM1))                                5APR.551
      YP(N)=DIAGIN*(SLPPN-DX2-SPDIAG*YP(NM1))                           5APR.552
C                                                                       5APR.553
C     PERFORM BACK SUBSTITUTION                                         5APR.554
C                                                                       5APR.555
      DO 40 I=2,N                                                       5APR.556
      IBAK=NP1-I                                                        5APR.557
40    YP(IBAK)=YP(IBAK)-TEMP(IBAK)*YP(IBAK+1)                           5APR.558
      RETURN                                                            5APR.559
50    IF (N.EQ.2) GO TO 60                                              5APR.560
C                                                                       5APR.561
C     IF NO DERIVATIVES ARE GIVEN USE SECOND ORDER POLYNOMIAL           5APR.562
C     INTERPOLATION ON INPUT DATA FOR VALUES AT ENDPOINTS.              5APR.563
C                                                                       5APR.564
      DELX2=X(3)-X(2)                                                   5APR.565
      DELX12=X(3)-X(1)                                                  5APR.566
      C1=-(DELX12+DELX1)/DELX12/DELX1                                   5APR.567
      C2=DELX12/DELX1/DELX2                                             5APR.568
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      C3=-DELX1/DELX12/DELX2                                                  SAPR.569
      SLPP1=C1*Y(1)+C2*Y(2)+C3*Y(3)                                           SAPR.570
      DELN=X(N)-X(NM1)                                                        SAPR.571
      DELNM1=X(NM1)-X(N-2)                                                    SAPR.572
      DELNN=X(N)-X(N-2)                                                       SAPR.573
      C1=(DELNN+DELN)/DELNN/DELN                                              SAPR.574
      C2=-DELNN/DELN/DELNM1                                                   SAPR.575
      C3=DELN/DELNN/DELNM1                                                    SAPR.576
      SLPPN=C3*Y(N-2)+C2*Y(NM1)+C1*Y(N)                                       SAPR.577
      GO TO 10                                                                SAPR.578
C                                                                             SAPR.579
C     IF ONLY TWO POINTS AND NO DERIVATIVES ARE GIVEN, USE                    SAPR.580
C     STRAIGHT LINE FOR CURVE                                                 SAPR.581
C                                                                             SAPR.582
60    YP(1)=0.                                                                SAPR.583
      YP(2)=0.                                                                SAPR.584
      RETURN                                                                  SAPR.585
      END                                                                     SAPR.586
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      FUNCTION CURVD (T,N,X,Y,YP,SIGMA,IT)                                    SAPR.588
C     THIS FUNCTION DIFFERENTIATES A CURVE AT A GIVEN POINT                   SAPR.589
C     USING AN INTERPOLATORY SPLINE UNDER TENSION. THE SUBROUTINE             SAPR.590
      INTEGER N,IT                                                            SAPR.591
      REAL T,X(N),Y(N),YP(N),SIGMA                                            SAPR.592
      S=X(N)-X(1)                                                             SAPR.593
C                                                                             SAPR.594
C     DENORMALIZE SIGMA                                                       SAPR.595
C                                                                             SAPR.596
      SIGMAP=ABS(SIGMA)*(N-1)/S                                               SAPR.597
C                                                                             SAPR.598
C     IF IT.NE.1 START SEARCH WHERE PREVIOUSLY TERMINATED.                    SAPR.599
C     OTHERWISE START FROM BEGINNING                                          SAPR.600
C                                                                             SAPR.601
      IF (IT.EQ.1) I1=2                                                       SAPR.602
C                                                                             SAPR.603
C     SEARCH FOR INTERVAL                                                     SAPR.604
C                                                                             SAPR.605
      DO 10 I=I1,N                                                            SAPR.606
      IF (X(I)-T) 10,10,20                                                    SAPR.607
10    CONTINUE                                                                SAPR.608
      I=N                                                                     SAPR.609
C                                                                             SAPR.610
C     SET UP AND PERFORM INTERPOLATION                                        SAPR.611
C                                                                             SAPR.612
20    DEL1=T-X(I-1)                                                           SAPR.613
      DEL2=X(I)-T                                                             SAPR.614
      DELS=X(I)-X(I-1)                                                        SAPR.615
      EXPS1=EXP(SIGMAP*DEL1)                                                  SAPR.616
      COSHD1=.5*(EXPS1+1./EXPS1)                                              SAPR.617
      EXPS=EXP(SIGMAP*DEL2)                                                   SAPR.618
      COSHD2=.5*(EXPS+1./EXPS)                                                SAPR.619
      EXPS=EXPS1*EXPS                                                         SAPR.620
      SINHS=.5*(EXPS-1./EXPS)/SIGMAP                                          SAPR.621
      CURVD=(YP(I)*COSHD1-YP(I-1)*COSHD2)/SINHS+((Y(I)-YP(I))-(Y(I-1)-YPSAPR.622
     1(I-1)))/DELS                                                            SAPR.623
      I1=I                                                                    SAPR.624
      RETURN                                                                  SAPR.625
      END                                                                     SAPR.626
```

```
      SUBROUTINE SOLVE                                                  SOLVE.2
                                                                        SOLVE.3
C                                                                       SOLVE.4
C     PROGRAM TO SOLVE SYSTEM OF EQUATIONS AND COMPUTE                  SOLVE.5
C     PRESSURES, FORCES AND MOMENTS                                     SOLVE.6
C                                                                       SOLVE.7
      COMMON /PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UIN,REFX,REFZ,CREF      SOLVE.8
      COMMON /CPS/ CPS(600)                                             SOLVE.9
      COMMON /CL/ CL,CDT,CDF,CDP,DUD(2),CM                              SOLVE.10
      COMMON /SCRAT/ U(600),V(600),W(600),A(100,100),GW(600),DMM(200),  SOLVE.11
     1XIP(8,100),ZIP(8,100),CPIP(8,100),NPP(8),DUMMY(192)               SOLVE.12
      COMMON/XSOLVE/ISOLVE                                              SOLVE.13
      COMMON/CLCM/ CLX(4),CMX(4)                                        SOLVE.14
      COMMON /POINT/ DELTA(600),THET(600),CHORD(600),QS(8,100),DUM(400),SOLVE.15
     1XU(750),XPT(600),ZPT(600)                                         SOLVE.16
      COMMON /ITR/ ITR,ITRMAX                                           SOLVE.17
      COMMON/KPRINT/KPRINT                                              SOLVE.18
      COMMON /VELCOM/ NPOINT,NPART,IMAX,EX,PRINT                        SOLVE.19
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(4),GTU(4),GTL(4),        SOLVE.20
     1NPU(4),NPL(4),ISTG(4),QTU(4),QTL(4),DIN(26),THKTE(4)              SOLVE.21
      COMMON /SIG/ SIG(200),SIGMAD(200),SIGMA(8,100)                    SOLVE.22
      COMMON/GAMM/GA,Q(600)                                             SOLVE.23
C                                                                       SOLVE.24
      DIMENSION UA(600),GA(600),WA(600),CP(600),NS(600),NB(600),        SOLVE.25
     1NW(600),NT(600),AS(100),AT(2)                                     SOLVE.26
      DIMENSION CPU(100),CPL(100)                                       SOLVE.27
      DIMENSION US(100),WS(100)                                         SOLVE.28
C                                                                       SOLVE.29
      EQUIVALENCE (UA,A),(WA,A(1201)),(CP,A(1801)),                     SOLVE.30
     1(NS,A(2401)),(NW,U),(NB,V),(NT,W),(AS,A(3001))                    SOLVE.31
C                                                                       SOLVE.32
      REAL MACH,NB,NW,NT,NS                                             SOLVE.33
      INTEGER COMPT,PRINT                                               SOLVE.34
C                                                                       SOLVE.35
      NWING=NPOINT                                                      SOLVE.36
      NMAX=60                                                           SOLVE.37
      PRINT=3                                                           SOLVE.38
      EM=MACH                                                           SOLVE.39
      B2=1.0-EM*EM                                                      SOLVE.40
      BETA=SQRT(B2)                                                     SOLVE.41
      RB2=1.0/B2                                                        SOLVE.42
      REWIND 1                                                          SOLVE.43
      REWIND 3                                                          SOLVE.44
      REWIND 8                                                          SOLVE.45
      ALP=ALPHA/57.2957795                                              SOLVE.46
      SINAL=SIN(ALP)                                                    SOLVE.47
      COSAL=COS(ALP)                                                    SOLVE.48
      CALL SORTR                                                        SOLVE.49
C                                                                       SOLVE.50
C     CALCULATE NORMAL VELOCITIES REQUIRED TO SATISFY BOUNDARY          SOLVE.51
C     CONDITIONS AT WING CONTROL POINTS                                 SOLVE.52
C                                                                       SOLVE.53
      DO 20 I=1,NPOINT                                                  SOLVE.54
      TANDEL=TAN(DELTA(I))                                              SOLVE.55
      NW(I)=COSAL*TANDEL-SINAL                                          SOLVE.56
      K=0                                                               SOLVE.57
      ASQ=0.                                                            SOLVE.58
      IF(ITR.EQ.1) GO TO 20                                             SOLVE.59
      DO 15 N=1,NCMPT                                                   SOLVE.60
      DO 14 NSIDE=1,2                                                   SOLVE.61
      K=K+1                                                             SOLVE.62
      IF(NSIDE.EQ.1) JL=NPU(N)                                          SOLVE.63
      IF(NSIDE.EQ.2) JL=NPL(N)                                          SOLVE.64
      READ(1) AT(NSIDE),(AS(J),J=1,JL)                                  SOLVE.65
      DO 12 J=1,JL                                                      SOLVE.66
   12 ASQ = ASQ + AS(J)*QS(K,J)                                         SOLVE.67
   14 CONTINUE                                                          SOLVE.68
      DNW=ASQ                                                           SOLVE.69
      IF(THKTE(N).EQ.0..OR.ITR.GT.1) DNW=ASQ+AT(1)*GTU(N)+AT(2)*GTL(N)  SOLVE.70
      NW(I)=NW(I)-DNW
```

```
   15 CONTINUE                                                          SOLVE.71
   20 CONTINUE                                                          SOLVE.72
      REWIND 1                                                          SOLVE.73
      IF(KPRINT.GT.0) WRITE(6,170) (NW(I),I=1,NWING)                    SOLVE.74
C                                                                       SOLVE.75
C     SOLVE MATRIX EQUATIONS - DIRECT SOLUTION IF MATRICES              SOLVE.76
C     LESS THAN 60*60 , ITERATIVE SOLUTION OTHERWISE                    SOLVE.77
C                                                                       SOLVE.78
      IF(ISOLVE.GT.0) GO TO 30                                          SOLVE.79
   25 CALL PARTIN                                                       SOLVE.80
      GO TO 50                                                          SOLVE.81
   30 CALL DIAGIN                                                       SOLVE.82
      CALL ITRATE                                                       SOLVE.83
   50 CONTINUE                                                          SOLVE.84
      I=0                                                               SOLVE.85
      J=0                                                               SOLVE.86
      JMAX=0                                                            SOLVE.87
      DO 60 N=1,NCMPT                                                   SOLVE.88
      J2=NC(N)                                                          SOLVE.89
      J1=J2-1                                                           SOLVE.90
      IT=J2-2                                                           SOLVE.91
      JMAX=JMAX+J2                                                      SOLVE.92
      IF(THKTE(N).EQ.0..OR.ITR.GT.1) GO TO 52                           SOLVE.93
      GTU(N)=GW(IT)                                                     SOLVE.94
      GTL(N)=-GW(IT)                                                    SOLVE.95
   52 CONTINUE                                                          SOLVE.96
      DO 60 II=1,J2                                                     SOLVE.97
      I=I+1                                                             SOLVE.98
      IF(II.GT.IT) GO TO 55                                             SOLVE.99
      J=J+1                                                             SOLVE.100
      GA(I)=GW(J)                                                       SOLVE.101
      GO TO 60                                                          SOLVE.102
   55 IF(II.EQ.J1) GA(I)=GTU(N)                                         SOLVE.103
      IF(II.EQ.J2) GA(I)=GTL(N)                                         SOLVE.104
   60 CONTINUE                                                          SOLVE.105
      DO 75 I=1,NPOINT                                                  SOLVE.106
      U(I)=0.                                                           SOLVE.107
      V(I)=0.                                                           SOLVE.108
      US(I)=0.                                                          SOLVE.109
      WS(I)=0.                                                          SOLVE.110
   75 W(I)=0.                                                           SOLVE.111
C                                                                       SOLVE.112
C     CALCULATE PRESSURES ON WING PANELS                                SOLVE.113
C                                                                       SOLVE.114
      DO 100 I=1,NWING                                                  SOLVE.115
      READ(8) (UA(J),WA(J),J=1,JMAX)                                    SOLVE.116
      DO 90 J=1,JMAX                                                    SOLVE.117
      U(I)=U(I)+UA(J)*GA(J)-WA(J)*Q(J)*RB2                              SOLVE.118
      W(I)=W(I)+WA(J)*GA(J)+UA(J)*Q(J)                                  SOLVE.119
      US(I)=US(I)-WA(J)*Q(J)*RB2                                        SOLVE.120
      WS(I)=WS(I)+UA(J)*Q(J)                                            SOLVE.121
   90 CONTINUE                                                          SOLVE.122
      AS(I)=WS(I)-BETA*TAN(DELTA(I))*US(I)                              SOLVE.123
      NS(I)=W(I)-BETA*TAN(DELTA(I))*U(I)-AS(I)                          SOLVE.124
      U(I)=U(I)+COSAL                                                   SOLVE.125
      W(I)=W(I)+SINAL                                                   SOLVE.126
      CP(I) = 1.0-U(I)*U(I) - W(I)*W(I)                                 SOLVE.127
      V(I) = 1.0 - GW(I)*GW(I) - Q(I)*Q(I)                              SOLVE.128
C     IF(ITR.GT.1) CP(I)=(CP(I)+CPS(I))*.5                              SOLVE.129
C     IF(ITR.GT.1) CP(I)= .666667*CP(I) + .333333*CPS(I)                SOLVE.130
      IF(ITR.GT.1) CP(I)=(CP(I)+CPS(I))*.5                              SOLVE.131
      CPS(I)=CP(I)                                                      SOLVE.132
  100 CONTINUE                                                          SOLVE.133
      IF(KPRINT.GT.0) WRITE(6,170) (NS(I),I=1,NWING)                    SOLVE.134
C                                                                       SOLVE.135
C     CALCULATE INDEX OF STAGNATION POINT                               SOLVE.136
C     AND DETERMINE LIFT OF EACH ELEMENT                                SOLVE.137
C                                                                       SOLVE.138
      I2=0                                                              SOLVE.139
```

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      IT=0                                                              SOLVE.140
      I=0                                                               SOLVE.141
      IX = 0                                                            SOLVE.142
      K=0                                                               SOLVE.143
      DO 120 N=1,NCMPT                                                  SOLVE.144
      K=K+1                                                             SOLVE.145
      J2=NC(N)                                                          SOLVE.146
      J1=J2-1                                                           SOLVE.147
      JN=NPU(N)                                                         SOLVE.148
      I1=IT+1                                                           SOLVE.149
      IN=I2                                                             SOLVE.150
      I2 = IX + J2 - 2                                                  SOLVE.151
      IX = I2                                                           SOLVE.152
      IT=J2-2                                                           SOLVE.153
      IL=I1+JN-1                                                        SOLVE.154
      ISTAG=I1                                                          SOLVE.155
      UMX = 0.                                                          SOLVE.156
      J=0                                                               SOLVE.157
      DO 110 II=I,IT                                                    SOLVE.158
      I=I+1                                                             SOLVE.159
      J=J+1                                                             SOLVE.160
      IF(I.LT.IL) CPU(J)=CP(I)                                          SOLVE.161
      IF(I.GE.IL) CPL(J-JN+1)=CP(I)                                     SOLVE.162
      IF(I.EQ.I2) GO TO 110                                             SOLVE.163
      IF(CP(I).LT.0.) GO TO 110                                         SOLVE.164
      IF(I.EQ.IL) GO TO 115                                             SOLVE.165
      UMXS = UMX                                                        SOLVE.166
      UMX = AMAX1(UMX,CP(I))                                            SOLVE.167
      IF(UMX.NE.UMXS) ISTAG = I                                         SOLVE.168
      GO TO 110                                                         SOLVE.169
  115 CONTINUE                                                          SOLVE.170
      UMXS = UMX                                                        SOLVE.171
      UMX = AMAX1(UMX,CP(I))                                            SOLVE.172
      IF(UMX.NE.UMXS) ISTAG = I                                         SOLVE.173
  110 CONTINUE                                                          SOLVE.174
      ISTG(N)=ISTAG                                                     SOLVE.175
      CPUT=1.0-GTU(N)*GTU(N)-QTU(N)*QTU(N)                              SOLVE.176
      CPLT=1.0-GTL(N)*GTL(N)-QTL(N)*QTL(N)                              SOLVE.177
      CALL LIFT(N,CPU,CPL,REFX,REFZ,CREF,COSAL,CL,CM)                   SOLVE.178
C                                                                       SOLVE.179
      CLX(N) = CL                                                       SOLVE.180
      CMX(N) = CM                                                       SOLVE.181
      IF(N.LE.1) GO TO 116                                              SOLVE.182
      CLX(N) = CLX(N) - CLXX                                            SOLVE.183
      CMX(N) = CMX(N) - CMXX                                            SOLVE.184
  116 CONTINUE                                                          SOLVE.185
      CLXX = CL                                                         SOLVE.186
      CMXX = CM                                                         SOLVE.187
C     FILL XIP,ZIP,CPIP ARRAYS FOR UPPER AND LOWER SURFACES             SOLVE.188
C                                                                       SOLVE.189
      CALL FILL(N,K,IN)                                                 SOLVE.190
  120 CONTINUE                                                          SOLVE.191
      REWIND 8                                                          SOLVE.192
      CALL SECOND(TIME)                                                 SOLVE.193
      WRITE(6,300) TIME                                                 SOLVE.194
      RETURN                                                            SOLVE.195
  135 FORMAT(1H0,20HPRESSURE COEFFICIENT)                               SOLVE.196
  140 FORMAT(1H1,39HVELOCITIES AND PRESSURE ON WING, MACH=F5.3          SOLVE.197
     1,3X,6HALPHA=F7.3 //)                                              SOLVE.198
  170 FORMAT(1H0,10F10.5)                                               SOLVE.199
  185 FORMAT(1X,5HPANEL,10X,6HVORTEX,10X,5HAXIAL,11X,7HLATERAL,10X,     SOLVE.200
     18HVERTICAL,10X,8HPRESSURE/2X,3HNO.,10X,8HSTRENGTH,8X,8HVELOCITY,  SOLVE.201
     29X,8HVELOCITY,9X,8HVELOCITY,9X,11HCOEFFICIENT//)                  SOLVE.202
  200 FORMAT(1H0,I4,7X,F10.5,5X,F10.5,5(7X,F10.5))                      SOLVE.203
  300 FORMAT(1H0,6HTIME = F10.5)                                        SOLVE.204
  600 FORMAT(1H0,I5)                                                    SOLVE.205
  601 FORMAT(1H ,6HISTAG=,I3)                                           SOLVE.206
      END                                                               SOLVE.207
```

```
      SUBROUTINE SORTR                                                  SORTR.2
                                                                        SORTR.3
C                                                                       SORTR.4
C     SUBROUTINE TO RECRDER SOURCE STRENGTH ARRAYS                      SORTR.5
C                                                                       SORTR.6
      COMMON /ITR/ ITR,ITRMAX                                           SORTR.7
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(4),GTU(4),GTL(4),        SORTR.8
     1NPU(4),NPL(4),ISTG(4),QTU(4),QTL(4),DIN(26),THKTE(4)              SORTR.9
      COMMON /SIG/ SIG(200),SIGMAD(200),SIGMA(8,100)                    SORTR.10
      COMMON /SCRAT/ U(600),V(600),W(600),A(100,100),GW(600),DMM(200),  SORTR.11
     1XIP(8,100),ZIP(8,100),CPIP(8,100),NPP(8),DUMMY(192)               SORTR.12
      COMMON /POINT/ DELTA(600),THET(600),CHORD(600),QS(8,100),DUM(400),SORTR.13
     1XU(750),XPT(600),ZPT(600)                                         SORTR.14
      COMMON/GAMM/GA(600),Q(600)                                        SORTR.15
C                                                                       SORTR.16
      J=0                                                               SORTR.17
      K=0                                                               SORTR.18
      JS=0                                                              SORTR.19
      DO 100 N=1,NCMPT                                                  SORTR.20
      TE=THETE(N)                                                       SORTR.21
      COST=COS(TE)                                                      SORTR.22
      RSINT=0.                                                          SORTR.23
      IF(TE.NE.0.) RSINT=1.0/SIN(TE)                                    SORTR.24
      J2=NC(N)+JS                                                       SORTR.25
      JS=JS+J2                                                          SORTR.26
      J1=J2-1                                                           SORTR.27
      JT=J2-2                                                           SORTR.28
      IF(ITR.GT.1) GO TO 10                                             SORTR.29
      DO 5 I=1,J2                                                       SORTR.30
      J=J+1                                                             SORTR.31
    5 Q(J)=0.                                                           SORTR.32
      GTU(N)=0.                                                         SORTR.33
      GTL(N)=0.                                                         SORTR.34
      QTU(N)=0.                                                         SORTR.35
      QTL(N)=0.                                                         SORTR.36
      GO TO 100                                                         SORTR.37
   10 K=K+1                                                             SORTR.38
      K1=K+1                                                            SORTR.39
      LU=NPU(N)                                                         SORTR.40
      LL=NPL(N)                                                         SORTR.41
      IF(N.EQ.1) ISTAG = ISTG(N)                                        SORTR.42
      IF(N.EQ.2) ISTAG = ISTG(N)-NC(N-1)+2                              SORTR.43
      IF(N.EQ.3) ISTAG=ISTG(N)-NC(N-2)-NC(N-1)+4                        SORTR.44
      IF(N.EQ.4) ISTAG = ISTG(N)-NC(N-3)-NC(N-2)-NC(N-1)+6              SORTR.45
      IF(NPP(K).LE.LU) GO TO 50                                         SORTR.46
      LI=ISTAG-LU+1                                                     SORTR.47
      DO 20 L=1,LU                                                      SORTR.48
      IF(L.LT.LU) J=J+1                                                 SORTR.49
      L1=L+LI                                                           SORTR.50
      QS(K,L)=SIGMA(K,L1)                                               SORTR.51
      IF(L.LT.LU) Q(J)=QS(K,L)                                          SORTR.52
   20 CONTINUE                                                          SORTR.53
      DO 40 L=1,LL                                                      SORTR.54
      IF(L.GT.LI+1) GO TO 30                                            SORTR.55
      IF(L.GT.1) J=J+1                                                  SORTR.56
      L2=LI+2-L                                                         SORTR.57
      QS(K1,L)= SIGMA(K,L2)                                             SORTR.58
      IF(L.GT.1) Q(J)=QS(K1,L)                                          SORTR.59
      GO TO 40                                                          SORTR.60
   30 L3=L-LI                                                           SORTR.61
      J=J+1                                                             SORTR.62
      QS(K1,L)= SIGMA(K1,L3)                                            SORTR.63
      Q(J)=QS(K1,L)                                                     SORTR.64
   40 CONTINUE                                                          SORTR.65
      GO TO 95                                                          SORTR.66
   50 IF(NPP(K).LT.LU) GO TO 70                                         SORTR.67
      DO 60 L=1,LU                                                      SORTR.68
      IF(L.LT.LU) J=J+1                                                 SORTR.69
      QS(K,L)=SIGMA(K,L)                                                SORTR.70
      IF(L.LT.LU) Q(J)=QS(K,L)
```

```
   60 CONTINUE                                                          SORTR.71
      DO 65 L=1,LL                                                      SORTR.72
      IF(L.GT.1) J=J+1                                                  SORTR.73
      QS(K1,L)= SIGMA(K1,L)                                             SORTR.74
      IF(L.GT.1) Q(J)=QS(K1,L)                                          SORTR.75
   65 CONTINUE                                                          SORTR.76
      GO TO 95                                                          SORTR.77
   70 LI=LU-NPP(K)                                                      SORTR.78
      DO 80 L=1,LU                                                      SORTR.79
      IF(L.LT.LU) J=J+1                                                 SORTR.80
      IF(L.GT.LI+1) GO TO 75                                            SORTR.81
      LI=LI+2-L                                                         SORTR.82
      QS(K,L)=SIGMA(K1,LI)                                              SORTR.83
      Q(J)=QS(K,L)                                                      SORTR.84
      GO TO 80                                                          SORTR.85
   75 L2=L-LI                                                           SORTR.86
      QS(K,L)=SIGMA(K,L2)                                               SORTR.87
      IF(L.LT.LU) Q(J)=QS(K,L)                                          SORTR.88
   80 CONTINUE                                                          SORTR.89
      DO 90 L=1,LL                                                      SORTR.90
      IF(L.GT.1) J=J+1                                                  SORTR.91
      L3=LI+L                                                           SORTR.92
      QS(K1,L)= SIGMA(K1,L3)                                            SORTR.93
      IF(L.GT.1) Q(J)=QS(K1,L)                                          SORTR.94
   90 CONTINUE                                                          SORTR.95
   95 CONTINUE                                                          SORTR.96
      Q(J1)=QS(K,LU)                                                    SORTR.97
      Q(J2)=QS(K1,LL)                                                   SORTR.98
      Q(JT)=0.                                                          SORTR.99
      JJ=J                                                              SORTR.100
      J=J+2                                                             SORTR.101
      GTU(N)=(-QS(K1,LL)+QS(K,LU)*COST)*RSINT                           SORTR.102
      GTL(N)=(-QS(K,LU)+QS(K1,LL)*COST)*RSINT                           SORTR.103
      QTU(N)=Q(J1)                                                      SORTR.104
      QTL(N)=Q(J2)                                                      SORTR.105
      K=K+1                                                             SORTR.106
      IF(THKTE(N).EQ.0..OR.ITR.GT.1) GO TO 100                          SORTR.107
      GTU(N)=0.                                                         SORTR.108
      GTL(N)=0.                                                         SORTR.109
  100 CONTINUE                                                          SORTR.110
  600 FORMAT(1H ,10F10.5)                                               SORTR.111
      RETURN                                                            SORTR.112
      END                                                               SORTR.113
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```
      SUBROUTINE FILL(N,KK,IN)                                          FILL.2
                                                                        FILL.3
C                                                                       FILL.4
C     FILL XIP,ZIP,CPIP ARRAYS FOR UPPER AND LOWER SURFACES             FILL.5
C                                                                       FILL.6
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(4),GTU(4),GTL(4),        FILL.7
     1NPU(4),NPL(4),ISTG(4),QTU(4),QTL(4)                               FILL.8
      COMMON /SCRAT/ U(600),V(600),W(600),A(100,100),GW(600),DMM(200),  FILL.9
     1XIP(8,100),ZIP(8,100),CPIP(8,100),NPP(8),PAV(100),DUMMY(92)       FILL.10
      COMMON /POINT/ DELTA(600),THET(600),CHORD(600),QS(8,100),DUM(400),FILL.11
     1XU(30,4),XL(30,4),ZU(30,4),ZL(30,4),DIM(270),XPT(600),ZPT(600)    FILL.12
      DIMENSION CP(600)                                                 FILL.13
      EQUIVALENCE (CP,A(1801))                                          FILL.14
C                                                                       FILL.15
      K=KK                                                              FILL.16
      ISTAG=ISTG(N)-IN                                                  FILL.17
      LU=NPU(N)-1                                                       FILL.18
      LT=NC(N)                                                          FILL.19
      LI=ISTAG-LU                                                       FILL.20
      JT=LT-2+IN                                                        FILL.21
      IF(LI.LE.0) GO TO 120                                             FILL.22
      DO 105 L=1,LU
```

```
      L1=LI+L                                                          FILL.23
      LN=L+IN                                                          FILL.24
      XIP(K,L1)=XPT(LN)                                                FILL.25
      ZIP(K,L1)=ZPT(LN)                                                FILL.26
  105 CPIP(K,L1)=CP(LN)                                                FILL.27
      LPU=ISTAG+1                                                      FILL.28
      NPP(K)=LPU                                                       FILL.29
      KUP = NPU(N)                                                     FILL.30
      XIP(K,LPU) = XU(KUP,N)                                           FILL.31
      ZIP(K,LPU) = ZU(KUP,N)                                           FILL.32
      L=LU+1+IN                                                        FILL.33
      CPIP(K,LPU)=CP(L-1)+(CP(L-1)-CP(L-2))*(XPT(JT)-XPT(L-1))/        FILL.34
     1(XPT(L-1)-XPT(L-2))                                              FILL.35
      DO 110 L=1,LI                                                    FILL.36
      L2=ISTAG+1-L+IN                                                  FILL.37
      XIP(K,L)=XPT(L2)                                                 FILL.38
      ZIP(K,L)=ZPT(L2)                                                 FILL.39
  110 CPIP(K,L)=CP(L2)                                                 FILL.40
      K=K+1                                                            FILL.41
      LPL=LT-1-ISTAG                                                   FILL.42
      NPP(K)=LPL                                                       FILL.43
      DO 115 L=1,LPL                                                   FILL.44
      L3=ISTAG+L-1+IN                                                  FILL.45
      XIP(K,L)=XPT(L3)                                                 FILL.46
      ZIP(K,L)=ZPT(L3)                                                 FILL.47
  115 CPIP(K,L)=CP(L3)                                                 FILL.48
      L=L3                                                             FILL.49
      CPIP(K,LPL)=CP(L-1)+(CP(L-1)-CP(L-2))*(XPT(L)-XPT(L-1))/         FILL.50
     1(XPT(L-1)-XPT(L-2))                                              FILL.51
      K1 = K - 1                                                       FILL.52
      CPIP(K1,LPU) = (CPIP(K1,LPU) + CPIP(K,LPL))*.5                   FILL.53
      CPIP(K,LPL) = CPIP(K1,LPU)                                       FILL.54
      GO TO 160                                                        FILL.55
  120 IF(ISTAG.GT.1) GO TO 135                                         FILL.56
      DO 125 L=1,LU                                                    FILL.57
      LN=L+IN                                                          FILL.58
      XIP(K,L)=XPT(LN)                                                 FILL.59
      ZIP(K,L)=ZPT(LN)                                                 FILL.60
  125 CPIP(K,L)=CP(LN)                                                 FILL.61
      LPU=NPU(N)                                                       FILL.62
      NPP(K)=LPU                                                       FILL.63
      KUP = NPU(N)                                                     FILL.64
      XIP(K,LPU) = XU(KUP,N)                                           FILL.65
      ZIP(K,LPU) = ZU(KUP,N)                                           FILL.66
      L=LU+1+IN                                                        FILL.67
      CPIP(K,LPU)=CP(L-1)+(CP(L-1)-CP(L-2))*(XPT(JT)-XPT(L-1))/        FILL.68
     1(XPT(L-1)-XPT(L-2))                                              FILL.69
      K=K+1                                                            FILL.70
      LPL=NPL(N)                                                       FILL.71
      NPP(K)=LPL                                                       FILL.72
      I1=IN+1                                                          FILL.73
      XIP(K,1)=XPT(I1)                                                 FILL.74
      ZIP(K,1)=ZPT(I1)                                                 FILL.75
      CPIP(K,1)=CP(I1)                                                 FILL.76
      DO 130 L=2,LPL                                                   FILL.77
      L3=L+LU-1+IN                                                     FILL.78
      XIP(K,L)=XPT(L3)                                                 FILL.79
      ZIP(K,L)=ZPT(L3)                                                 FILL.80
  130 CPIP(K,L)=CP(L3)                                                 FILL.81
      L=L3                                                             FILL.82
      CPIP(K,LPL)=CP(L-1)+(CP(L-1)-CP(L-2))*(XPT(L)-XPT(L-1))/         FILL.83
     1(XPT(L-1)-XPT(L-2))                                              FILL.84
      K1 = K - 1                                                       FILL.85
      CPIP(K1,LPU) = (CPIP(K1,LPU) + CPIP(K,LPL))*.5                   FILL.86
      CPIP(K,LPL) = CPIP(K1,LPU)                                       FILL.87
      GO TO 160                                                        FILL.88
  135 CONTINUE                                                         FILL.89
      LU=NPU(N)-ISTAG                                                  FILL.90
      LPU=LU+1                                                         FILL.91
```

```
      NPP(K)=LPU                                                        FILL.92
      DO 140 L=1,LU                                                     FILL.93
      L1=L+ISTAG-1+IN                                                   FILL.94
      XIP(K,L)=XPT(L1)                                                  FILL.95
      ZIP(K,L)=ZPT(L1)                                                  FILL.96
  140 CPIP(K,L)=CP(L1)                                                  FILL.97
      KUP = NPU(N)                                                      FILL.98
      XIP(K,LPU) = XU(KUP,N)                                            FILL.99
      ZIP(K,LPU) = ZU(KUP,N)                                            FILL.100
      L=LU+2                                                            FILL.101
      CPIP(K,LPU)=CP(L-1)+(CP(L-1)-CP(L-2))*(XPT(JT)-XPT(L-1))/         FILL.102
     1(XPT(L-1)-XPT(L-2))                                               FILL.103
      K=K+1                                                             FILL.104
      LPL=NPL(N)+ISTAG-1                                                FILL.105
      NPP(K)=LPL                                                        FILL.106
      DO 145 L=1,ISTAG                                                  FILL.107
      L2=ISTAG-L+1+IN                                                   FILL.108
      XIP(K,L)=XPT(L2)                                                  FILL.109
      ZIP(K,L)=ZPT(L2)                                                  FILL.110
  145 CPIP(K,L)=CP(L2)                                                  FILL.111
      LI=ISTAG+1                                                        FILL.112
      DO 150 L=LI,LPL                                                   FILL.113
      L3=LU+L-1+IN                                                      FILL.114
      XIP(K,L)=XPT(L3)                                                  FILL.115
      ZIP(K,L)=ZPT(L3)                                                  FILL.116
  150 CPIP(K,L)=CP(L3)                                                  FILL.117
      L=L3                                                              FILL.118
      CPIP(K,LPL)=CP(L-1)+(CP(L-1)-CP(L-2))*(XPT(L)-XPT(L-1))/          FILL.119
     1(XPT(L-1)-XPT(L-2))                                               FILL.120
      K1 = K - 1                                                        FILL.121
      CPIP(K1,LPU) = (CPIP(K1,LPU) + CPIP(K,LPL))*.5                    FILL.122
      CPIP(K,LPL) = CPIP(K1,LPU)                                        FILL.123
  160 CONTINUE                                                          FILL.124
      L1=LPU-1                                                          FILL.125
      L2=LPU-2                                                          FILL.126
      K=K-1                                                             FILL.127
      K1=K+1                                                            FILL.128
      DO 200 L=2,L1                                                     FILL.129
  200 PAV(L)=.5*(CPIP(K,L-1)+CPIP(K,L))                                 FILL.130
      CPIP(K,1)=.5*(CPIP(K,1)+CPIP(K1,1))                               FILL.131
      CPIP(K1,1)=CPIP(K,1)                                              FILL.132
      DO 210 L=2,L1                                                     FILL.133
      CPIP(K,L) = PAV(L)                                                FILL.134
  210 CONTINUE                                                          FILL.135
      CPIP(K,LPU)=CPIP(K,L1)+(CPIP(K,L1)-CPIP(K,L2))                    FILL.136
     1*(XIP(K,LPU)-XIP(K,L1))/(XIP(K,L1)-XIP(K,L2))                     FILL.137
      L1=LPL-1                                                          FILL.138
      L2=LPL-2                                                          FILL.139
      DO 250 L=2,L2                                                     FILL.140
  250 PAV(L)=.5*(CPIP(K1,L)+CPIP(K1,L+1))                               FILL.141
      PAV(L1) = .5*(CPIP(K1,L1) + CP(L3))                               FILL.142
      DO 220 L=2,L1                                                     FILL.143
      CPIP(K1,L) = PAV(L)                                               FILL.144
  220 CONTINUE                                                          FILL.145
      CPIP(K1,LPL)=CPIP(K1,L1)+(CPIP(K1,L1)-CPIP(K1,L2))                FILL.146
     1*(XIP(K1,LPL)-XIP(K1,L1))/(XIP(K1,L1)-XIP(K1,L2))                 FILL.147
      KK=K1                                                             FILL.148
  170 FORMAT(1H0,10F10.5)                                               FILL.149
      RETURN                                                            FILL.150
      END                                                               FILL.151
```

```
      SUBROUTINE PARTIN                                                 PARTIN.2
C                                                                       PARTIN.3
C     DIRECT MATRIX INVERSION                                           PARTIN.4
C                                                                       PARTIN.5
      COMMON /PARAM/ MACH,ALPHA,REFA,MATIN                              PARTIN.6
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),NX(58)                         PARTIN.7
      COMMON /VELCOM/ NPOINT,NPART,ITRMAX,EX,PRINT                      PARTIN.8
      COMMON /SCRAT/ NW(600),NB(600),NT(600),A(100,100),GW(600)         PARTIN.9
      REAL NW,NB,NT                                                     PARTIN.10
      NDIM=100                                                          PARTIN.11
      NWING=NPOINT                                                      PARTIN.12
      CALL SECOND(TIME)                                                 PARTIN.13
      WRITE(6,300) TIME                                                 PARTIN.14
      REWIND 9                                                          PARTIN.15
      DO 100 I=1,NWING                                                  PARTIN.16
  100 READ(9) (A(I,J),J=1,NWING)                                        PARTIN.17
      IF(MATIN.EQ.1) GO TO 115                                          PARTIN.18
      REWIND 9                                                          PARTIN.19
      CALL INVERT(A,NWING,NDIM)                                         PARTIN.20
      DO 110 I=1,NWING                                                  PARTIN.21
  110 WRITE(9) (A(I,J),J=1,NWING)                                       PARTIN.22
      MATIN=1                                                           PARTIN.23
  115 DO 120 I=1,NWING                                                  PARTIN.24
      GW(I)=0.                                                          PARTIN.25
      DO 120 J=1,NWING                                                  PARTIN.26
      GW(I)=GW(I)+A(I,J)*NW(J)                                          PARTIN.27
  120 CONTINUE                                                          PARTIN.28
  150 CALL SECOND(TIME)                                                 PARTIN.29
      WRITE(6,300) TIME                                                 PARTIN.30
  300 FORMAT(1H0,6HTIME = F10.5)                                        PARTIN.31
      REWIND 9                                                          PARTIN.32
      RETURN                                                            PARTIN.33
      END                                                               PARTIN.34
```

```
      SUBROUTINE DIAGIN                                                 DIAGIN.2
      COMMON /PARAM/ MACH,ALPHA,REFA,MATIN                              DIAGIN.3
      COMMON /SCRAT/ NW(600),A(100,100)                                 DIAGIN.4
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),NX(58)                         DIAGIN.5
      IF(MATIN.EQ.1) RETURN                                             DIAGIN.6
      REWIND 3                                                          DIAGIN.7
      REWIND 10                                                         DIAGIN.8
      NDIM = 100                                                        DIAGIN.9
      DO 20 N=1,NCMPT                                                   DIAGIN.10
      JT=NC(N)-2                                                        DIAGIN.11
      DO 10 I=1,JT                                                      DIAGIN.12
   10 READ(3) (A(I,J),J=1,JT)                                           DIAGIN.13
      CALL INVERT(A,JT,NDIM)                                            DIAGIN.14
   20 WRITE(10) A                                                       DIAGIN.15
      MATIN=1                                                           DIAGIN.16
      REWIND 3                                                          DIAGIN.17
      REWIND 10                                                         DIAGIN.18
      RETURN                                                            DIAGIN.19
      END                                                               DIAGIN.20
```

```
      SUBROUTINE ITRATE                                                 ITRATE.2
      COMMON /SCRAT/ NW(600),RW(600),DNW(600),D(100,100),GW(100),GS(600)ITRATE.3
     1,A(600)                                                           ITRATE.4
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),NX(58)                         ITRATE.5
      COMMON /VELCOM/ NPOINT,NPART,ITRMAX,EX,PRINT                      ITRATE.6
      COMMON/ITR/ITR999,ITRM99                                          ITRATE.7
      COMMON/ARC/ TOLL1,TOLL2                                           ITRATE.8
      DIMENSION ITAB(6)                                                 ITRATE.9
      DATA ITAB/25,25,25,30,35,40/,ITEND/6/                             ITRATE.10
      REAL NW                                                           ITRATE.11
      INTEGER PRINT                                                     ITRATE.12
      REWIND 9                                                          ITRATE.13
      NDX=ITR999                                                        ITRATE.14
      IF(NDX.GT.ITEND)NDX=ITEND                                         ITRATE.15
      IMAX=ITAB(NDX)                                                    ITRATE.16
      IT=0                                                              ITRATE.17
      DO 5 N=1,NPOINT                                                   ITRATE.18
      GS(N)=0.                                                          ITRATE.19
    5 RW(N)=NW(N)                                                       ITRATE.20
   10 IT=IT+1                                                           ITRATE.21
      ITEST=0                                                           ITRATE.22
      IW=0                                                              ITRATE.23
      JW=0                                                              ITRATE.24
      MM = 0                                                            ITRATE.25
      DO 60 N=1,NCMPT                                                   ITRATE.26
      JT=NC(N)-2                                                        ITRATE.27
      READ(10) D                                                        ITRATE.28
      DO 50 I=1,JT                                                      ITRATE.29
      IW=IW+1                                                           ITRATE.30
      JW = MM                                                           ITRATE.31
      GW(IW)=0.                                                         ITRATE.32
      DO 40 J=1,JT                                                      ITRATE.33
      JW=JW+1                                                           ITRATE.34
   40 GW(IW)=GW(IW)+D(I,J)*RW(JW)                                       ITRATE.35
      IF(ABS(GW(IW)-GS(IW)).GT.TOLL2) ITEST = 1                         ITRATE.36
      IF(IT.LT.IMAX) GS(IW)=GW(IW)                                      ITRATE.37
   50 CONTINUE                                                          ITRATE.38
      MM = MM + JT                                                      ITRATE.39
   60 CONTINUE                                                          ITRATE.40
      REWIND 10                                                         ITRATE.41
C     CALL SECOND(TIME)                                                 ITRATE.42
C     WRITE(6,400) IT,TIME                                              ITRATE.43
      IF(ITEST.EQ.0) GO TO 90                                           ITRATE.44
      IT1=IT-1                                                          ITRATE.45
      IF(IT.EQ.IMAX) GO TO 85                                           ITRATE.46
      DO 80 I=1,NPOINT                                                  ITRATE.47
      DNW(I)=0.                                                         ITRATE.48
      READ(9) (A(J),J=1,NPOINT)                                         ITRATE.49
      DO 70 J=1,NPOINT                                                  ITRATE.50
   70 DNW(I)=DNW(I)+A(J)*GW(J)                                          ITRATE.51
   80 RW(I)=NW(I)-DNW(I)                                                ITRATE.52
      REWIND 9                                                          ITRATE.53
      IF(IT.LT.IMAX) GO TO 10                                           ITRATE.54
   85 WRITE(6,300) IT                                                   ITRATE.55
      WRITE(6,350) IT1                                                  ITRATE.56
      WRITE(6,600) (GS(I),I=1,NPOINT)                                   ITRATE.57
      WRITE(6,350) IT                                                   ITRATE.58
      WRITE(6,600) (GW(I),I=1,NPOINT)                                   ITRATE.59
      RETURN                                                            ITRATE.60
   90 WRITE(6,500) IT                                                   ITRATE.61
  100 RETURN                                                            ITRATE.62
  300 FORMAT(1H0,20HNO CONVERGENCE AFTER ,I5,10HITERATIONS,/            ITRATE.63
     1,1X,32HLAST TWO SOLUTION VECTORS FOLLOW,/)                        ITRATE.64
  350 FORMAT(1H0,15HSOLUTION VECTOR,I5,/)                               ITRATE.65
  500 FORMAT(1H0,24HSOLUTION CONVERGED AFTER,I5,10HITERATIONS,/)        ITRATE.66
  400 FORMAT(1H0,14HITERATION NO. ,I3,5X,6HTIME =,F10.5)                ITRATE.67
  600 FORMAT(1H0,10F10.5)                                               ITRATE.68
      END                                                               ITRATE.69
```

```
      SUBROUTINE INVERT(A,IA,NROWS)                                      INVERT.2
      REAL A(NROWS, NROWS), PIVOT, T                                     INVERT.3
      INTEGER IPIVOT(125),INDXR(125),INDXC(125)                          INVERT.4
      N = IA                                                             INVERT.5
      DO 20 J=1, N                                                       INVERT.6
   20 IPIVOT(J) = 0                                                      INVERT.7
      DO 550 I=1, N                                                      INVERT.8
      T = 0.0                                                            INVERT.9
      DO 105 J=1, N                                                      INVERT.10
      IF (IPIVOT(J).EQ.1) GO TO 105                                      INVERT.11
      DO 100 K=1, N                                                      INVERT.12
      IF (IPIVOT(K).EQ.1) GO TO 100                                      INVERT.13
      IF ( .NOT. (ABS(A(J,K)) -ABS(T) .GT. 0.0) ) GO TO 100              INVERT.14
      IROW = J                                                           INVERT.15
      ICOL = K                                                           INVERT.16
      T = A(J,K)                                                         INVERT.17
  100 CONTINUE                                                           INVERT.18
  105 CONTINUE                                                           INVERT.19
      IPIVOT(ICOL) = IPIVOT(ICOL)+1                                      INVERT.20
      IF (IROW.EQ.ICOL) GO TO 260                                        INVERT.21
      DO 200 L=1, N                                                      INVERT.22
      T = A(IROW,L)                                                      INVERT.23
      A(IROW,L) = A(ICOL,L)                                              INVERT.24
  200 A(ICOL,L) = T                                                      INVERT.25
  260 INDXR(I) = IROW                                                    INVERT.26
      INDXC(I) = ICOL                                                    INVERT.27
      PIVOT = A(ICOL,ICOL)                                               INVERT.28
      IF (PIVOT) 270, 750, 270                                           INVERT.29
  270 A(ICOL,ICOL) = 1.0                                                 INVERT.30
      DO 350 L=1, N                                                      INVERT.31
  350 A(ICOL,L) = A(ICOL,L)/PIVOT                                        INVERT.32
      DO 540 L=1, N                                                      INVERT.33
      IF (L.EQ.ICOL) GO TO 540                                           INVERT.34
      T = A(L,ICOL)                                                      INVERT.35
      A(L,ICOL) = 0.0                                                    INVERT.36
      DO 450 M=1, N                                                      INVERT.37
  450 A(L,M) = A(L,M)-A(ICOL,M)*T                                        INVERT.38
  540 CONTINUE                                                           INVERT.39
  550 CONTINUE                                                           INVERT.40
      DO 710 I=1, N                                                      INVERT.41
      L = N+1-I                                                          INVERT.42
      IF( INDXR(L)  .EQ.  INDXC(L) )  GO TO 710                          INVERT.43
      IROW = INDXR(L)                                                    INVERT.44
      ICOL = INDXC(L)                                                    INVERT.45
      DO 705 K=1, N                                                      INVERT.46
      T = A(K,IROW)                                                      INVERT.47
      A(K,IROW) = A(K,ICOL)                                              INVERT.48
  705 A(K,ICOL) = T                                                      INVERT.49
  710 CONTINUE                                                           INVERT.50
C                                                                        INVERT.51
C     SUCCESSFUL SOLUTION                                                INVERT.52
C                                                                        INVERT.53
      RETURN                                                             INVERT.54
C                                                                        INVERT.55
  750 CONTINUE                                                           INVERT.56
C                                                                        INVERT.57
C     SINGULAR MATRIX                                                    INVERT.58
C                                                                        INVERT.59
      WRITE (6, 751)                                                     INVERT.60
  751 FORMAT (29H ERROR THE MATRIX IS SINGULAR)                          INVERT.61
      CALL EXIT                                                          INVERT.62
      END                                                                INVERT.63
```

```
      SUBROUTINE LIFT(N,CPU,CPL,XREF,ZREF,CREF,COSAL,CL,CM)                  LIFT.2
      COMMON/POINT/ARRAY(4950)                                               LIFT.3
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(12),NPU(4),NPL(4),ISTG(4)LIFT.4
      DIMENSION  CPU(1),CPL(1),XU(30,4),XL(30,4)                             LIFT.5
      EQUIVALENCE (ARRAY(3001),XU),(ARRAY(3121),XL)                          LIFT.6
      EQUIVALENCE (ARRAY(3241),ZU),(ARRAY(3361),ZL)                          LIFT.7
      DIMENSION ZU(30,4),ZL(30,4)                                            LIFT.8
      NU=NPU(N)-1                                                            LIFT.9
      NL=NPL(N)-1                                                            LIFT.10
      IF(N.LE.1) CL = 0.                                                     LIFT.11
      IF(N.LE.1) CM = 0.                                                     LIFT.12
      CLU=0.                                                                 LIFT.13
      CLL=0.                                                                 LIFT.14
      CMU=0.                                                                 LIFT.15
      CML=0.                                                                 LIFT.16
      DO 10 I=1,NU                                                           LIFT.17
      DELX=XU(I+1,N)-XU(I,N)                                                 LIFT.18
      DELZ=ZU(I+1,N)-ZU(I,N)                                                 LIFT.19
      XPT=(XU(I,N)+XU(I+1,N))*.5                                             LIFT.20
      ZPT=(ZU(I,N)+ZU(I+1,N))*.5                                             LIFT.21
      CZU=CPU(I)*DELX                                                        LIFT.22
      CXU=CPU(I)*DELZ                                                        LIFT.23
      CLU=CLU+CZU                                                            LIFT.24
      CMU=CZU*(XPT-XREF)+CXU*(ZPT-ZREF)+CMU                                  LIFT.25
   10 CONTINUE                                                               LIFT.26
      DO 25 I=1,NL                                                           LIFT.27
      DELX=XL(I+1,N)-XL(I,N)                                                 LIFT.28
      DELZ=ZL(I+1,N)-ZL(I,N)                                                 LIFT.29
      XPT=(XL(I,N)+XL(I+1,N))*.5                                             LIFT.30
      ZPT=(ZL(I,N)+ZL(I+1,N))*.5                                             LIFT.31
      CXL=CPL(I)*DELZ                                                        LIFT.32
      CZL=CPL(I)*DELX                                                        LIFT.33
      CLL=CLL+CZL                                                            LIFT.34
      CML=CZL*(XPT-XREF)+CXL*(ZPT-ZREF)+CML                                  LIFT.35
   25 CONTINUE                                                               LIFT.36
      CL=(CLL-CLU)*COSAL/CREF+CL                                             LIFT.37
      CM=(CML-CML)/CREF**2 + CM                                              LIFT.38
      RETURN                                                                 LIFT.39
      END                                                                    LIFT.40
```

```
                  OVERLAY(FNIS,2,0)
      PROGRAM IBL                                                            IBL.3
      COMMON  / AKAP   / AKAP,AKAP2,C1,PI,PI2                                IBL.4
      COMMON  / AREA   / AREA                                                IBL.5
      COMMON  / ASCALE / ASCALE                                              IBL.6
      COMMON  / CL     / CL,CDT,CDF,CDP,SEPTRB(2)                            IBL.7
      COMMON  / DU2T   / DU2T                                                IBL.8
      COMMON  / HTURB  / HTURB                                               IBL.9
      COMMON  / INSTB  / INSTB,ITRAN                                         IBL.10
      COMMON  / ISEP   / ISEP,ITRIP,IATT,TE                                  IBL.11
      COMMON  / I3D    / I3D                                                 IBL.12
      COMMON  / NBL    / NBL                                                 IBL.13
      COMMON  / NKRV   / IDIAG,AHMINM,AHSTRT,MXXN,MFAIL1,MSTEP2              IBL.14
      COMMON  / NLAM   / NLAM                                                IBL.15
      COMMON  / NORDER / NORDER,ALFR,FLAG                                    IBL.16
      COMMON  / NPT    / NPT                                                 IBL.17
      COMMON  / NTURB  / NTURB                                               IBL.18
      COMMON  / NUS    / NUS                                                 IBL.19
      COMMON  / RNB    / RNB                                                 IBL.20
      COMMON  / SANGLE / SANGLE                                              IBL.21
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),          IBL.22
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),H1(200),      IBL.23
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),          IBL.24
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),       IBL.25
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)         IBL.26
      COMMON  / SEP    / SEP                                                 IBL.27
      COMMON  / TITLE  / TITLE(8)                                            IBL.28
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      COMMON  / TITLEP / TITLEP(24)                                                  IBL.29
      COMMON  / TRIP   / TRIP(2)                                                     IBL.30
      COMMON  / TRIPUL / TRIPUP,TRIPOP                                               IBL.31
      COMMON  / XIN    / XIN(100),YIN(100),UIN(100)                                  IBL.32
      COMMON  / ZZ     / ZZ(4)                                                       IBL.33
      COMMON/NXT/NXT                                                                 IBL.34
      COMMON/MTRAN/ MTRAN                                                            IBL.35
      COMMON/SEG/ NCMPT,NFLAP,NFP,DUM(44),XTE(4),DUMM(18)                            IBL.36
      COMMON/SLOT/HSS(100),TSS(100),OSS(100),CSS(100),USS(100),DTSS(100)             IBL.37
      NTP=3                                                                          IBL.38
      CALL INPUT                                                                     IBL.39
      CALL BOUND                                                                     IBL.40
      IF(MTRAN.GE.2) GO TO 1                                                         IBL.41
      CALL DRAG                                                                      IBL.42
    1 CONTINUE                                                                       IBL.43
      CALL PRINTER                                                                   IBL.44
      IF(MTRAN.EQ.1) GO TO 3                                                         IBL.45
      DO 2 I=1,NXT                                                                   IBL.46
      HSS(I) = H(I)                                                                  IBL.47
      TSS(I) = THT(I)                                                                IBL.48
      OSS(I) = DU(I)                                                                 IBL.49
      CSS(I) = CFD(I)                                                                IBL.50
      USS(I) = U(I)                                                                  IBL.51
      DTSS(I) = 0.                                                                   IBL.52
      IF(I.GE.ITRAN) DTSS(I) = DELT(I)                                               IBL.53
    2 CONTINUE                                                                       IBL.54
    3 CONTINUE                                                                       IBL.55
      RETURN                                                                         IBL.56
      END                                                                            IBL.57
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      SUBROUTINE ACOE(SS,IND)                                                        ACOE.2
      COMMON  / SOLN   / Y(3),YP(3)                                                  ACOE.3
      EQUIVALENCE  ( Y(1),TH ) , ( Y(2),P ) , ( Y(3),H )                             ACOE.4
      COMMON /USXX/ US , DUS , ALPZ , ALP , K , OAS , KDA                            ACOE.5
      COMMON /FSOL/ RTH , BETA , TB , HDS , HHDS , CF1 , F , DGDH                   ACOE.6
      COMMON /RPOLY/  C , D , E , J , DCDH , DDDH , DEDH , DJDH                      ACOE.7
      COMMON/MATX/ A(4,4),B(4),IPR(3)                                                ACOE.8
      REAL KDA,K,J,KCTB                                                              ACOE.9
      CALL CPOLY( H )                                                                ACOE.10
      CALL FAT(SS,IND)                                                               ACOE.11
      CF12= CF1/2.0                                                                  ACOE.12
      A(1,1) = 1.0                                                                   ACOE.13
      A(1,2) =-K*J                                                                   ACOE.14
      A(1,3) = -K*P*DJDH                                                             ACOE.15
      B(1) = CF12 - DUS*(2.0 + H)*TH + KDA*(TH - P*C*TB)                             ACOE.16
      KCTB = K*C*TB                                                                  ACOE.17
      A(2,1) = P*KCTB/TH                                                             ACOE.18
      A(2,2) = E - KCTB - K*F*C/TH/HHDS                                              ACOE.19
      A(2,3) = P*DEDH - K*P*TB*DCDH - P*KCTB*(1.0 + DGDH)/HHDS                       ACOE.20
      BA = TH*(H+1.0) + P*C*TB                                                       ACOE.21
      B(2) = CF12*TB - 2.0*DUS*P*E + K*DUS*(BA) + 2.0*KDA*P*E                        ACOE.22
      A(3,1) = HDS                                                                   ACOE.23
      A(3,2) = K*D                                                                   ACOE.24
      A(3,3) = TH*DGDH + K*P*DDDH                                                    ACOE.25
      B(3) = F + TH*HDS*(KDA - DUS)                                                  ACOE.26
C     DETERM  = A(1,1)*(A(2,2)*A(3,3) - A(3,2)*A(2,3))                              ACOE.27
C    1          -A(1,2)*(A(2,1)*A(3,3) - A(2,3)*A(3,1))                            ACOE.28
C    1          +A(1,3)*(A(2,1)*A(3,2) - A(2,2)*A(3,1))                            ACOE.29
C     WRITE(6,6000) SS,US,DUS,DETERM                                                ACOE.30
      RETURN                                                                         ACOE.31
      END                                                                            ACOE.32
```

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      SUBROUTINE BOUND                                                  BOUND.2
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),     BOUND.3
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),H1(200), BOUND.4
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),     BOUND.5
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),  BOUND.6
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)    BOUND.7
      COMMON/MTRAN/ MTRAN                                               BOUND.8
      COMMON/SEG/ NCMPT,NFLAP,NFP,DUM(44),XTE(4),DUMM(18)               BOUND.9
      COMMON  / SANGLE / SANGLE                                         BOUND.10
      COMMON  / RNB    / RNB                                            BOUND.11
      COMMON  / NUS    / NUS                                            BOUND.12
      COMMON  / TRIP   / TRIP(2)                                        BOUND.13
      COMMON  / I3D    / I3D                                            BOUND.14
      COMMON  / NLAM   / NLAM                                           BOUND.15
      COMMON  /INSTB  / INSTB,ITRAN                                     BOUND.16
      COMMON  / HTURB  / HTURB                                          BOUND.17
      COMMON  / ISEP   / ISEP,ITRIP,IATT,IE                             BOUND.18
      COMMON  / ZZ      / ZZ(4)                                         BOUND.19
      COMMON  / NTURB  / NTURB                                          BOUND.20
      COMMON  / NBL     /NBL                                            BOUND.21
      COMMON/NXT/NXT                                                    BOUND.22
      COMMON  / CL     / CL,CDT,CDF,CDP,SEPTRB(2)                       BOUND.23
      NUS = 200                                                         BOUND.24
      NBL = 0                                                           BOUND.25
      TRIPS=TRIP(1)                                                     BOUND.26
      THTZ = 0.                                                         BOUND.27
      IF(SANGLE .GT. 0.) 550,575                                        BOUND.28
  550 IF(HTURB .NE. 0.) 575,525                                         BOUND.29
C     CALCULATE CSTAR TO DETERMINE IF LAMINAR ANALYSIS IS TO BE         BOUND.30
C     PERFORMED. IF SO, USE RTH1 TO OBTAIN STARTING THETA.              BOUND.31
  525 CONTINUE                                                          BOUND.32
      CALL INIT(UUD,RTH1,HT1)                                           BOUND.33
      IF(I3D .EQ. 1) 560,570                                            BOUND.34
  560 HTURB  = HT1                                                      BOUND.35
      GO TO 571                                                         BOUND.36
  570 HTURB   = 0.                                                      BOUND.37
  571 THTZ    = RTH1/(U(1)*RNB)                                         BOUND.38
      GO TO 1000                                                        BOUND.39
  575 IF(THTZ)1000,600,1000                                             BOUND.40
  600 CONTINUE                                                          BOUND.41
  700 PKZ      = .0855                                                  BOUND.42
      DU(1) = ABS(DU(1))                                                BOUND.43
  900 ZZERO=PKZ/DU(1)                                                   BOUND.44
      ZZ(1)=ZZERO                                                       BOUND.45
      GO TO 1100                                                        BOUND.46
C     CALCULATE L INITIAL Z                                             BOUND.47
 1000 ZZ(1)=THTZ**2*RNB                                                 BOUND.48
 1100 CONTINUE                                                          BOUND.49
      IF(HTURB .NE. 0.) 1200,1300                                       BOUND.50
 1200 ITRAN   = 1                                                       BOUND.51
      INSTB    = 1                                                      BOUND.52
      THT(1)   = THTZ                                                   BOUND.53
      IF(MTRAN.EQ.2) MTRAN = 3                                          BOUND.54
      IF(MTRAN.EQ.3) NUS = 100                                          BOUND.55
      GO TO 1600                                                        BOUND.56
 1300 NLAM=NUS                                                          BOUND.57
      CALL LAMINAR                                                      BOUND.58
 1375 CALL TRANSIT(TRIPS)                                               BOUND.59
      IF(MTRAN.EQ.1) GO TO 1380                                         BOUND.60
      NF = NFLAP-NFP+1                                                  BOUND.61
      NXT = ITRAN                                                       BOUND.62
      IF(ITRAN.GT.100) NXT = 100                                        BOUND.63
      IF(X(ITRAN).GT.XTE(NF)) GO TO 1800                                BOUND.64
      NUS = 100                                                         BOUND.65
      NXT = NUS                                                         BOUND.66
      MTRAN = 3                                                         BOUND.67
 1380 CONTINUE                                                          BOUND.68
      NLAM=ITRAN                                                        BOUND.69
      NBL=ITRAN                                                         BOUND.70
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      IF(TE .NE. 0. .OR.  NBL .EQ. NUS) GO TO 1800                      BOUND.71
      IF(ISEP .EQ. 1)IF(IATT .EQ. 2)1400,1700                           BOUND.72
 1400 CONTINUE                                                          BOUND.73
 1600 CALL TURB                                                         BOUND.74
 1602 NBL=NTURB                                                         BOUND.75
      IF(MTRAN.EQ.3) GO TO 1800                                         BOUND.76
      IF(NBL.LT.NUS) GO TO 1900                                         BOUND.77
      IF(NBL.EQ.NUS.AND.H(NUS).GT.3..OR.H(NUS).LT.1.) GO TO 1900        BOUND.78
      GO TO 1700                                                        BOUND.79
 1900 CONTINUE                                                          BOUND.80
      IF(H(NBL).LT.1.) THT(NBL) = 1.1*THT(NBL-1)                        BOUND.81
      IF(H(NBL).LT.1.) H(NBL) = 1.1*H(NBL-1)                            BOUND.82
      IF(RTH(NBL).LT.0.) H(NBL) = 1.1*H(NBL-1)                          BOUND.83
      IF(RTH(NBL).LT.0.) THT(NBL) = 1.1*THT(NBL-1)                      BOUND.84
      DO 2000 I = NBL,NUS                                               BOUND.85
      SS = S(I)                                                         BOUND.86
      H(I) = TBLU1(SS,S,H,1,NBL)                                        BOUND.87
      THT(I) = TBLU1(SS,S,THT,1,NBL)                                    BOUND.88
 2000 CONTINUE                                                          BOUND.89
 1700 CONTINUE                                                          BOUND.90
 1800 CONTINUE                                                          BOUND.91
      RETURN                                                            BOUND.92
      END                                                               BOUND.93
       SUBROUTINE DRAG                                                   DRAG.2
       COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),     DRAG.3
     1CF2(200),DEL(200),DELSY2(200),DELT(200),H(200),HHDS(200),H1(200),  DRAG.4
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),      DRAG.5
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),   DRAG.6
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)     DRAG.7
       COMMON  / AREA    / AREA                                          DRAG.8
       DATA TWOPI/6.283185308/                                           DRAG.9
       COMMON  / NUS     / NUS                                           DRAG.10
       COMMON  / NORDER  / DUM2,ALFR,FLAG                                DRAG.11
       COMMON  / NBL     / NBL                                           DRAG.12
       COMMON  / INSTB   / INSTB,ITRAN                                   DRAG.13
       COMMON  / CL      / CL,CDT,CDF,CDP,SEPTRB(2)                      DRAG.14
       COMMON  /CF   /   CF(200)                                         DRAG.15
       COMMON  /CD   /   CDS(200)                                        DRAG.16
       COMMON  / ISEP    / ISEP,ITRIP,IATT,TE                            DRAG.17
       CD=0.                                                             DRAG.18
       CF(1)=0.                                                          DRAG.19
       DX=0.                                                             DRAG.20
       DY=0.                                                             DRAG.21
       NM1 = NBL - 1                                                     DRAG.22
       CI = CFD(1)                                                       DRAG.23
       DO 400 I=1,NM1                                                    DRAG.24
       DDX=X(I+1)-X(I)                                                   DRAG.25
       DDY=Y(I+1)-Y(I)                                                   DRAG.26
       DS      = S(I+1) - S(I)                                           DRAG.27
       CIP1 = CFD(I+1)                                                   DRAG.28
       A=(CIP1 - CI)/DS                                                  DRAG.29
       B=CI -A*S(I)                                                      DRAG.30
       DXX=.5*A*(S(I+1)**2-S(I)**2)+B*DS                                 DRAG.31
       DINCX    = DXX*DDX/DS                                             DRAG.32
       DINCY    = DXX*DDY/DS                                             DRAG.33
       CF(I+1)=DINCY *SIN(ABS(ALFR))+DINCX *COS(ABS(ALFR))+CF(I)         DRAG.34
       CI      = CIP1                                                    DRAG.35
   400 CONTINUE                                                          DRAG.36
   100 DO 200 I = ITRAN,NBL                                              DRAG.37
       F1=.5*(H(I)+5.)                                                   DRAG.38
       IF(H(I).GT.2.6) F1 = 3.8                                          DRAG.39
       CDS(I)=2.*THT(I)*U(I)**F1                                         DRAG.40
   200 CONTINUE                                                          DRAG.41
       CD = CDS(NBL)                                                     DRAG.42
       CDT = CD                                                          DRAG.43
       CDF     = CF(NBL)                                                 DRAG.44
       CDP=CDT-CDF                                                       DRAG.45
       RETURN                                                            DRAG.46
       END                                                               DRAG.47
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      SUBROUTINE CPOLY( H )                                              CPOLY.2
      COMMON /RPOLY/ C , D , E , J , DCDH , DDDH , DEDH , DJDH           CPOLY.3
      COMMON  / FSOL   / RTH, BETA, TB, HDS, HHDS, CF1, F, DGDH          CPOLY.4
      REAL J                                                             CPOLY.5
                                                                         CPOLY.6
C                                                                        CPOLY.7
      HD = (H+1.0)*(H+3.0)*(H+5.0)                                       CPOLY.8
      D        =-16.0/HD                                                 CPOLY.9
      DDDH = 16.0*(3.0*H*H + 18.0*H + 23.0)/ (HD*HD)                     CPOLY.10
      HE = H*(H+1.0)*(H+2.0)                                             CPOLY.11
      E        = -2.0/HE                                                 CPOLY.12
      DEDH = 2.0*(3.0*H*H + 6.0*H + 2.0)/(HE*HE )                        CPOLY.13
      J = E - D                                                          CPOLY.14
      DJDH = DEDH - DDDH                                                 CPOLY.15
      HC = H*(H+1.0)*(H+2.0)*(H+3.0)*(H+4.0)                             CPOLY.16
      C        = -24.0/HC                                                CPOLY.17
      DCDH = 24.0*(5.0*H**4 + 40.0*H**3 + 105.0*H*H + 100.0*H + 24.)     CPOLY.18
     1   /(HC*HC)                                                        CPOLY.19
      RETURN                                                             CPOLY.20
      END

      SUBROUTINE ARC(N,S,U,SINAZ,SINAZ2,SS,US,ALFS)                        ARC.2
      DIMENSION S(1),SS(1),U(1),US(1),ALFS(1)                              ARC.3
      SS(1)    = 0.                                                        ARC.4
      US(1)     = SQRT(U(1)*U(1) + SINAZ2)                                 ARC.5
      NM1       = N -1                                                     ARC.6
      ALFS(1)   = ASIN(SINAZ/US(1))                                        ARC.7
      DO 100 I=1,NM1                                                       ARC.8
      UT        = U(I+1)                                                   ARC.9
      US(I+1) = SQRT(UT*UT+SINAZ2)                                         ARC.10
      SA        = SINAZ/US(I+1)                                            ARC.11
      ALFS(I+1)= ASIN(SA)                                                  ARC.12
      TA        = TAN(ALFS(I+1))                                           ARC.13
      DS        = S(I+1)-S(I)                                              ARC.14
      SS(I+1)   = SS(1) + SQRT(1.+TA*TA)*DS                                ARC.15
  100 CONTINUE                                                             ARC.16
      RETURN                                                               ARC.17
      END                                                                  ARC.18

       SUBROUTINE FAT(SS,IND)                                              FAT.2
       COMMON /SCRAT/ ALFS(200),BETA(200),DUM1(3200),S(200),U(200),        FAT.3
      1DU(200),DUM2(1000),THT(200)                                         FAT.4
       COMMON  / INSTB  / INSTB,ITRAN                                      FAT.5
       COMMON  / SOLN   / Y(3),YP(3)                                       FAT.6
       COMMON  / SANGLE / SANGLE                                           FAT.7
       COMMON  / RNB    / RINF                                             FAT.8
       COMMON  / HTURB  / HTURB                                            FAT.9
       COMMON  / NUS    / NUS                                              FAT.10
       EQUIVALENCE ( Y(1),TH ) , ( Y(2),P ) , ( Y(3),H )                   FAT.11
       COMMON /USXX/ US , DUS , ALPZ , ALP , K , DAS , KDA                 FAT.12
       COMMON /FSOL/ RTH , BET , TB , HDS , HHDS , CF1 , F , DGDH          FAT.13
       COMMON /RPOLY/ C , D , E , J , DCDH , DDDH , DEDH , DJDH            FAT.14
       COMMON /XXXX/  X , DSDX , XW , YW , XS , YS                         FAT.15
       REAL KDA,K,J                                                        FAT.16
C                                                                          FAT.17
C                                                                          FAT.18
       US = TBLU1(SS,S,U,1,NUS)                                            FAT.19
       DUS     = TBLU1(SS,S,DU,1,NUS)                                      FAT.20
C      WARNING--VARIABLE DUS =(DU/DS)/US, NOT MERELY DU/DS.                FAT.21
       DUS     = DUS/US                                                    FAT.22
       ALP = A SIN(    SINAZ/US)                                           FAT.23
       DAS     = -SINAZ/(US*COS(ALP))*DUS                                  FAT.24
       K = TAN(ALP)                                                        FAT.25
       KDA = K*DAS                                                         FAT.26
       RTH = US*TH*RINF                                                    FAT.27
       IF(RTH.LT.0.) GO TO 230                                             FAT.28
       Z = ALOG(RTH)                                                       FAT.29
       TK1 = 0.01952 - 0.3868*Z + 0.02834*Z*Z - 0.0007*Z*Z*Z               FAT.30
       TK2 = 0.19151 - 0.8349*Z + 0.06259*Z*Z - 0.001953*Z*Z*Z             FAT.31
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      SUBROUTINE FMAT (N,SS,YY,YYP,IND)                                 FMAT.2
      DIMENSION YY(3), YYP(3),CC(4)                                     FMAT.3
      COMMON  / SOLN    / Y(3),YP(3)                                    FMAT.4
      EQUIVALENCE  ( Y(1),TH ) , ( Y(2),P ) , ( Y(3),H )                FMAT.5
      COMMON  / MATX/  A(4,4) , B(4) , IPR(3)                           FMAT.6
      COMMON  /USXX/ US , DUS , ALPZ , ALP , K , DAS , KDA              FMAT.7
      COMMON  / FSOL/ RTH , BETA , TB , HDS , HHDS , CF1 , F , DGDH     FMAT.8
      REAL KDA,K,J                                                      FMAT.9
C                                                                       FMAT.10
      TH = YY(1)                                                        FMAT.11
      P = YY(2)                                                         FMAT.12
      H = YY(3)                                                         FMAT.13
      CALL ACOE(SS,IND)                                                 FMAT.14
      IF(IND .EQ. 1) GO TO 300                                          FMAT.15
C                                                                       FMAT.16
      CALL SMLN(A,CC,B,3)                                               FMAT.17
C                                                                       FMAT.18
      YYP(1) =CC(1)                                                     FMAT.19
      YYP(2) =CC(2)                                                     FMAT.20
      YYP(3) =CC(3)                                                     FMAT.21
  300 RETURN                                                            FMAT.22
      END                                                               FMAT.23

      SUBROUTINE INIT(U1,RTH1,H1)                                       INIT.2
      DIMENSION U1(1)                                                   INIT.3
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),     INIT.4
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),DUM(200),INIT.5
     2PK(200),RDEL(200),RINST8(200),RTRAN(200),PKBAR(200),RTH(200),     INIT.6
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),  INIT.7
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)    INIT.8
      COMMON  / NUS     / NUS                                           INIT.9
      DIMENSION CSTART(16),RTHTAB(16),HTAB(16)                          INIT.10
      COMMON/SWEEP/ HH1,RRTH1,KSW                                       INIT.11
      COMMON/SEG/ NCMPT,NFLAP,NFP,NC(66)                                INIT.12
      COMMON/NSIDE/NSIDE                                                INIT.13
      COMMON  / I3D     / I3D                                           INIT.14
      DATA NTAB/16/                                                     INIT.15
      COMMON  / SANGLE / SANGLE                                         INIT.16
      COMMON  / RNB     / RNB                                           INIT.17
C     GIVEN A CALCULATED VALUE OF C*, A TABLE SEARCH IS PERFORMED TO    INIT.18
C     OBTAIN AN INITIAL RTHETA AND H.                                   INIT.19
      DATA (HTAB(I), I=1,16) /                                          INIT.20
     1    2.54       ,2.54      ,2.54      ,2.38      ,1.78      ,1.70      , INIT.21
     2    1.60       ,1.56      ,1.54      ,1.53      ,1.51      ,1.50      , INIT.22
     3    1.47       ,1.45      ,1.44      ,1.43                            / INIT.23
      DATA (RTHTAB(I), I=1,16) /                                        INIT.24
     1    0.         ,57.1      ,80.88      ,100.      ,200.      ,245.      , INIT.25
     2    295.       ,350.      ,400.      ,430.      ,450.      ,550.      , INIT.26
     3    640.       ,720.      ,805.      ,875.                            / INIT.27
      DATA (CSTART(I), I=1,16) /                                        INIT.28
     1    0.        ,2.E4      ,4.E4      ,6.E4      ,8.E4      ,1.E5      , INIT.29
     2    1.2E5      ,1.4E5     ,1.6E5     ,1.8E5     ,2.0E5     ,2.5E5     , INIT.30
     3    3.0E5      ,3.5E5     ,4.E5      ,4.5E5                           / INIT.31
      GO TO (4,2,4,3,4,3,4,3),NSIDE                                     INIT.32
    3 CONTINUE                                                          INIT.33
      IF(NFLAP.GT.0) GO TO 4                                            INIT.34
      GO TO 2                                                           INIT.35
    4 CONTINUE                                                          INIT.36
      I3D      = 0                                                      INIT.37
      H1       = 0                                                      INIT.38
      PIOV180 = .01745329                                               INIT.39
      V       = SIN(SANGLE*PIOV180)                                     INIT.40
      DELX = SUD(2) - SUD(1)                                            INIT.41
      DU1DX = (U1(2) - U1(1))/DELX                                      INIT.42
      CSTAR     = (V*V/DU1DX)*RNB                                       INIT.43
      CSTAR = ABS(CSTAR)                                                INIT.44
      IF(CSTAR .GT. 1.3E+05) 50,100                                     INIT.45
   50 I3D      = 1                                                      INIT.46
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      H1      = TBLU1(CSTAR,CSTART,HTAB,2,NTAB)                          INIT.47
  100 RTH1    = TBLU1(CSTAR,CSTART,RTHTAB,2,NTAB)                        INIT.48
      IF(CSTAR.GT.5.E+05) GO TO 10                                       INIT.49
      GO TO 20                                                           INIT.50
   10 CONTINUE                                                           INIT.51
      H1 = 1.41                                                          INIT.52
      RTH1 = 1000.                                                       INIT.53
   20 CONTINUE                                                           INIT.54
      HH1 = H1                                                           INIT.55
      RRTH1 = RTH1                                                       INIT.56
      KSW = I3D                                                          INIT.57
      GO TO 5                                                            INIT.58
    2 CONTINUE                                                           INIT.59
      H1 = HH1                                                           INIT.60
      RTH1 = RRTH1                                                       INIT.61
      I3D = KSW                                                          INIT.62
    5 CONTINUE                                                           INIT.63
      RETURN                                                             INIT.64
      END                                                                INIT.65

      SUBROUTINE INPUT                                                   INPUT.2
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),      INPUT.3
     1CF2(200),DEL(200),DELS12(200),DELT(200),H(200),HHDS(200),H1(200),  INPUT.4
     2PK(200),RDEL(200),RINST3(200),RTRAN(200),PKBAR(200),RTH(200),      INPUT.5
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),   INPUT.6
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)     INPUT.7
      COMMON/IPRINT/IPRINT,KSKIP                                         INPUT.8
      COMMON  / RNR     / RNR                                            INPUT.9
      COMMON  / TRIPUL  / TRIPUP                                         INPUT.10
      COMMON  / ANGLE   / ANGLE                                          INPUT.11
      COMMON  / NUS     / NUS                                            INPUT.12
      COMMON  / NPT     / NPT                                            INPUT.13
      COMMON  / TRIP    / TRIP(2)                                        INPUT.14
      COMMON  / TITLE   / TITLE(8)                                       INPUT.15
      COMMON  / NORDER / NORDER,ALFR,FLAG                                INPUT.16
      COMMON  / TITLEP / TITLEP(24)                                      INPUT.17
      COMMON/XIN/ XIN(100),YIN(100),CPIN(100),SU(100)                    INPUT.18
      DIMENSION UIN(100)                                                 INPUT.19
      COMMON  / CL      / CL,CDT,CDF,CDP,SEPTRB(2)                       INPUT.20
      COMMON  / HTURB   / HTURB                                          INPUT.21
      COMMON  / SANGLE / SANGLE                                          INPUT.22
      COMMON  / SINAZ2 /  SINAZ2                                         INPUT.23
                                                                         INPUT.24
      NUS = 200                                                          INPUT.25
      PI=3.14159265                                                      INPUT.26
      ALFR=ANGLE*PI/180.                                                 INPUT.27
      HTURB = 0.                                                         INPUT.28
      SINAZ   = SIN(SANGLE*0.01745329252)                                INPUT.29
      SINAZ2   = SINAZ*SINAZ                                             INPUT.30
      NORDER=1                                                           INPUT.31
      KKK = 1                                                            INPUT.32
      IF(KKK.EQ.1) GO TO 1                                               INPUT.33
      GO TO 2                                                            INPUT.34
    1 CONTINUE                                                           INPUT.35
      DO 3 I = 1,NPT                                                     INPUT.36
      UIN(I) = SQRT(1.-CPIN(I))                                          INPUT.37
    3 CONTINUE                                                           INPUT.38
    2 CONTINUE                                                           INPUT.39
      DO 4 I = 1,NPT                                                     INPUT.40
      CPC(I) = 1. - UIN(I)**2                                            INPUT.41
    4 CONTINUE                                                           INPUT.42
      CALL SCHORD(NPT,XIN,YIN,SU)                                        INPUT.43
      CALL SMOOTH(NPT,SU,UIN,NUS,SUD,UUD,DU)                             INPUT.44
      CALL ARC(NUS,SUD,UUD,SINAZ,SINAZ2,S,U,ALFS)                        INPUT.45
      CALL SDERV(NPT,SU,UIN,NUS,S,U,DU)                                  INPUT.46
      DU(1) = ABS(DU(1))                                                 INPUT.47
      DO 10 I = 1,NUS                                                    INPUT.48
      X(I) = TBLU1(SUD(I),SU,XIN,1,NPT)                                  INPUT.49
      Y(I) = TBLU1(SUD(I),SU,YIN,1,NPT)                                  INPUT.50
   10 CONTINUE
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      IF(X(2) .LE. X(1))1100,1400                                        INPUT.51
 1100 I=2                                                                INPUT.52
 1200 IF(X(I+1) .LE. X(I)) 1300,1500                                     INPUT.53
 1300 I     = I+1                                                        INPUT.54
      GO TO 1200                                                         INPUT.55
 1400 I     = 1                                                          INPUT.56
 1500 TRIP(1) = TBLU1(TRIPUP,X(I),SUD(I),1,NUS-I+1)                      INPUT.57
      RETURN                                                             INPUT.58
      END                                                                INPUT.59

      SUBROUTINE INSTAB(N,S,PK,RT,RD,TRIP,TE,ISEP,IATT,IN,IT,RI,PKIN,    INSTAB.2
     1TRIPOP)                                                            INSTAB.3
      COMMON /SCRAT/ SCRAT(5200),THT(200),X(200),Y(200),CPC(200)         INSTAB.4
      COMMON/NSEP/NSEP                                                   INSTAB.5
      COMMON  / TRIPUL / TRIPUP,DUM4                                     INSTAB.6
      COMMON  / NUS    / NUS                                             INSTAB.7
      COMMON  / INVALK / INVALK                                          INSTAB.8
      COMMON  / NTURB  / NTURB                                           INSTAB.9
      COMMON  / ISEP   / DUM1,ITRIP,DUM2,DUM3                            INSTAB.10
      COMMON  / KSEP   / KSEP                                            INSTAB.11
      COMMON  / ISTART / ISTART                                          INSTAB.12
      COMMON  / DU2T   / DU2T                                            INSTAB.13
      DIMENSION S(1),PK(1),RT(1),RD(1),RI(1)                             INSTAB.14
      IPASS  = 1                                                         INSTAB.15
      TRIPX = TRIPUP                                                     INSTAB.16
      IF(TRIPX .EQ. 1.) 400,500                                          INSTAB.17
  400 CONTINUE                                                           INSTAB.18
      TRIP = S(NUS)                                                      INSTAB.19
  500 IF(KSEP .LT. NUS)600,700                                           INSTAB.20
  600 KFLAG=1                                                            INSTAB.21
      GO TO 800                                                          INSTAB.22
  700 KFLAG = 2                                                          INSTAB.23
  800 CONTINUE                                                           INSTAB.24
      DO 2400 I=1,N                                                      INSTAB.25
      RLOG = ALOG(RT(I))                                                 INSTAB.26
      IF(RT(I).LE.650.) GO TO 100                                        INSTAB.27
      PKC = .69412 - .23992*RLOG + .0205*RLOG**2                         INSTAB.28
      GO TO 200                                                          INSTAB.29
  100 PKC = - .4709 + .11066*RLOG - .0058591*RLOG**2                     INSTAB.30
  200 CONTINUE                                                           INSTAB.31
      IN = I                                                             INSTAB.32
      GO TO (1300,1400),KFLAG                                            INSTAB.33
 1300 IF(KSEP.EQ.I) 1200,1400                                            INSTAB.34
 1200 CONTINUE                                                           INSTAB.35
      GO TO 2500                                                         INSTAB.36
 1400 IF(INVALK .EQ. I)1500,1600                                         INSTAB.37
 1500 WRITE(6,6000)                                                      INSTAB.38
 6000 FORMAT(1H1*LAMINAR SEPARATION*)                                    INSTAB.39
      GO TO 2500                                                         INSTAB.40
 1600 IF(PKC.GE.PK(I)) GO TO 2800                                        INSTAB.41
      IF(TRIP .LE. S(IN) .AND. IN .NE. NUS)1800,2400                     INSTAB.42
 1800 IF(TRIPOP .EQ. 0.) 2400,1900                                       INSTAB.43
 1900 IF(RT(I) .GE. 200.) 2000,2100                                      INSTAB.44
 2000 IT    = IN                                                        INSTAB.45
      ITRIP   = 1                                                        INSTAB.46
      NSEP = 5                                                           INSTAB.47
      GO TO 3200                                                         INSTAB.48
 2100 DO 2300 II=I,N                                                     INSTAB.49
      IF(RT(II) .GE. 200.) 2200,2300                                     INSTAB.50
 2200 IT  = II                                                           INSTAB.51
      IN   = II                                                          INSTAB.52
      ITRIP   = 1                                                        INSTAB.53
      NSEP = 5                                                           INSTAB.54
      GO TO 3200                                                         INSTAB.55
 2300 CONTINUE                                                           INSTAB.56
 2400 CONTINUE                                                           INSTAB.57
      NTURB = NUS                                                        INSTAB.58
      TE=1.                                                              INSTAB.59
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      IT=IN                                                              INSTAB.60
      GO TO 3200                                                         INSTAB.61
 2500 ISEP = 1                                                           INSTAB.62
      IF(KSEP .EQ. I)GO TO 2600                                          INSTAB.63
      IF(RT(IN) .LT. 125.) 3500,2575                                     INSTAB.64
 2575 PKT  = .0227-.0007575*RT(IN)-.000001157*RT(IN)*RT(IN)              INSTAB.65
      IF(PKT .GE. PK(IN))GO TO 3300                                      INSTAB.66
 2600 IATT=2                                                             INSTAB.67
      IT=IN                                                              INSTAB.68
      NSEP = 3                                                           INSTAB.69
      GO TO 3200                                                         INSTAB.70
 2800 CONTINUE                                                           INSTAB.71
      GO TO 2900                                                         INSTAB.72
 3300 CONTINUE                                                           INSTAB.73
      NSEP = 2                                                           INSTAB.74
 2900 IF(IN .EQ. NUS)3200,3000                                           INSTAB.75
C     IF TRIP . S(IN), SET TRIP EQUAL TO S(IN).                          INSTAB.76
 3000 IF(TRIP .LE. S(IN)) 3100,3200                                      INSTAB.77
 3100 IT = IN                                                            INSTAB.78
      ITRIP = 1                                                          INSTAB.79
      NSEP = 5                                                           INSTAB.80
 3200 CONTINUE                                                           INSTAB.81
      RETURN                                                             INSTAB.82
      END                                                                INSTAB.83

       SUBROUTINE INTBL(IND)                                              INTBL.2
       COMMON /SCRAT/ SCRAT(3600),S(200),U(200),DU(200)                   INTBL.3
       COMMON  / NUS     / NUS                                            INTBL.4
       COMMON  / NTURB   / NTURB                                          INTBL.5
       COMMON  / INSTB   / INSTB,ITRAN                                    INTBL.6
       DIMENSION G(3),SCRA(3),TCRA(3)                                     INTBL.7
       COMMON /CONTRL/ IEND                                               INTBL.8
       COMMON  / SOLN    / Y(3),YP(3)                                     INTBL.9
       EXTERNAL FMAT                                                      INTBL.10
       S1 = S(I)                                                          INTBL.11
       S2 = S(I+1)                                                        INTBL.12
    15 CONTINUE                                                           INTBL.13
       CALL MERSON(3,S1,S2,Y,FMAT,HEST,HMIN,ALWNC,YP,G,SCRA,TCRA,IND)     INTBL.14
       I  = I + 1                                                         INTBL.15
       NTURB  = I                                                         INTBL.16
C                                                                         INTBL.17
       IF(S(I)    .GE. S(NUS))IEND=1                                      INTBL.18
       RETURN                                                             INTBL.19
C                                                                         INTBL.20
       ENTRY SETUP                                                        INTBL.21
C      INITIALIZE SOME TERMS                                              INTBL.22
       IND = 0                                                            INTBL.23
       IEND = 0                                                           INTBL.24
       HEST  = 1.E-05                                                     INTBL.25
       HMIN   = 1.E-08                                                    INTBL.26
       S2 = 0.0                                                           INTBL.27
       ALWNC  = 1.E-03                                                    INTBL.28
       I  = ITRAN                                                         INTBL.29
       NTURB  = I                                                         INTBL.30
       RETURN                                                             INTBL.31
       END                                                                INTBL.32

      SUBROUTINE LAMINAR                                                  LAMINAR.2
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CF (200),CF1(200),       LAMINAR.3
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),H1(200),   LAMINAR.4
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTHETA(200),    LAMINAR.5
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),    LAMINAR.6
     4THET22(200),THETA(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)    LAMINAR.7
      COMMON  / RNB    / RNB                                              LAMINAR.8
      COMMON  / NUS     / N                                               LAMINAR.9
      COMMON  / NLAM    / NLAM                                            LAMINAR.10
      COMMON  / KSEP    / KSEP                                            LAMINAR.11
      COMMON  / INVALK / INVALK                                           LAMINAR.12
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      COMMON  / ZZ       / ZZ(4)                                          LAMINAR.13
      COMMON  / DU2T     / DU2T                                           LAMINAR.14
      DIMENSION DU2(3),SS(3)                                              LAMINAR.15
C     THE FOLLOWING DATA S. DEFINES COEFFICIENTS FOR THE CUBIC F0         LAMINAR.16
      DATA C1/.4140848557 /,  C2/-5.6932810302/,  C3/6.5043150606 /,      LAMINAR.17
     1    C4A/8.550205550/, C4B/55.573995455 /                            LAMINAR.18
C     THE FOLLOWING DATA S. DEFINES COEFFICIENTS FOR THE CUBIC F1         LAMINAR.19
      DATA D1/.04870877648/,  D2/.78169607867 /,  D3/1.7944503366 /,      LAMINAR.20
     1    D4A/2.401088104 /,D4B/-.91455761599 /                           LAMINAR.21
C     THE FOLLOWING DATA S. DEFINES COEFFICIENTS FOR THE CUBIC G1         LAMINAR.22
      DATA E1/.14979607851/,  E2/.98086769883 /,  E3/4.1234674158 /,      LAMINAR.23
     1    E4A/-13.13432892/,  E4B/-10.896754750/                          LAMINAR.24
      F(Q1,Q2,Q3,Q4,P)= Q4*P*P*P + Q3*P*P + Q2*P + Q1                     LAMINAR.25
      DF(Q2,Q3,Q4,P) = 3.*Q4*P*P+ 2.*Q3*P+ Q2                            LAMINAR.26
      DIMENSION KTAB(24),PF0(24),PF1(24),PG1(24),                        LAMINAR.27
     1 PKTAB(9),SLTAB(9),HTAB(9)                                         LAMINAR.28
      DATA PKTAB/2.04, 1.05, .52, .25, .20, .14, .12, .10, .08/,         LAMINAR.29
     1 SLTAB/1.58, 1.03, .69, .5, .463, .404, .382, .359, .333/,         LAMINAR.30
     2 HTAB/1.39, 1.64, 1.88, 2.00, 2.07, 2.18, 2.23, 2.28, 2.34/       LAMINAR.31
      REAL MU                                                            LAMINAR.32
      REAL KTAB                                                          LAMINAR.33
      DATA KTAB /     0.0855,   0.08,   0.07,   0.06,   0.05,           LAMINAR.34
     1    0.04,    0.03,    0.02,    0.01,    0.0,     -0.01,           LAMINAR.35
     2    -0.02,   -0.03,   -0.04,   -0.05,   -0.06,   -0.07,          LAMINAR.36
     3    -0.08,   -0.09,   -0.10,   -0.11,   -0.12,   -0.13,          LAMINAR.37
     4    -0.133/,                                                      LAMINAR.38
     5    PF0 /     0.0,     0.0258,   0.0736,   0.1225,   0.1724,      LAMINAR.39
     6  0.2236,   0.2761,   0.3299,  0.3848,   0.4411,   0.4986,        LAMINAR.40
     7    0.5572,   0.6167,   0.6777,   0.7404,   0.8053,   0.8729,     LAMINAR.41
     8    0.9433,   1.0166, 1.0929,   1.1723,   1.2539,   1.3372,       LAMINAR.42
     9    1.3686/,                                                      LAMINAR.43
     *    PF1 /     0.1296,   0.1236,   0.1129,   0.1025,   0.0925,     LAMINAR.44
     *    0.0830,   0.0738,   0.0651,   0.0567,   0.0487,   0.0411,     LAMINAR.45
     *    0.0338,   0.0270,   0.0207,   0.0149,   0.0095,   0.0048,     LAMINAR.46
     *    0.0010,   -0.0019,   -0.0039,   -0.0051,   -0.0055,   -0.0051,LAMINAR.47
     *    -0.0047/,                                                     LAMINAR.48
     *    PG1 /     0.2626,   0.2535,   0.2377,   0.2228,   0.2087,     LAMINAR.49
     *    0.1953,   0.1827,   0.1710,   0.1600,   0.1498,   0.1404,     LAMINAR.50
     *    0.1319,   0.1240,   0.1161,   0.1073,   0.0970,   0.0853,     LAMINAR.51
     *    0.0728,   0.0601,   0.0470,   0.0335,   0.0197,   0.0054,     LAMINAR.52
     *    0.0/                                                          LAMINAR.53
C  CURLES METHOD                                                        LAMINAR.54
C     NOTATION Z=(THETA/C)**2 * RNB                                     LAMINAR.55
C  INITIAL CONDITIONS                                                   LAMINAR.56
      CONST     = 5.                                                    LAMINAR.57
      ILITE     = 1                                                     LAMINAR.58
      KSEP      = N + 1                                                 LAMINAR.59
      INVALK    = N + 1                                                 LAMINAR.60
      FACT      = 2.22                                                  LAMINAR.61
      NTAB = 9                                                          LAMINAR.62
      NKTAB     = 24                                                    LAMINAR.63
      ISAV      = 0                                                     LAMINAR.64
      DO 25 I = 2,50                                                    LAMINAR.65
      IF(U(I).LT.0.1) 23,26                                             LAMINAR.66
   23 ISAV      = I                                                     LAMINAR.67
   25 CONTINUE                                                          LAMINAR.68
   26 ISAV = ISAV+1                                                     LAMINAR.69
      IF(ISAV.LE.2) GO TO 28                                            LAMINAR.70
      N         = N - ISAV + 2                                          LAMINAR.71
      NLAM      = N                                                     LAMINAR.72
      DO 27 I=2,N                                                       LAMINAR.73
      ITEMP     = ISAV + I-2                                            LAMINAR.74
      U(I)      = U(ITEMP)                                              LAMINAR.75
      DU(I)      = DU(ITEMP)                                            LAMINAR.76
      CPC(I)    = CPC(ITEMP)                                            LAMINAR.77
   27 CONTINUE                                                          LAMINAR.78
   28 SUM       = 0.                                                    LAMINAR.79
      A         = 0.45                                                  LAMINAR.80
      GI        = 0.      $ GINNI = 0.                                  LAMINAR.81
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      ZSAV     = 1.                                                    LAMINAR.82
      Z(1)     = ZZ(1)                                                 LAMINAR.83
      PK(1)     = Z(1)* DU(1)                                          LAMINAR.84
      THETA(1) = SQRT(Z(1)/RNB)                                        LAMINAR.85
      RTHETA(1) = RNB * U(1) * THETA(1)                                LAMINAR.86
      RDEL(1)  = 0.                                                    LAMINAR.87
      F1       = TBLU1(PK(1),KTAB,PF1,3,NKTAB)                         LAMINAR.88
      SL2      = F1                                                    LAMINAR.89
      SL       = SQRT(SL2)                                             LAMINAR.90
      CF(1)    = 0.                                                    LAMINAR.91
      F        = 0.                                                    LAMINAR.92
      IF(DU(1) .EQ. 0.) 50,75                                          LAMINAR.93
   50 H(1)     = 2.554                                                 LAMINAR.94
      GO TO 85                                                         LAMINAR.95
   75 H(1)     = (SL-2.*PK(1)-F*.5)/PK(1)                              LAMINAR.96
   85 DEL(1)   = H(1) * THETA(1)                                       LAMINAR.97
      NM1      = N - 1                                                 LAMINAR.98
      NM2      = N - 2                                                 LAMINAR.99
      UMIN1    = TBLU1(-2.*S(2),S,U,2,N)                               LAMINAR.100
      U0       = TBLU1(-S(2),S,U,2,N)                                  LAMINAR.101
      U201     = TBLU1(S(N)+S(2),S,U,2,N)                              LAMINAR.102
      U202     = TBLU1(S(N)+2.*S(2),S,U,2,N)                           LAMINAR.103
      SS(1)    = 0.                                                    LAMINAR.104
      SS(2)    = S(2)                                                  LAMINAR.105
      SS(3)    = S(3)                                                  LAMINAR.106
      SSOL0    = SS(3)                                                 LAMINAR.107
      DU2(1)   = (U(3)-2.*U(1)+UMIN1)/(4.*S(2)**2)                     LAMINAR.108
      DU2(2)   = (U(4)-2.*U(2)+U0)/(4.*S(2)**2)                        LAMINAR.109
      DU2(3)   = (U(5)-2.*U(3)+U(1))/(4.*(S(3)-S(2))**2)               LAMINAR.110
C                                                                      LAMINAR.111
C     INITIALIZATION ENDED WITH PRECEDING STATEMENT.                   LAMINAR.112
C                                                                      LAMINAR.113
C                                                                      LAMINAR.114
      DO 2700 I = 2,N                                                  LAMINAR.115
      U5IM1    = U(I-1)**5                                             LAMINAR.116
      U51      = U5IM1                                                 LAMINAR.117
  200 IF(I .EQ. 2) 400,300                                             LAMINAR.118
C                                                                      LAMINAR.119
C                                                                      LAMINAR.120
C     CALCULATE NN WHERE NN IS THE NUMBER OF INTEGRATION STEPS TO BE   LAMINAR.121
C     TAKEN IN THE INTERVAL (S(I-1),S(I)).                             LAMINAR.122
C                                                                      LAMINAR.123
  300 NN       = (ABS(DU(I)) + ABS(DU(I-1)))*.5/CONST + 1.             LAMINAR.124
      IF(DU(I).GE.0.) NN=1                                             LAMINAR.125
      GO TO 500                                                        LAMINAR.126
  400 NN       = 1                                                     LAMINAR.127
  500 DSOV2= .5*(S(I)-S(I-1))/FLOAT(NN)                                LAMINAR.128
      DS       = 2.*DSOV2                                              LAMINAR.129
C                                                                      LAMINAR.130
C                                                                      LAMINAR.131
C     THE FOLLOWING DO-LOOP INTEGRATES THE MOMENTUM-INTEGRAL EQUATION  LAMINAR.132
C     FROM S(I-1) TO S(I) IN NN STEPS.                                 LAMINAR.133
C                                                                      LAMINAR.134
      DO 1300 KK=1,NN                                                  LAMINAR.135
      S2       = S(I-1) + FLOAT(KK)*DS                                 LAMINAR.136
      U2       = TBLU1(S2,S,U,1,N)                                     LAMINAR.137
      U52      = U2**5                                                 LAMINAR.138
      DU2T = TBLU1(S2,SS,DU2,1,3)                                      LAMINAR.139
      DUT = TBLU1(S2,S,DU,1,N)                                         LAMINAR.140
  700 ITER     = 0                                                     LAMINAR.141
      TIM1     = (1. + FACT*GINM1)*U51                                 LAMINAR.142
  800 ITER     = ITER + 1                                              LAMINAR.143
      TI       = (1. + FACT*GI)*U52                                    LAMINAR.144
  900 SUMTEMP  = SUM + (TIM1 + TI)*DSOV2                               LAMINAR.145
      Z(I)     = A * SUMTEMP / U2**6                                   LAMINAR.146
      IF(Z(I).LT.0.) GO TO 1175                                        LAMINAR.147
      PK(I)    = Z(I)*DUT                                              LAMINAR.148
      IF(PK(I) .LT.-.12) 1000,1100                                     LAMINAR.149
 1000 INVALK = I                                                       LAMINAR.150
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      IF(Z(I) .LT. 0.) 1010,1020                                        LAMINAR.151
 1010 WRITE(6,6400)I                                                    LAMINAR.152
 6400 FORMAT(* INVALID K. Z(*I3*) ) 0.*/* ANALYSIS IS TERMINATED.*)     LAMINAR.153
      GO TO 1175                                                        LAMINAR.154
 1020 THETA(I)=SQRT(Z(I)/RNB)                                           LAMINAR.155
      RTHETA(I)=RNB*U(I)*THETA(I)                                       LAMINAR.156
      GO TO 2900                                                        LAMINAR.157
 1100 MU        = Z(I)**2 * U2  * DU2T                                 LAMINAR.158
      IF(PK(I) .GT. .0855 .AND. KK .EQ. NN) GO TO 2100                  LAMINAR.159
      F0 = TBLU1(PK(I),KTAB,PF0,1,NKTAB)                                LAMINAR.160
      G0        = 0.66 + 3.*PK(I)                                       LAMINAR.161
      IF(DU(I).GE.0.) MU = 0.                                           LAMINAR.162
      F         = F0 - MU*G0                                            LAMINAR.163
      GI        = F-0.45 + 6.*PK(I)                                     LAMINAR.164
      IF(DU(I).GE.0.) GO TO 1200                                        LAMINAR.165
      IF(ITER.GE.2.AND.ABS(1.-Z(I)/ZSAV).LT..0001) GO TO 1200           LAMINAR.166
      ZSAV    = Z(I)                                                    LAMINAR.167
      IF(ITER.LE.25) GO TO 809                                          LAMINAR.168
 1175 INVALK = I                                                        LAMINAR.169
      THETA(I) = THETA(I-1)                                             LAMINAR.170
      RTHETA(I) = RTHETA(I-1)                                           LAMINAR.171
      GO TO 2900                                                        LAMINAR.172
 1200 SUM     = SUMTEMP                                                 LAMINAR.173
      IF(DU(I).GE.0.) GI = 0.                                           LAMINAR.174
      GINM1    = GI                                                     LAMINAR.175
      U51      = U52                                                    LAMINAR.176
 1300 CONTINUE                                                          LAMINAR.177
C                                                                       LAMINAR.178
C     FOLLOWING EVALUATES H(I),CF(I),DEL(I)                             LAMINAR.179
C                                                                       LAMINAR.180
 1500 IF(Z(I) .LT. 0.) GO TO 1175                                       LAMINAR.181
      THETA(I)=SQRT(Z(I)/RNB)                                           LAMINAR.182
      RTHETA(I)=RNB * U(I) * THETA(I)                                   LAMINAR.183
      F1 = TBLU1(PK(I),KTAB,PF1,1,NKTAB)                                LAMINAR.184
      G1 = TBLU1(PK(I),KTAB,PG1,1,NKTAB)                                LAMINAR.185
      IF(DU(I).GE.0.) MU = 0.                                           LAMINAR.186
      SL2       = F1 - MU*G1                                            LAMINAR.187
      IF(SL2 .LE. 0.) GO TO 2800                                        LAMINAR.188
      SL        = SQRT(SL2)                                             LAMINAR.189
      CF(I)     = 2.*SL/RTHETA(I)                                       LAMINAR.190
      PKT       = PK(I)                                                 LAMINAR.191
      IF(ABS(PKT) .LT. .01) 1600,1900                                   LAMINAR.192
 1600 IF(PKT .LT. 0. ) 1700,1800                                        LAMINAR.193
 1700 H(I)      = .5/SQRT(F(D1,D2,D3,D4B,PKT) - MU*F(E1,E2,E3,E4B,PKT))  LAMINAR.194
     1             *(DF(D2,D3,D4B,PKT) - MU*DF(E2,E3,E4B,PKT))          LAMINAR.195
     2            -.5*(DF(C2,C3,C4B,PKT) - MU*3.) - 2.                  LAMINAR.196
      GO TO 2000                                                        LAMINAR.197
 1800 H(I)      = .5/SQRT(F(D1,D2,D3,D4A,PKT) - MU*F(E1,E2,E3,E4A,PKT))  LAMINAR.198
     1             *(DF(D2,D3,D4A,PKT) - MU*DF(E2,E3,E4A,PKT))          LAMINAR.199
     2            -.5*(DF(C2,C3,C4A,PKT) - MU*3.) -2.                   LAMINAR.200
      GO TO 2000                                                        LAMINAR.201
 1900 H(I)      = (SL-F*.5)/PK(I) -2.                                   LAMINAR.202
 2000 DEL(I)    = H(I)*THETA(I)                                         LAMINAR.203
      RDEL(I)   = H(I)*RTHETA(I)                                        LAMINAR.204
      GO TO 2200                                                        LAMINAR.205
 2100 THETA(I)=SQRT(Z(I)/RNB)                                           LAMINAR.206
      SUM = SUMTEMP                                                     LAMINAR.207
      IF(DU(I).GE.0.) GI = 0.                                           LAMINAR.208
      GINM1 = GI                                                        LAMINAR.209
      U51 = U52                                                         LAMINAR.210
      RTHETA(I)= RNB* U(I) * THETA(I)                                   LAMINAR.211
      H(I)      = TBLU1(PK(I),PKTAB,HTAB,1,NTAB)                        LAMINAR.212
      SL        = TBLU1(PK(I),PKTAB,SLTAB,1,NTAB)                       LAMINAR.213
      CF(I)     = 2.*SL/RTHETA(I)                                       LAMINAR.214
      DEL(I)    = H(I)*THETA(I)                                         LAMINAR.215
      RDEL(I)   = H(I)*RTHETA(I)                                        LAMINAR.216
 2200 CONTINUE                                                          LAMINAR.217
      SS(I) = S(I)                                                      LAMINAR.218
      IF(I.EQ.N) GO TO 2210                                             LAMINAR.219
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      SS(2) = S(I+1)                                                    LAMINAR.220
      SS(3) = S(I+2)                                                    LAMINAR.221
      GO TO 2220                                                        LAMINAR.222
 2210 SS(2) = S(I) + S(2)                                               LAMINAR.223
      SS(3) = S(I) + S(3)                                               LAMINAR.224
 2220 CONTINUE                                                          LAMINAR.225
      GO TO (2250,2250,2700), ILITE                                     LAMINAR.226
 2250 DU2(1)   = DU2(2)                                                 LAMINAR.227
      DU2(2)   = DU2(3)                                                 LAMINAR.228
      GO TO (2300,2600), ILITE                                          LAMINAR.229
 2300 IF(I+4 .GT. N) 2500,2400                                          LAMINAR.230
 2400 DU2(3) = (U(I+3)-2.*U(I+2)+  U(I+1))/((S(I+3)-S(I+2))*(S(I+2)-S(I+LAMINAR.231
     11)))                                                              LAMINAR.232
      GO TO 2700                                                        LAMINAR.233
 2500 DU2(3)   = (U201-2.*U(N-1)+U(N-3))/(4.*(S(N)-S(N-1))**2)          LAMINAR.234
      ILITE   = 2                                                       LAMINAR.235
      GO TO 2700                                                        LAMINAR.236
 2600 DU2(3)   = (U202-2.*U(N)+U(N-2))/(4.*(S(N)-S(N-1))**2 )           LAMINAR.237
      ILITE   = 3                                                       LAMINAR.238
 2700 CONTINUE                                                          LAMINAR.239
      GO TO 2900                                                        LAMINAR.240
 2800 KSEP   = I                                                        LAMINAR.241
 2900 CONTINUE                                                          LAMINAR.242
      RETURN                                                            LAMINAR.243
      END                                                               LAMINAR.244
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      SUBROUTINE MERSON(N,U,Z,Y,FUNC,H,HMIN,E,F,G,S,T,IND)              MERSON.2
      DIMENSION Y(1),F(1),G(1),S(1),T(1)                                MERSON.3
      X       = U                                                       MERSON.4
      IF(HMIN.LT.0.) HMIN=.01*ABS(H)                                    MERSON.5
      IH=1                                                              MERSON.6
      IR=1                                                              MERSON.7
      IX=1                                                              MERSON.8
      IC=1                                                              MERSON.9
      IF(E.GE.1.) IC = 0                                                MERSON.10
      E5 = ABS(E)*5.                                                    MERSON.11
      IF(Z.GT.X.AND.H.LT.0..OR.Z.LT.X.AND.H.GT.0.) H=-H                 MERSON.12
   10 IF(IC.EQ.0) GO TO 14                                              MERSON.13
      XS=X                                                              MERSON.14
      DO 12 J=1,N                                                       MERSON.15
   12 G(J)=Y(J)                                                         MERSON.16
   14 HS=H                                                              MERSON.17
      Q=X+H-Z                                                           MERSON.18
      IE=1                                                              MERSON.19
      IF(H.GT.0..AND.Q.GE.0..OR.H.LT.0..AND.Q.LE.0.) GO TO 16           MERSON.20
      GO TO 18                                                          MERSON.21
   16 H=Z-X                                                             MERSON.22
      IR=0                                                              MERSON.23
   18 H3=H/3.                                                           MERSON.24
      IND     = 0                                                       MERSON.25
      DO 75 ISW=1,5                                                     MERSON.26
      CALL FUNC(N,X,Y,F,IND)                                            MERSON.27
      IF(IND .EQ. 1) GO TO 9999                                         MERSON.28
      DO 70 I=1,N                                                       MERSON.29
      Q=H3*F(I)                                                         MERSON.30
      GO TO (21,22,23,24,25),ISW                                        MERSON.31
   21 T(I)=Q                                                            MERSON.32
      R=Q                                                               MERSON.33
      GO TO 26                                                          MERSON.34
   22 R=.5*(Q+T(I))                                                     MERSON.35
      GO TO 26                                                          MERSON.36
   23 R=3.*Q                                                            MERSON.37
      S(I)=R                                                            MERSON.38
      R=.375*(R+T(I))                                                   MERSON.39
      GO TO 26                                                          MERSON.40
   24 R=T(I)+4.*Q                                                       MERSON.41
      T(I)=R                                                            MERSON.42
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      R=1.5*(R-S(I))                                                    MERSON.43
      GO TO 26                                                          MERSON.44
   25 R=.5*(Q+T(I))                                                     MERSON.45
      Q=ABS(2.*R-1.5*(Q+S(I)))                                          MERSON.46
   26 Y(I)=G(I)+R                                                       MERSON.47
      IF(ISW.NE.5) GO TO 70                                             MERSON.48
      IF(IC.EQ.0) GO TO 70                                              MERSON.49
      R=ABS(Y(I))                                                       MERSON.50
      IF(R.LT.1.E-03) GO TO 28                                          MERSON.51
      R=E5*R                                                            MERSON.52
      GO TO 30                                                          MERSON.53
   28 R=E5                                                              MERSON.54
   30 IF(Q.GE.R.AND.IX.EQ.1) GO TO 32                                   MERSON.55
      GO TO 50                                                          MERSON.56
   32 IR=1                                                              MERSON.57
      IH=0                                                              MERSON.58
      H=.5*H                                                            MERSON.59
      IF(ABS(H).GE.HMIN) GO TO 40                                       MERSON.60
      H=SIGN(HMIN,H)                                                    MERSON.61
      IX=0                                                              MERSON.62
   40 DO 42 J=1,N                                                       MERSON.63
   42 Y(J)=G(J)                                                         MERSON.64
      X=XS                                                              MERSON.65
      GO TO 14                                                          MERSON.66
   50 IF(Q.GE..03125*R) IE=0                                            MERSON.67
   70 CONTINUE                                                          MERSON.68
      GO TO (71,75,73,74,75),ISW                                        MERSON.69
   71 X=X+H3                                                            MERSON.70
      GO TO 75                                                          MERSON.71
   73 X=X+.5*H3                                                         MERSON.72
      GO TO 75                                                          MERSON.73
   74 X = X + .5*H                                                      MERSON.74
   75 CONTINUE                                                          MERSON.75
      IF(IC.EQ.0) GO TO 80                                              MERSON.76
      IF(IE.NE.IH.OR.IR.NE.IR) GO TO 77                                 MERSON.77
      H=2.*H                                                            MERSON.78
      IX=1                                                              MERSON.79
   77 IH=1                                                              MERSON.80
   80 CONTINUE                                                          MERSON.81
      IF(IR.EQ.1) GO TO 10                                              MERSON.82
      H=HS                                                              MERSON.83
 9999 RETURN                                                            MERSON.84
      END                                                               MERSON.85

      SUBROUTINE OUTPUT                                                 OUTPUT.2
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CF (200),CF1(200),     OUTPUT.3
     1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),H1(200), OUTPUT.4
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),     OUTPUT.5
     3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),  OUTPUT.6
     4THET22(200),THT(200),DUMMY(3400)                                  OUTPUT.7
      COMMON  / SOLN   / Y(3),YP(3)                                     OUTPUT.8
      EQUIVALENCE  ( Y(1),THETA),( Y(2),P ) , ( Y(3),TH)                OUTPUT.9
      COMMON /USXX/ US , DUS , ALPZ , ALP , K , DAS , KDA               OUTPUT.10
      COMMON /FSOL/TRTH ,TBETA , TB , THDS ,THHDS , TCF1 , F , DGDH     OUTPUT.11
      COMMON /RPOLY/  C , D , E , J , DCDH , DDDH , DEDH , DJDH         OUTPUT.12
      COMMON /MATX/  A(3,3) , B(3) , IPR(3)                             OUTPUT.13
      COMMON /XXXX/  X , DSDX , XW , YW , XS , YS                       OUTPUT.14
      COMMON  / NTURB  / NTURB                                          OUTPUT.15
      REAL KDA,K,J                                                      OUTPUT.16
C                                                                       OUTPUT.17
C                                                                       OUTPUT.18
      I       = NTURB                                                   OUTPUT.19
      ALFS(I)  = ALP                                                    OUTPUT.20
      H(I)     = TH                                                     OUTPUT.21
      THT(I)   = THETA                                                  OUTPUT.22
      CF1(I)   = TCF1                                                   OUTPUT.23
      HHDS(I)  = THHDS                                                  OUTPUT.24
      RTH(I)    = TRTH                                                  OUTPUT.25
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      BETA(I)   = TBETA                                                    OUTPUT.26
      THET12(I) = P*J                                                     OUTPUT.27
      THET21(I)= P*E                                                      OUTPUT.28
      THET22(I)= P*C*TB                                                   OUTPUT.29
      CF(I)     = CF1(I)/COS(BETA(I))                                     OUTPUT.30
      CF2(I)    = CF1(I)*TAN(BETA(I))                                     OUTPUT.31
      DELT(I) = THT(I)*HHOS(I)                                            OUTPUT.32
      DEL(I)    = THT(I)*H(I)                                             OUTPUT.33
      DELST2(I)= P*D                                                      OUTPUT.34
      CD(I)     = 2.*THETA*(US  *COS(ALFS(I)-ALPZ)) **((TH+5.)/2.)        OUTPUT.35
      RETURN                                                              OUTPUT.36
      END                                                                 OUTPUT.37

      SUBROUTINE PRINTER                                                  PRINTER.2
      COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),       PRINTER.3
     1CF2(200),DEL(200),DELST2(200),DELTA(200),H(200),HHOS(200),H1(200),PRINTER.4
     2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),       PRINTER.5
     3S(200),U(200),DUDS(200),SUD(200),UUD(200),THET12(200),THET21(200),PRINTER.6
     4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)      PRINTER.7
      COMMON/TITLE/TITLE(8)                                               PRINTER.8
      COMMON/IPRINT/IPRINT,KSKIP                                          PRINTER.9
      COMMON/NSEP/NSEP                                                    PRINTER.10
      COMMON/RNB/RNB                                                      PRINTER.11
      COMMON/SANGLE/SANGLE                                                PRINTER.12
      COMMON/CL/CL,CDT,CDF,CDP,DUM(2),CM                                  PRINTER.13
      COMMON/NSIDE/NSIDE                                                  PRINTER.14
      COMMON  / NBL     / NBL                                             PRINTER.15
      COMMON/MTRAN/ MTRAN                                                 PRINTER.16
      COMMON  / INSTB   / INSTB,ITRAN                                     PRINTER.17
      COMMON/MSEP/MSEP                                                    PRINTER.18
      COMMON/I3D/I3D                                                      PRINTER.19
      COMMON/ITR/ITR,ITRMAX                                               PRINTER.20
      WRITE(6,7800)                                                       PRINTER.21
      WRITE(6,7900)(TITLE(I),I = 1,8)                                     PRINTER.22
      WRITE(6,6700)                                                       PRINTER.23
      WRITE(6,6800) RNB,SANGLE,ITR,NSIDE                                  PRINTER.24
      IF(ITR.GT.1.AND.ITR.LT.ITRMAX) GO TO 50                             PRINTER.25
      IF(I3D.EQ.1) GO TO 1                                                PRINTER.26
      GO TO 2                                                             PRINTER.27
1     CONTINUE                                                            PRINTER.28
      ITRAN = 1                                                           PRINTER.29
      GO TO 80                                                            PRINTER.30
2     CONTINUE                                                            PRINTER.31
      WRITE(6,6600)                                                       PRINTER.32
      WRITE(6,7600)                                                       PRINTER.33
      I = 1                                                               PRINTER.34
      IF(ITRAN.GE.190) NSEP=6                                             PRINTER.35
      GO TO 15                                                            PRINTER.36
10    I = I + KSKIP                                                       PRINTER.37
15    CONTINUE                                                            PRINTER.38
      WRITE(6,6400)I,X(I),S(I),U(I),DUDS(I),H(I),THT(I),                  PRINTER.39
     1  CFD(I)                                                            PRINTER.40
      IF(I.GT.200) I = 200                                                PRINTER.41
      IF(I.GE.197) GO TO 21                                               PRINTER.42
      IF(I.EQ.ITRAN) GO TO 25                                             PRINTER.43
      IF((I + KSKIP).GE.ITRAN) 20,10                                      PRINTER.44
20    I = ITRAN                                                           PRINTER.45
      GO TO 15                                                            PRINTER.46
21    NSEP = 6                                                            PRINTER.47
25    CONTINUE                                                            PRINTER.48
      GO TO(60,65,70,80,75,400),NSEP                                      PRINTER.49
60    WRITE(6,7100)                                                       PRINTER.50
      GO TO 80                                                            PRINTER.51
65    WRITE(6,7200)                                                       PRINTER.52
      GO TO 400                                                           PRINTER.53
70    WRITE(6,7300)                                                       PRINTER.54
      GO TO 80                                                            PRINTER.55
75    WRITE(6,7400)                                                       PRINTER.56
80    CONTINUE                                                            PRINTER.57
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      IF(MTRAN.EQ.2) GO TO 400                                          PRINTER.58
      WRITE(6,6900)                                                     PRINTER.59
      WRITE(6,7700)                                                     PRINTER.60
      I = ITRAN                                                         PRINTER.61
      GO TO 35                                                          PRINTER.62
   30 I = I + KSKIP                                                     PRINTER.63
   35 CONTINUE                                                          PRINTER.64
      BETA(I) = BETA(I)*57.29578049                                     PRINTER.65
      WRITE(6,6500) I,X(I),S(I),U(I),H(I),DELTA(I),THT(I),BETA(I),      PRINTER.66
     1   RTH(I),CFD(I)                                                  PRINTER.67
      IF(I.EQ.NBL) GO TO 50                                             PRINTER.68
      IF((I + KSKIP).GE.NBL) 40,30                                      PRINTER.69
   40 I = NBL                                                           PRINTER.70
      GO TO 35                                                          PRINTER.71
   50 CONTINUE                                                          PRINTER.72
      IF(MTRAN.GE.2) GO TO 400                                          PRINTER.73
      IF(MSEP.EQ.1) WRITE(6,7500)                                       PRINTER.74
      IF(IPRINT.EQ.0.OR.SANGLE.EQ.0.) GO TO 300                         PRINTER.75
      IF(ITR.GT.1.AND.ITR.LT.ITRMAX) GO TO 300                          PRINTER.76
      WRITE(6,7000)                                                     PRINTER.77
      WRITE(6,6100)                                                     PRINTER.78
      WRITE(6,6000)                                                     PRINTER.79
      WRITE(6,6200)                                                     PRINTER.80
      I    = ITRAN                                                      PRINTER.81
      GO TO 110                                                         PRINTER.82
  100 I    = I+KSKIP                                                    PRINTER.83
  110 CONTINUE                                                          PRINTER.84
  150 ALFS(I)  = ALFS(I)*57.29578049                                    PRINTER.85
      WRITE(6,6300) I,X(I),S(I),DUDS(I),ALFS(I),DELST2(I),              PRINTER.86
     1              THET12(I),THET21(I),THET22(I),CF1(I)                PRINTER.87
      IF(I .EQ. NBL) GO TO 300                                          PRINTER.88
      IF((I+KSKIP) .GE. NBL) 200,100                                    PRINTER.89
  200 I    = NBL                                                        PRINTER.90
      GO TO 150                                                         PRINTER.91
  300 CONTINUE                                                          PRINTER.92
      WRITE(6,8000) CL                                                  PRINTER.93
      WRITE(6,8100) CDF                                                 PRINTER.94
      WRITE(6,8200) CDP                                                 PRINTER.95
      WRITE(6,8300) CDT                                                 PRINTER.96
      WRITE(6,8400) CM                                                  PRINTER.97
  400 CONTINUE                                                          PRINTER.98
      RETURN                                                            PRINTER.99
 6000 FORMAT(1H ,3X,*I*6X *X* 9X *S* 9X *DU/DS* 6X *ALPHA*              PRINTER.100
     1           7X *DEL* 11X *THETA* 9X *THETA* 9X *THETA* 10X *CF*)   PRINTER.101
 6100 FORMAT(1H0,55X,1H*)                                               PRINTER.102
 6200 FORMAT(1H ,55X,*2*15X*12* 12X *21*12X *22* 10X *1* //)            PRINTER.103
 6300 FORMAT(3X,I3,2X,2(F6.4,4X),E10.3,3X,F6.2,4X                       PRINTER.104
     1       5(E10.3,4X))                                               PRINTER.105
 6400 FORMAT(I5,2F10.4,5(E12.4,5X))                                     PRINTER.106
 6500 FORMAT(I5,3X,2(F6.4,4X),F5.3,4X,6(E10.3,4X))                      PRINTER.107
 6600 FORMAT(1H0,50X,*LAMINAR BOUNDARY LAYER DEVELOPMENT*/)             PRINTER.108
 6700 FORMAT(1H0,35X,*RE* 9X *SWEEP ANGLE* 9X *ITERATION* 9X *SURFACE*) PRINTER.109
 6800 FORMAT(1H0,30X,E10.3,5X,E10.3,10X,I5,10X,I5)                      PRINTER.110
 6900 FORMAT(1H0,50X,*TURBULENT BOUNDARY LAYER DEVELOPMENT*/)           PRINTER.111
 7000 FORMAT(1H0,50X,*CROSS-FLOW PARAMETERS*)                           PRINTER.112
 7100 FORMAT(1H0,5X,*NATURAL TRANSITION*)                               PRINTER.113
 7200 FORMAT(1H0,5X,*LAMINAR SEPARATION NO REATTACHMENT*)               PRINTER.114
 7300 FORMAT(1H0,5X,*LAMINAR SEPARATION  REATTACHMENT AS TURBULENT       PRINTER.115
     1BOUNDARY LAYER*)                                                  PRINTER.116
 7400 FORMAT(1H0,5X,*BOUNDARY LAYER TRIP*)                              PRINTER.117
 7500 FORMAT(1H0,5X,*TURBULENT SEPARATION*)                             PRINTER.118
 7600 FORMAT(1H0,2X,*I* 7X *X* 8X *S* 8X *US* 14X *DU/DS* 14X           PRINTER.119
     1    *H* 14X *THETAS* 10X *CFS*/)                                  PRINTER.120
 7700 FORMAT(1H0,2X,*I* 6X *X* 8X *S* 8X *US* 9X *H* 13X *DELTAS* 8X    PRINTER.121
     1     *THETAS* 8X *BETA* 11X *RTHETAS* 9X *CFS*/)                  PRINTER.122
 7800 FORMAT(1H0,50X,*INCOMPRESSIBLE BOUNDARY LAYER CALCULATIONS*//)    PRINTER.123
 7900 FORMAT(1H0,50X,8A10)                                              PRINTER.124
 8000 FORMAT(1H ,5X,26H      LIFT COEFFICIENT   =,F10.6)                PRINTER.125
 8100 FORMAT(1H ,5X,26H    SKIN FRICTION DRAG   =,F10.6)                PRINTER.126
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 8200 FORMAT(1H ,5X,26H          PRESSURE DRAG    =,F10.6)                    PRINTER.127
 8300 FORMAT(1H ,5X,26HPROFILE DRAG COEFFICIENT =,F10.6)                      PRINTER.128
 8400 FORMAT(1H ,5X,26H       MOMENT COEFFICIENT =,F10.6)                     PRINTER.129
      END                                                                     PRINTER.130

      SUBROUTINE SCHORD(N,X,Y,S)                                              SCHORD.2
      DIMENSION X(1),Y(1),S(1)                                                SCHORD.3
C     COMPUTE ARC-LENGTH ALONG WALL                                           SCHORD.4
      S(1)=0.                                                                 SCHORD.5
      DO 200 I=2,N                                                            SCHORD.6
      DDX=X(I)-X(I-1)                                                         SCHORD.7
      DDY=Y(I)-Y(I-1)                                                         SCHORD.8
      DDS=SQRT (DDX**2+DDY**2)                                                SCHORD.9
  200 S(I)=S(I-1)+DDS                                                         SCHORD.10
      RETURN                                                                  SCHORD.11
      END                                                                     SCHORD.12

      SUBROUTINE SMOOTH(N,XX,YY,NOUT,X,S,Y)                                   SMOOTH.2
      DIMENSION XX(1),YY(1),X(1),Y(1),S(1)                                    SMOOTH.3
      FNM1=NOUT-1                                                             SMOOTH.4
      NM1     = NOUT-1                                                        SMOOTH.5
      DEL=XX(N)/FNM1                                                          SMOOTH.6
      X(1)=XX(1)                                                              SMOOTH.7
      X(NOUT)  = XX(N)                                                        SMOOTH.8
      DEL      =(XX(N)-XX(1))/FNM1                                            SMOOTH.9
      DO 200 I=2,NM1                                                          SMOOTH.10
  200 X(I)     = X(I-1)+DEL                                                   SMOOTH.11
      S(1)     = YY(1)                                                        SMOOTH.12
      S(NOUT) =YY(N)                                                          SMOOTH.13
C     PERFORM 2ND ORDER LAGRANGE INTERPOLATION.                               SMOOTH.14
      DO 300 I=2,NM1                                                          SMOOTH.15
      S(I)  = TBLU1(X(I),XX,YY,1,N)                                           SMOOTH.16
  300 CONTINUE                                                                SMOOTH.17
      RETURN                                                                  SMOOTH.18
      ENTRY SDERV                                                             SMOOTH.19
CALCULATE DERIVATIVES.                                                        SMOOTH.20
      DO 450 I=2,NM1                                                          SMOOTH.21
      Y(I)   =((S(I+1)-S(I))/(X(I+1)-X(I))+(S(I)-S(I-1))/(X(I)-X(I-1)         SMOOTH.22
     1          ))*.5                                                        SMOOTH.23
  450 CONTINUE                                                                SMOOTH.24
      Y(1)   = TBLU1(X(1),X(2),Y(2),1,NOUT-2)                                 SMOOTH.25
      Y(NOUT)  = TBLU1(X(NOUT),X,Y,1,NOUT-1)                                  SMOOTH.26
      RETURN                                                                  SMOOTH.27
      END                                                                     SMOOTH.28

     SUBROUTINE TRANSIT(TRIP)                                                 TRANSIT.2
     COMMON /SCRAT/ ALFS(200),BETA(200),CD(200),CFD(200),CF1(200),            TRANSIT.3
    1CF2(200),DEL(200),DELST2(200),DELT(200),H(200),HHDS(200),H1(200),        TRANSIT.4
    2PK(200),RDEL(200),RINSTB(200),RTRAN(200),PKBAR(200),RTH(200),            TRANSIT.5
    3S(200),U(200),DU(200),SUD(200),UUD(200),THET12(200),THET21(200),         TRANSIT.6
    4THET22(200),THT(200),X(200),Y(200),CPC(200),Z(200),DUMMY(2600)           TRANSIT.7
     COMMON  / NUS     / NUS                                                  TRANSIT.8
     COMMON  / NLAM    / NLAM                                                 TRANSIT.9
     COMMON  / INSTB   / INSTB,ITRAN                                          TRANSIT.10
     COMMON  / HTURB   / HTURB                                                TRANSIT.11
     COMMON  / ISEP    / ISEP,ITRIP,IATT,TE                                   TRANSIT.12
     COMMON/NSEP/NSEP                                                         TRANSIT.13
     INSTB=0                                                                  TRANSIT.14
     ISEP=0                                                                   TRANSIT.15
     ITRIP=0                                                                  TRANSIT.16
     IATT=0                                                                   TRANSIT.17
     ITRAN=0                                                                  TRANSIT.18
     TE=0.                                                                    TRANSIT.19
     CALL INSTAB(NLAM,S,PK,RTH,RDEL,TRIP,TE,ISEP,IATT,INSTB,ITRAN,            TRANSIT.20
    1RINSTB,PKINS,TRIPOP)                                                     TRANSIT.21
     IF(INSTB .EQ. NUS) 100,200                                               TRANSIT.22
 100 ITRAN = NUS                                                              TRANSIT.23
     NSEP= 6                                                                  TRANSIT.24
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      GO TO 600                                                          TRANSIT.25
  200 IF(TE) 600,300,600                                                 TRANSIT.26
  300 IF(IATT-ISEP) 400,500,500                                          TRANSIT.27
  400 NLAM=INSTB                                                         TRANSIT.28
      ITRAN=INSTB                                                        TRANSIT.29
      GO TO 600                                                          TRANSIT.30
  500 INP1=INSTB+1                                                       TRANSIT.31
      CALL TRCALC(NLAM,INP1,S,PK,RTH,TRIP,ITRIP,ISEP,IATT,               TRANSIT.32
     1            ITRAN,RTRAN,PKBAR,HTURB,TE)                            TRANSIT.33
  600 CONTINUE                                                           TRANSIT.34
      RETURN                                                             TRANSIT.35
      END                                                                TRANSIT.36

      SUBROUTINE TRCALC(N,INP1,S,PK,RT,TRIP,ITRIP,ISEP,IATT,IT,           TRCALC.2
     1                  RTN,PKB,HT,TE)                                    TRCALC.3
      DIMENSION S(1),PK(1),RT(1),RD(1),RTN(1),PKB(1)                      TRCALC.4
      COMMON /SCRAT/ SCRAT(5200),THT(200),X(200),Y(200),CPC(200)          TRCALC.5
      COMMON/NSEP/NSEP                                                    TRCALC.6
      COMMON  / ISTART / ISTART                                           TRCALC.7
      COMMON  / NUS    / NUS                                              TRCALC.8
      COMMON  / KSEP   / KSEP                                             TRCALC.9
      COMMON  / INVALK / INVALK                                           TRCALC.10
      COMMON  / DU2T   / DU2T                                             TRCALC.11
      COMMON/PHIL/IPHIL                                                   TRCALC.12
      COMMON/ITR/ITR999,ITRM99                                            TRCALC.13
      IPASS= 1                                                            TRCALC.14
      IF(IT.NE.0) 100,200                                                 TRCALC.15
  100 RTN(IT) = RT(IT)                                                    TRCALC.16
      NSEP = 5                                                            TRCALC.17
      IF(TRIP.GT.S(IT)) NSEP = 3                                          TRCALC.18
      GO TO 2200                                                          TRCALC.19
  200 TE=0.                                                               TRCALC.20
      SKDX=0.                                                             TRCALC.21
      IF(KSEP .LT. N) 300,400                                             TRCALC.22
  300 KFLAG = 1                                                           TRCALC.23
      GO TO 500                                                           TRCALC.24
  400 KFLAG = 2                                                           TRCALC.25
  500 DO 1600 I = INP1,N                                                  TRCALC.26
      IT=I                                                                TRCALC.27
C     TEST FOR SEPERATION                                                 TRCALC.28
 1100 GO TO (1200,1300),KFLAG                                             TRCALC.29
 1200 IF(KSEP .EQ. I) 1250,1300                                           TRCALC.30
 1250 CONTINUE                                                            TRCALC.31
      GO TO 1800                                                          TRCALC.32
 1300 IF(INVALK .EQ. I) 1400,1500                                         TRCALC.33
 1400 CONTINUE                                                            TRCALC.34
      IF(ITR999.LT.IPHIL)GO TO 1800                                       TRCALC.35
      WRITE(6,6000)                                                       TRCALC.36
 6000 FORMAT(1H1*LAMINAR SEPARATION*)                                     TRCALC.37
      GO TO 1800                                                          TRCALC.38
 1500 CONTINUE                                                            TRCALC.39
      DELS=S(I)-S(I-1)                                                    TRCALC.40
      PKSTAR=.5*(PK(I)+PK(I-1))                                           TRCALC.41
      SKDX=SKDX+PKSTAR*DELS                                               TRCALC.42
      PKB(I)=SKDX/(S(I)-S(INP1-1))                                        TRCALC.43
      RLOG = ALOG(RT(I))                                                  TRCALC.44
      IF(RT(I).LE.750.) GO TO 600                                         TRCALC.45
      IF(RT(I).LE.1100.) GO TO 700                                        TRCALC.46
      PKBC = 1.59381 - .45543*RLOG + .032534*RLOG**2                      TRCALC.47
      GO TO 800                                                           TRCALC.48
  600 PKBC = - .0925 + .00007*RT(I)                                       TRCALC.49
      GO TO 800                                                           TRCALC.50
  700 PKBC = - .12571 + .00011486*RT(I)                                   TRCALC.51
  800 CONTINUE                                                            TRCALC.52
      IF(PKBC.GE.PKB(I)) GO TO 2100                                       TRCALC.53
      IF(TRIP-S(I)) 1700,1700,1600                                        TRCALC.54
 1600 CONTINUE                                                            TRCALC.55
      TE=1.                                                               TRCALC.56
      GO TO 2600                                                          TRCALC.57
```

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1700 ITRIP=1                                                                    TRCALC.58
     NSEP = 5                                                                   TRCALC.59
     RTN(IT) = TBLU1(TRIP,S,RT,1,N)                                             TRCALC.60
     S(IT)=TRIP                                                                 TRCALC.61
     GO TO 2200                                                                 TRCALC.62
1800 ISEP=1                                                                     TRCALC.63
     IF(KSEP .EQ. I) GO TO 2000                                                 TRCALC.64
     IF(RT(IT) .LT. 125.) 2600,1950                                             TRCALC.65
1950 PKT = .0227-.0007575*RT(IT)-.000001157*RT(IT)*RT(IT)                       TRCALC.66
     IF(PKT .GE. PK(IT)) GO TO 2600                                             TRCALC.67
2000 IATT=2                                                                     TRCALC.68
     NSEP = 3                                                                   TRCALC.69
     GO TO 2200                                                                 TRCALC.70
2100 CONTINUE                                                                   TRCALC.71
     NSEP = 1                                                                   TRCALC.72
2200 CONTINUE                                                                   TRCALC.73
     HT    = 1.4754/ALOG10(RT (IT)) + .9698                                     TRCALC.74
     GO TO 2700                                                                 TRCALC.75
2600 CONTINUE                                                                   TRCALC.76
     NSEP = 2                                                                   TRCALC.77
2700 CONTINUE                                                                   TRCALC.78
     RETURN                                                                     TRCALC.79
     END                                                                        TRCALC.80

        SUBROUTINE TURB                                                          TURB.2
        COMMON/MSEP/MSEP                                                         TURB.3
        COMMON  / CL      / DUM(4),SEPTRB(2)                                     TURB.4
        COMMON  / CONTRL/ IEND                                                   TURB.5
        MSEP = 0                                                                 TURB.6
        SEPTRB(1) = 0.                                                           TURB.7
        CALL SETUP(IND)                                                          TURB.8
        CALL INFAT(SS,IND)                                                       TURB.9
        CALL OUTPUT                                                              TURB.10
        CALL ISTEP(STEP)                                                         TURB.11
     20 CONTINUE                                                                 TURB.12
        CALL INTBL(IND)                                                          TURB.13
        CALL OUTPUT                                                              TURB.14
        IF(IND .EQ. 0) 30,21                                                     TURB.15
     21 CONTINUE                                                                 TURB.16
        MSEP = 1                                                                 TURB.17
        SEPTRB(1) = 1.                                                           TURB.18
        GO TO 40                                                                 TURB.19
     30 IF (IEND .EQ. 0) GO TO 20                                                TURB.20
     40 RETURN                                                                   TURB.21
        END                                                                      TURB.22

        SUBROUTINE XSTEP(STEP)                                                   XSTEP.2
        COMMON  /USXX/ US , DUS , ALPZ , ALP , K , DAS , KDA                     XSTEP.3
        COMMON /FSOL/ RTH , BETA , TB , HDS , HHDS , CF1 , F , DGDH              XSTEP.4
        COMMON /XXXX/  X , DSDX , XW , YW , XS , YS                              XSTEP.5
        REAL KDA,K,J                                                             XSTEP.6
                                                                                 XSTEP.7
  C                                                                              XSTEP.8
        FXNEW = COS(ALP + BETA)                                                  XSTEP.9
        FYNEW = SIN(ALP + BETA)                                                  XSTEP.10
        XSNEW = COS(ALP)                                                         XSTEP.11
        YSNEW = SIN(ALP)                                                         XSTEP.12
        XW = XW + STEP*(FXOLD + FXNEW)                                           XSTEP.13
        YW = YW + STEP*(FYOLD + FYNEW)                                           XSTEP.14
        XS = XS + STEP*(XSOLD + XSNEW)                                           XSTEP.15
        YS = YS + STEP*(YSOLD + YSNEW)                                           XSTEP.16
        FXOLD = FXNEW                                                            XSTEP.17
        FYOLD = FYNEW                                                            XSTEP.18
        XSOLD = XSNEW                                                            XSTEP.19
        YSOLD = YSNEW                                                            XSTEP.20
        RETURN                                                                   XSTEP.21
        ENTRY ISTEP                                                              XSTEP.22
        XW = 0.0                                                                 XSTEP.23
        YW = 0.0                                                                 XSTEP.24
        XS = 0.0
```

```
      YS = 0.0                                                          XSTEP.25
      FXOLD = COS(ALP + BETA)                                           XSTEP.26
      FYOLD = SIN(ALP + BETA)                                           XSTEP.27
      XSOLD = COS(ALP)                                                  XSTEP.28
      YSOLD = SIN(ALP)                                                  XSTEP.29
      RETURN                                                            XSTEP.30
      END                                                               XSTEP.31
```

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                  OVERLAY(FRIS,3,0)                                     INSPAN.3
      PROGRAM INSPAN                                                    INSPAN.4
C     THREE DIMENSIONAL INFINITE SWEPT WING BOUNDARY LAYER PROGRAM      INSPAN.5
C     FINITE DIFFERENCE METHOD USING AN EDDY VISCOSITY METHOD TO        INSPAN.6
C     CLOSE THE NUMERICAL METHOD                                        INSPAN.7
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),INSPAN.8
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),INSPAN.9
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),     INSPAN.10
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  INSPAN.11
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),          INSPAN.12
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    INSPAN.13
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)INSPAN.14
     7,A4(100),XTEMP(50),STEMP(50),DUMMY(352)                           INSPAN.15
      COMMON /SEG/ NCMPT,NFLAP,NFP,NC(4),THETE(12),NPU(4),NPL(4),ISTG(4)INSPAN.16
     1,UCU(4),UCL(4),WCU(4),WCL(4),XTE(4),ZTE(4),DELZ(3),NG(3),NPG(4)   INSPAN.17
      COMMON/GEO/ CFI,FI,RTN,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,      INSPAN.18
     1 KYG,KX,JMX                                                       INSPAN.19
      COMMON/GRID/YCP(20),CP(20,30),YGAP                                INSPAN.20
      COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UINF                     INSPAN.21
      COMMON/DENSE/SUD(200),USD(200)                                    INSPAN.22
      COMMON/FSTART/ CFIN,HIN,THTIN,UTE                                 INSPAN.23
      COMMON /TITLE/ TITLE(8)                                           INSPAN.24
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                INSPAN.25
      COMMON /RNB/   RNB                                                INSPAN.26
      COMMON /NPT/ NPT                                                  INSPAN.27
      COMMON /SANGLE/ SANGLE                                            INSPAN.28
      COMMON/NXT/NXT                                                    INSPAN.29
      COMMON/ XSTART / XSTART                                           INSPAN.30
      COMMON/ITR/ITR,ITRMAX                                             INSPAN.31
      COMMON/UIN/UIN(100)                                               INSPAN.32
      COMMON/NGRID/NGRID                                                INSPAN.33
      COMMON/XTRIP/ KCODE,TRIP                                          INSPAN.34
      COMMON/XFND/ XFIND(20),NXFIND                                     INSPAN.35
      COMMON/GAP/ ZGAP(2),SXU(2)                                        INSPAN.36
      COMMON/KLAM/KLAM                                                  INSPAN.37
      COMMON/BEGIN/ HX,THETAX,DELTX,DUX,CFX,DSTARX,UGAP                 INSPAN.38
      COMMON/SLOT/HSS(100),TSS(100),DSS(100),CSS(100),USS(100),DTSS(100)INSPAN.39
      COMMON/CURVES/ R(30,2)                                            INSPAN.40
      COMMON/NST/NST,MC,NRU                                             INSPAN.41
      DATA FRIS/4HFRIS/
```

```
C  INPUT INITIAL DATA                                                    INSPAN.42
      NF = NFLAP-NFP+1                                                   INSPAN.43
      MC = NCMPT-NFLAP+NF                                                INSPAN.44
      NST = NPT - NPU(MC) + NPG(MC)                                      INSPAN.45
      NRU = NPU(MC)                                                      INSPAN.46
      NGRID = NG(NF)                                                     INSPAN.47
      SU(1) = 0.                                                         INSPAN.48
      DO 10 I=2,NPT                                                      INSPAN.49
      DDX = XIN(I) - XIN(I-1)                                            INSPAN.50
      DDZ = ZIN(I) - ZIN(I-1)                                            INSPAN.51
      DDS = SQRT(DDX**2 + DDZ**2)                                        INSPAN.52
      SU(I) = SU(I-1) + DDS                                              INSPAN.53
   10 CONTINUE                                                           INSPAN.54
      IF(ITR.GT.1) GO TO 16                                              INSPAN.55
      IF(NF.GT.1) GO TO 16                                               INSPAN.56
      IF(NXFIND.EQ.0) GO TO 16                                           INSPAN.57
      DO 17 I =1,NPT                                                     INSPAN.58
      IF(XIN(I+1).GE.XIN(I)) GO TO 18                                    INSPAN.59
   17 CONTINUE                                                           INSPAN.60
   18 CONTINUE                                                           INSPAN.61
      NXM = I                                                            INSPAN.62
      NPTM = NPT-NXM+1                                                   INSPAN.63
      DO 19 I = 1,NPTM                                                   INSPAN.64
      IM = I+NXM-1                                                       INSPAN.65
      XTEMP(I) = XIN(IM)                                                 INSPAN.66
      STEMP(I) = SU(IM)                                                  INSPAN.67
   19 CONTINUE                                                           INSPAN.68
      DO 15 I=1,NXFIND                                                   INSPAN.69
      XFIND(I) = TBLU1(XFIND(I),XTEMP,STEMP,1,NPTM)                      INSPAN.70
      XFIND(I) = XFIND(I)*REFC                                           INSPAN.71
   15 CONTINUE                                                           INSPAN.72
      WRITE(6,600) (XFIND(I),I=1,NXFIND)                                 INSPAN.73
   16 CONTINUE                                                           INSPAN.74
      XSTART = (SU(NST) + SXU(NF))*REFC                                  INSPAN.75
      YGAP = ZGAP(NF)                                                    INSPAN.76
      TRIP = TRIP*REFC                                                   INSPAN.77
      KLAM = 1                                                           INSPAN.78
      IF(XSTART.GT.TRIP) KLAM = 2                                        INSPAN.79
      SUD(1) = 0.                                                        INSPAN.80
      DELX = SU(NPT)/199.                                                INSPAN.81
      DO 20 I = 2,200                                                    INSPAN.82
      SUD(I) = SUD(I-1) + DELX                                           INSPAN.83
   20 CONTINUE                                                           INSPAN.84
      SS = XSTART/REFC                                                   INSPAN.85
      DELTX = 0.                                                         INSPAN.86
      HX     = TBLU1(SS,SUD,HSS,1,NXT)                                   INSPAN.87
      THETAX = TBLU1(SS,SUD,TSS,1,NXT)                                   INSPAN.88
      DUX    = TBLU1(SS,SUD,DSS,1,NXT)                                   INSPAN.89
      CFX    = TBLU1(SS,SUD,CSS,1,NXT)                                   INSPAN.90
      UGAP   = TBLU1(SS,SUD,USS,1,NXT)                                   INSPAN.91
      IF(KLAM.EQ.2) DELTX = TBLU1(SS,SUD,DTSS,1,NXT)                     INSPAN.92
      DSTARX = HX*THETAX                                                 INSPAN.93
      WRITE(6,601)                                                       INSPAN.94
      WRITE(6,600) XSTART,TRIP                                           INSPAN.95
  600 FORMAT(1H0,20X,F10.5,20X,F10.5)                                    INSPAN.96
  601 FORMAT(1H0,25X,*S-START* 20X *FLAP-TRANSITION*)                    INSPAN.97
      CALL OVERLAY(FRI5,3,1)                                             INSPAN.98
C  CALCULATE BOUNDARY LAYER DEVELOPMENT                                  INSPAN.99
      CALL OVERLAY(FRI5,3,2)                                             INSPAN.100
      RETURN                                                             INSPAN.101
      END                                                                INSPAN.102
```

```
                OVERLAY(FRIS,3,1)
      PROGRAM BOUNDRY                                                    BOUNDRY.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),BOUNDRY.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),BOUNDRY.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),      BOUNDRY.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),   BOUNDRY.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),           BOUNDRY.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),     BOUNDRY.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)BOUNDRY.10
     7,A4(100),DUMMY(452)                                                BOUNDRY.11
      COMMON/ GEO / CFI,HI,RTH,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,    BOUNDRY.12
     1 KYG,KX,JMX                                                        BOUNDRY.13
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                 BOUNDRY.14
      COMMON /NPT/ NPT                                                   BOUNDRY.15
      COMMON/IPRINT/IPRINT,KSKIP                                         BOUNDRY.16
      COMMON /SANGLE/ SANGLE                                             BOUNDRY.17
      COMMON /RNB/   RNB                                                 BOUNDRY.18
      KX = 0                                                             BOUNDRY.19
C INPUT DATA.                                                            BOUNDRY.20
      CALL DATIN(2)                                                      BOUNDRY.21
C PRINT-OUT INPUT DATA.                                                  BOUNDRY.22
      IF(IPRINT.GT.0) CALL DATOUT(1)                                     BOUNDRY.23
  100 CALL DATIN(1)                                                      BOUNDRY.24
      KX = KX+1                                                          BOUNDRY.25
CALCLATE INITIAL PROFILE.                                                BOUNDRY.26
      CALL VELIN                                                         BOUNDRY.27
C PRINTOUT STARTING PROFILE.                                             BOUNDRY.28
      IF(IPRINT.GT.0) CALL DATOUT(2)                                     BOUNDRY.29
      CALL PCALC                                                         BOUNDRY.30
      CALL WRITE                                                         BOUNDRY.31
      RETURN                                                             BOUNDRY.32
      END                                                                BOUNDRY.33
```

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      SUBROUTINE DATIN(L)                                                DATIN.2
                                                                         DATIN.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),DATIN.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),DATIN.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),      DATIN.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),   DATIN.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),           DATIN.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),     DATIN.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)DATIN.10
     7,A4(100),DUMMY(452)                                                DATIN.11
      COMMON/ GEO / CFI,HI,RTH,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,    DATIN.12
     1 KYG,KX,JMX                                                        DATIN.13
      COMMON/NPT/ NPT                                                    DATIN.14
      COMMON/UIN/UIN(100)                                                DATIN.15
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                 DATIN.16
      COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UINF                      DATIN.17
      COMMON/FSTART/ CFIN,HIN,THTIN,UTE                                  DATIN.18
      COMMON /RNB/   RNB                                                 DATIN.19
      DIMENSION IY(11),IYT(11),EY(11),EDD(50),EAMI(50)                   DATIN.20
      DATA (IY(I), I=1,11)/2,6,10,13,16,19,22,25,29,32,41/               DATIN.21
      DATA (IYT(I), I=1,11)/5,9,12,15,18,21,24,28,31,40,99/              DATIN.22
      DATA (EY(I), I=1,11)/.0003125,.000625,.00125,.0025,.005,.01,.02,   DATIN.23
     1.04,.08,.16,.32/                                                   DATIN.24
      DATA (EDD(I), I=1,50)/.0,.01,.02,.03,.04,.05,.06,.07,.075,.08,.085DATIN.25
     1                      ,.09,.095,.1, .105,.11,.115,.12,.125,.13,   DATIN.26
     2                      .135,.14,.145,.15,.155,.16,.165,.17,.175,.18DATIN.27
     3                      ,.185,.19,.195,.2,.25,.3,.35,.4,.45,.5,.55, DATIN.28
     4                      .6,.65,.7,.75,.8,.85,.9,.95,1.0/            DATIN.29
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      DATA (EAMI(I),I=1,50)/9*1.,.998,.9965,.995,.9935,.992,.99,.988,    DATIN.30
     1                      .986,.9835,.981,.978,.975,.972,.9695,.965,   DATIN.31
     2                      .9615,.958,.954,.95,.946,.942,.9375,.933,    DATIN.32
     3                      .928,.923,.869,.806,.736,.659,.58,.5,.42,    DATIN.33
     4                      .341,.263,.19,.127,.077,.044,.02,.006,.0/    DATIN.34
C  STANDARD ARRAY                                                        DATIN.35
      KYG = 50                                                           DATIN.36
      DO 1 I=1,11                                                        DATIN.37
      JY(I) = IY(I)                                                      DATIN.38
      JYT(I) = IYT(I)                                                    DATIN.39
      DY(I) = EY(I)                                                      DATIN.40
    1 CONTINUE                                                           DATIN.41
      DO 2 I=1,50                                                        DATIN.42
      YDD(I) = EDD(I)                                                    DATIN.43
      GAMI(I) = EAMI(I)                                                  DATIN.44
    2 CONTINUE                                                           DATIN.45
      GO TO (50,99), L                                                   DATIN.46
   50 CONTINUE                                                           DATIN.47
      UN = RN8*UTE/REFC                                                  DATIN.48
      CFI = CFIN                                                         DATIN.49
      HI = HIN                                                           DATIN.50
      THETAI = THTIN/REFC                                                DATIN.51
      DO 10 I=1,NPT                                                      DATIN.52
      UIN(I) = SQRT(1.- CPIN(I))                                         DATIN.53
   10 CONTINUE                                                           DATIN.54
      RTH = THTIN*RN8*UTE                                                DATIN.55
      RETURN                                                             DATIN.56
   99 CONTINUE                                                           DATIN.57
      KL = 11                                                            DATIN.58
CALCULATE STANDARD Y ARRAY.                                              DATIN.59
      Y(1)=0.                                                            DATIN.60
      DO 200 K=1,KL                                                      DATIN.61
      KS=JY(K)                                                           DATIN.62
      KF=JYT(K)                                                          DATIN.63
      DO 200 KQ=KS,KF                                                    DATIN.64
  200 Y(KQ) = Y(KQ-1)+DY(K)                                              DATIN.65
      RETURN                                                             DATIN.66
      END                                                                DATIN.67


      SUBROUTINE DATOUT(L)                                               DATOUT.2
                                                                         DATOUT.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),DATOUT.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),DATOUT.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),      DATOUT.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),   DATOUT.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),           DATOUT.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),     DATOUT.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)DATOUT.10
     7,A4(100),DUMMY(452)                                                DATOUT.11
      COMMON/ GEO / CFI,HI,RTH,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,    DATOUT.12
     1 KYG,KX,JMX                                                        DATOUT.13
      COMMON/PHIL/IPHIL                                                  DATOUT.14
      COMMON/ITR/ITR999,ITRM99                                           DATOUT.15
      GO TO (100,200),L                                                  DATOUT.16
  100 CONTINUE                                                           DATOUT.17
      IF(ITR999.LT.IPHIL)GO TO 500                                       DATOUT.18
      WRITE(6,1)                                                         DATOUT.19
      WRITE(6,3) (J,JY(J),JYT(J),DY(J), J=1,KL)                          DATOUT.20
      WRITE(6,4) (Y(J), J=1,KF)                                          DATOUT.21
  500 CONTINUE                                                           DATOUT.22
      DO 170 I=1,KYG,10                                                  DATOUT.23
      KA=I                                                               DATOUT.24
      IF(KA+9-KYG)155,155,157                                            DATOUT.25
  155 KB=I+9                                                             DATOUT.26
      GO TO 160                                                          DATOUT.27
  157 KB=KYG                                                             DATOUT.28
C PRINT TABLE OF GAM VS. YDD.                                            DATOUT.29
  160 CONTINUE                                                           DATOUT.30
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      IF(KB-KYG)170,180,180                                              DATOUT.31
  170 CONTINUE                                                           DATOUT.32
  180 CONTINUE                                                           DATOUT.33
      RETURN                                                             DATOUT.34
  200 CONTINUE                                                           DATOUT.35
      IF(ITR999.LT.IPHIL)GO TO 510                                       DATOUT.36
      WRITE(6,7) ITER                                                    DATOUT.37
      WRITE(6,11)                                                        DATOUT.38
  510 CONTINUE                                                           DATOUT.39
      IF(KF-KYG  ) 381,382,383                                           DATOUT.40
  381 LZ2=1                                                              DATOUT.41
      LZ1=KF                                                             DATOUT.42
      LZ3=KYG                                                            DATOUT.43
      GO TO 384                                                          DATOUT.44
  382 LZ2=3                                                              DATOUT.45
      LZ1=KF+2                                                           DATOUT.46
      LZ3=KF                                                             DATOUT.47
      GO TO 384                                                          DATOUT.48
  383 LZ2=2                                                              DATOUT.49
      LZ1=KYG                                                            DATOUT.50
      LZ3=KF                                                             DATOUT.51
  384 CONTINUE                                                           DATOUT.52
      LZ3 = JMX+2                                                        DATOUT.53
      DO 395 J=1,LZ3                                                     DATOUT.54
      IF(J-LZ1) 391,391,394                                              DATOUT.55
  391 CONTINUE                                                           DATOUT.56
      KX = 3                                                             DATOUT.57
      IF(ITR999.LT.IPHIL)GO TO 395                                       DATOUT.58
      WRITE(6,41) YDD(J), GAMI(J), Y(J),YD(J),GAMF(J),U(J,KX)            DATOUT.59
      GO TO 395                                                          DATOUT.60
  394 CONTINUE                                                           DATOUT.61
      GO TO (390,392,384), LZ2                                           DATOUT.62
  390 CONTINUE                                                           DATOUT.63
      IF(ITR999.LT.IPHIL)GO TO 395                                       DATOUT.64
      WRITE(6,41) YDD(J), GAMI(J)                                        DATOUT.65
      GO TO 395                                                          DATOUT.66
  392 CONTINUE                                                           DATOUT.67
      KX = 3                                                             DATOUT.68
      IF(ITR999.LT.IPHIL)GO TO 395                                       DATOUT.69
      WRITE(6,42) Y(J),YD(J),GAMF(J),U(J,KX)                             DATOUT.70
                                                                         DATOUT.71
  395 CONTINUE                                                           DATOUT.72
      RETURN                                                             DATOUT.73
    1 FORMAT(1H1,20X,*INSPAN OUTPUT FOR FLAP UPPER SURFACE*//1H0,30X,    DATOUT.74
     1  *INPUT Y  GRID*)                                                 DATOUT.75
    3 FORMAT(1H0,4X,1HJ,3X,2HJY,2X,3HJYD,6X,2HDY/(1H ,3I5,F10.6))        DATOUT.76
    4 FORMAT(1H0, 30X, 17HSTANDARD Y ARRAY./ (1H ,10F10.5)/)             DATOUT.77
    7 FORMAT(1H ,12X,6HINPUTS,15X,24HSTARTING U PROFILE AFTER,I3,12H ITEDATOUT.78
     1RATIONS.)                                                          DATOUT.79
   11 FORMAT(1H ,6X,4HY/DS,8X,4HGAMI,12X,1HY,11X,4HY/DS,7X,4HGAMF,7X,5HUDATOUT.80
     1/UFS)                                                            DATOUT.81
   41 FORMAT(1H ,2F12.4,4X,4F12.4)                                     DATOUT.82
   42 FORMAT(1H ,28X,4F12.4)                                           DATOUT.83
      END
```

```
      SUBROUTINE PCALC                                                   PCALC.2
C  SURFACE PRESSURE GRADIENTS AND EFFECTIVE SWEEP ANGLE                  PCALC.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),PCALC.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),PCALC.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),     PCALC.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  PCALC.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),          PCALC.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    PCALC.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)PCALC.10
     7,A4(100),DUMMY(452)                                               PCALC.11
      COMMON/UIN/ UIN(100)                                              PCALC.12
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                PCALC.13
      COMMON /NPT/ NPT                                                  PCALC.14
      COMMON /SANGLE/ SANGLE                                            PCALC.15
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      COMMON/ XSTART / XSTART                                                  PCALC.16
      SINAZ = SIN(SANGLE*0.01745329252)                                        PCALC.17
      DO 10 I = 1,NPT                                                          PCALC.18
      ALFS(I) = ATAN(SINAZ/UIN(I))                                             PCALC.19
   10 CONTINUE                                                                 PCALC.20
 6000 FORMAT(I5,5X,E12.4)                                                      PCALC.21
      CALL DCPDX(UIN,SU,DU,NPT)                                                PCALC.22
      RETURN                                                                   PCALC.23
      END                                                                      PCALC.24

      SUBROUTINE SEARCH(J,KR)                                                  SEARCH.2
                                                                               SEARCH.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),       SEARCH.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),       SEARCH.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),            SEARCH.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),         SEARCH.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),                 SEARCH.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),           SEARCH.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)       SEARCH.10
                                                                               SEARCH.11
     7,A4(100),DUMMY(452)                                                      SEARCH.12
      COMMON/ GEO / CFI,HI,RTH,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,          SEARCH.13
     1 KYG,KX,JMX                                                              SEARCH.14
   90 CONTINUE                                                                 SEARCH.15
      DY1 = YD(J)-YDD(KR)                                                      SEARCH.16
      IF(ABS(DY1)-1.E-8) 200,200,100                                           SEARCH.17
  100 IF(DY1) 300,200,150                                                      SEARCH.18
  150 KR=KR+1                                                                  SEARCH.19
      IF(KR-KYG) 90,90,900                                                     SEARCH.20
  200 GAMF(J)=GAMI(KR)                                                         SEARCH.21
      RETURN                                                                   SEARCH.22
  300 DY3= YDD(KR)-YDD(KR-1)                                                   SEARCH.23
      DY2=YD(J)-YDD(KR-1)                                                      SEARCH.24
      DG = GAMI(KR)-GAMI(KR-1)                                                 SEARCH.25
       GAMF(J) = GAMI(KR-1) + (DG*DY2)/(DY3)                                   SEARCH.26
      RETURN                                                                   SEARCH.27
  900 GAMF(J) = GAMI(KR)                                                       SEARCH.28
      RETURN                                                                   SEARCH.29
      END

      SUBROUTINE VELCAL                                                        VELCAL.2
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),       VELCAL.3
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),       VELCAL.4
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),            VELCAL.5
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),         VELCAL.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),                 VELCAL.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),           VELCAL.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)       VELCAL.9
                                                                               VELCAL.10
     7,A4(100),DUMMY(452)                                                      VELCAL.11
      COMMON/ GEO / CFI,HI,RTH,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,          VELCAL.12
     1 KYG,KX,JMX                                                              VELCAL.13
      L=1                                                                      VELCAL.14
      UTAU = SQRT(CFI/2.)                                                      VELCAL.15
C ROUTINE TO CALCULATE STARTING PROFILE.                                       VELCAL.16
      Q    =    (2.8034 -.8468*ALOG(HI) + .979*ALOG(RTH))                     VELCAL.17
      RD = EXP(Q)                                                              VELCAL.18
      DELS = RD/UN                                                             VELCAL.19
      DO 200 J=1,KF                                                            VELCAL.20
      YPL(J) = UTAU*Y(J)*UN                                                    VELCAL.21
  200 CONTINUE                                                                 VELCAL.22
C BEGIN ITERATION LOOP.                                                        VELCAL.23
      ITER = 0                                                                 VELCAL.24
  210 CONTINUE                                                                 VELCAL.25
  300 ITER = ITER+1                                                            VELCAL.26
      DELS = RD/UN                                                             VELCAL.27
      KR=2                                                                     VELCAL.28
      DO 400 J=1,KF                                                            VELCAL.29
CALCULATE THE STARTING PROFILE                                                 VELCAL.30
      IF(YPL(J)-4.)330,340,310                                                 VELCAL.31
  310 IF(YPL(J)-30.) 340,340,350
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C LOWER REGION.                                                          VELCAL.32
  330 UT(J) = UTAU*YPL(J)                                                VELCAL.33
      GO TO 360                                                          VELCAL.34
C MIDDLE REGION.                                                         VELCAL.35
  340 D = ALOG(YPL(J))                                                   VELCAL.36
      UT(J) = UTAU*(2.3977-2.7048*D      + 3.5181*D**2 - .5289*D**3)     VELCAL.37
      GO TO 360                                                          VELCAL.38
C OUTER REGION.                                                          VELCAL.39
  350 UT(J) = UTAU*(5.4 + 2.389*ALOG(YPL(J)-5.03))                       VELCAL.40
  360 CONTINUE                                                           VELCAL.41
      YD(J) = Y(J)/DELS                                                  VELCAL.42
      IF(YD(J)-1.) 370,380,380                                           VELCAL.43
CALL ROUTINE FOR GAMMA SEARCH.                                           VELCAL.44
  370 CALL SEARCH(J,KR)                                                  VELCAL.45
      GO TO 390                                                          VELCAL.46
  380 GAMF(J) = 0.                                                       VELCAL.47
      IF(L.EQ.2) GO TO 10                                                VELCAL.48
      JMX = J                                                            VELCAL.49
      L=2                                                                VELCAL.50
   10 CONTINUE                                                           VELCAL.51
  390 UP(J)=UT(J)*GAMF(J) + 1.-GAMF(J)                                   VELCAL.52
  400 CONTINUE                                                           VELCAL.53
CALCULATE THE BNDRY. LAYER THICKNESS AND MOMENTUM THICKNESS.             VELCAL.54
      DELS = 0.                                                          VELCAL.55
      THETAI = 0.                                                        VELCAL.56
      DO 500 J=2,KF                                                      VELCAL.57
      DDY = Y(J)-Y(J-1)                                                  VELCAL.58
      DUD = UP(J) + UP(J-1)                                              VELCAL.59
      DUS = UP(J)**2 + UP(J-1)**2                                        VELCAL.60
      DELS = DELS +(1.-.5*DUD)*DDY                                       VELCAL.61
      THETAI= THETAI+.5*(DUD-DUS)*DDY                                    VELCAL.62
  500 CONTINUE                                                           VELCAL.63
      Z = THETAI*UN                                                      VELCAL.64
      C =(RTH-Z)/RTH                                                     VELCAL.65
      CV= ABS(C)                                                         VELCAL.66
      IF(CV-.001)700,700,600                                             VELCAL.67
  600 RD = (1.+C)*RD                                                     VELCAL.68
      IF(ITER-25) 210,700,700                                            VELCAL.69
  700 HI= DELS/THETAI                                                    VELCAL.70
      RETURN                                                             VELCAL.71
      END                                                                VELCAL.72
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      SUBROUTINE VELIN                                                   VELIN.2
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),VELIN.3
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),VELIN.4
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),      VELIN.5
     3 UP(100),W(100,3),D(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),   VELIN.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),           VELIN.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),     VELIN.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)VELIN.9
     7,A4(100),DUMMY(452)                                                VELIN.10
      COMMON/GRID/YCP(20),CP(20,30),YGAP                                 VELIN.11
      COMMON/ GEO / CFI,HI,RTH,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,    VELIN.12
     1 KYG,KX,JMX                                                        VELIN.13
      COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UIN                       VELIN.14
      COMMON/FSTART/CFIN,HIN,THTIN,UTE                                   VELIN.15
      COMMON/SEG/ NCMPT,NFLAP,NFP,NC(66)                                 VELIN.16
      COMMON/SANGLE/SANGLE                                               VELIN.17
      COMMON/PHIL/IPHIL                                                  VELIN.18
      COMMON/ITR/ITR999,ITRM99                                           VELIN.19
      COMMON/KLAM/KLAM                                                   VELIN.20
      COMMON/RNB/RNB                                                     VELIN.21
      COMMON/BEGIN/ HX,THETAX,DELTX,DUX,CFX,DSTARX,UGAP                  VELIN.22
      DIMENSION XC(4,4),B(4),CC(4)                                       VELIN.23
      KSWAT = 1                                                          VELIN.24
      SINAZ = SIN(SANGLE*0.017453292)                                    VELIN.25
      WE = SINAZ                                                         VELIN.26
      YY(1)=0.                                                           VELIN.27
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      US(1) = 0.                                                        VELIN.28
      I = 3                                                             VELIN.29
      UUR(1) = 0.                                                       VELIN.30
      UR(1) = 0.                                                        VELIN.31
      U(1,I) = 0.                                                       VELIN.32
      UEDGE(1) = 0.                                                     VELIN.33
      GAP = 2.                                                          VELIN.34
      KGAP = INT(GAP)                                                   VELIN.35
      GO TO (10,20,20),KGAP                                             VELIN.36
   10 CONTINUE                                                          VELIN.37
      KKK = 2                                                           VELIN.38
      YGAP = 0.                                                         VELIN.39
      GO TO 40                                                          VELIN.40
   20 CONTINUE                                                          VELIN.41
      YGAP = YGAP*REFC                                                  VELIN.42
C  ****************                                                     VELIN.43
      UPOT = 1.                                                         VELIN.44
C                                                                       VELIN.45
C  ************************                                           VELIN.46
      DGAP = .333*YGAP                                                  VELIN.47
      DTGAP = .667*YGAP                                                 VELIN.48
      GO TO(1,2) KLAM                                                   VELIN.49
    1 CONTINUE                                                          VELIN.50
      ITE = 0                                                           VELIN.51
      DZ = 6.5*DSTARX                                                   VELIN.52
      A = -RNB*DUX/12.                                                  VELIN.53
    7 ITE = ITE + 1                                                     VELIN.54
      DELTX = 10.*DSTARX/(A*DZ**2 + 3.)                                 VELIN.55
      ERR = (DELTX-DZ)/DELTX                                            VELIN.56
      ERRA = ABS(ERR)                                                   VELIN.57
      IF(ERRA.LE.0.001) GO TO 8                                         VELIN.58
      DNEW = ABS(DELTX-DZ)                                              VELIN.59
      IF(ITE.LT.2) GO TO 11                                             VELIN.60
      IF(ITE.GE.3) GO TO 14                                             VELIN.61
      IF(DNEW.LE.DOLD) KCON = 1                                         VELIN.62
      IF(DNEW.GT.DOLD) KCON = 2                                         VELIN.63
   14 GO TO(11,12),KCON                                                 VELIN.64
   11 CONTINUE                                                          VELIN.65
      DZ = (1.+ERR)*DZ                                                  VELIN.66
      GO TO 13                                                          VELIN.67
   12 CONTINUE                                                          VELIN.68
      DZ = (1.-ERR)*DZ                                                  VELIN.69
   13 CONTINUE                                                          VELIN.70
      DOLD = DNEW                                                       VELIN.71
      IF(ITE.LT.25) GO TO 7                                             VELIN.72
    8 CONTINUE                                                          VELIN.73
      DLAMDA = RNB*DUX*DELTX**2                                         VELIN.74
    2 CONTINUE                                                          VELIN.75
      DLGAP = DELTX*REFC                                                VELIN.76
      WRITE(6,605) DELTX                                                VELIN.77
  605 FORMAT(1H0,25X,*BOUNDARY LAYER THICKNESS ON FLAP AT S-START =*,    VELIN.78
     1F10.5)                                                            VELIN.79
      GO TO(5,6) KLAM                                                   VELIN.80
    6 CONTINUE                                                          VELIN.81
      UN = RNB*UGAP/REFC                                                VELIN.82
      CFI = CFX                                                         VELIN.83
      HI = HX                                                           VELIN.84
      RTN = THETAX*RNB*UGAP                                             VELIN.85
      CALL VELCAL                                                       VELIN.86
    5 CONTINUE                                                          VELIN.87
      DO 30 J = 2,100                                                   VELIN.88
      IF(Y(J).GT.YGAP) GO TO 35                                         VELIN.89
      IF(Y(J).GT.DTGAP) GO TO 32                                        VELIN.90
      IF(Y(J).GT.DLGAP) GO TO 31                                        VELIN.91
      ETA = Y(J)/DLGAP                                                  VELIN.92
      GO TO(3,4) KLAM                                                   VELIN.93
    3 CONTINUE                                                          VELIN.94
C  CALCULATE LAMINAR PROFILE                                            VELIN.95
      UUR(J) = 1.-(1.+ETA)*(1.-ETA)**3 + DLAMDA*ETA*(1.-ETA)**3/6.      VELIN.96
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      YY(J) = Y(J)                                                      VELIN.97
      GO TO 30                                                          VELIN.98
    4 CONTINUE                                                          VELIN.99
      UUR(J) = UP(J)                                                    VELIN.100
      IF(UUR(J).GT.1.) UUR(J) = 1.                                      VELIN.101
      YY(J) = Y(J)                                                      VELIN.102
      GO TO 30                                                          VELIN.103
   31 CONTINUE                                                          VELIN.104
      UUR(J) = UPOT                                                     VELIN.105
      YY(J) = Y(J)                                                      VELIN.106
      GO TO 30                                                          VELIN.107
   32 CONTINUE                                                          VELIN.108
      ETA = (YGAP-Y(J))/DGAP                                            VELIN.109
      UUR(J) = ETA**.14286                                              VELIN.110
      YY(J) = Y(J)                                                      VELIN.111
   30 CONTINUE                                                          VELIN.112
   35 CONTINUE                                                          VELIN.113
      KKK = J                                                           VELIN.114
      KGAP = KGAP - 1                                                   VELIN.115
   40 CONTINUE                                                          VELIN.116
      NF = NFLAP-NFP+1                                                  VELIN.117
      IF(NF.EQ.1) GO TO 41                                              VELIN.118
      REWIND 12                                                         VELIN.119
      READ(12) JMX,(UP(J),Y(J),J=1,JMX)                                 VELIN.120
      REWIND 12                                                         VELIN.121
      IF(ITR999.LT.IPHIL)GO TO 42                                       VELIN.122
      WRITE(6,6000) (UP(J),J=1,JMX)                                     VELIN.123
      GO TO 42                                                          VELIN.124
   41 CONTINUE                                                          VELIN.125
      UN = RNB*UTE/REFC                                                 VELIN.126
      CFI = CFIN                                                        VELIN.127
      HI = HIN                                                          VELIN.128
      RTN = THTIN*RNB*UTE                                               VELIN.129
      CALL VELCAL                                                       VELIN.130
   42 CONTINUE                                                          VELIN.131
      YMAX = YGAP + Y(JMX+1)                                            VELIN.132
      DO 900 J = KKK,100                                                VELIN.133
      YY(J) = Y(J-KKK+2) + YGAP                                         VELIN.134
      UUR(J) = UP(J-KKK+2)                                              VELIN.135
      IF(YY(J).GE.YMAX) GO TO 135                                       VELIN.136
      KF=J                                                              VELIN.137
  900 CONTINUE                                                          VELIN.138
  135 CONTINUE                                                          VELIN.139
      N = JYT(KL)                                                       VELIN.140
  136 CONTINUE                                                          VELIN.141
      YQ = Y(N)-YY(KF)                                                  VELIN.142
      IF(YQ) 139,139,137                                                VELIN.143
  137 N=N-1                                                             VELIN.144
      GO TO 136                                                         VELIN.145
  139 CONTINUE                                                          VELIN.146
       JMX = N+ 1                                                       VELIN.147
C FIX OUTER VALUES.                                                     VELIN.148
      III = N+1                                                         VELIN.149
      II2 = JYT(KL)                                                     VELIN.150
      DO 141 JJ=III,II2                                                 VELIN.151
      UR(JJ) = UUR(KF)                                                  VELIN.152
      KYM = JJ                                                          VELIN.153
  141 CONTINUE                                                          VELIN.154
      YY(KF+1) = Y(N+1)                                                 VELIN.155
      YY(KF+2) = Y(N+2)                                                 VELIN.156
      YY(KF+3) = Y(N+3)                                                 VELIN.157
      KST = 1                                                           VELIN.158
      JP = KST-1                                                        VELIN.159
      KE = JYT(KL)                                                      VELIN.160
      KKK = N                                                           VELIN.161
      JP = JP+1                                                         VELIN.162
      DO 300 J=2,KKK                                                    VELIN.163
  200 CONTINUE                                                          VELIN.164
      YS = YY(JP)                                                       VELIN.165
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C SEARCH THE ARRAY.                                                     VELIN.166
      YQ2 = YS-Y(J)                                                     VELIN.167
      IF(ABS(YQ2)-1.E-9)  909,201,909                                   VELIN.168
  909 IF(YQ2) 209,201,204                                               VELIN.169
  209 CONTINUE                                                          VELIN.170
      JP = JP+1                                                         VELIN.171
      GO TO 200                                                         VELIN.172
  201 CONTINUE                                                          VELIN.173
C EXACT SPOT.                                                           VELIN.174
      UR(J) = UUR(JP)                                                   VELIN.175
      GO TO 220                                                         VELIN.176
  204 CONTINUE                                                          VELIN.177
      DO 210 N=1,4                                                      VELIN.178
      KK2 = N+JP-3                                                      VELIN.179
      IF(KK2.LT.2)  KK2=2                                               VELIN.180
      B(N) = UUR(KK2)                                                   VELIN.181
      XC(N,1) = 1.0                                                     VELIN.182
      XC(N,2) = YY(KK2)                                                 VELIN.183
      XC(N,3) = XC(N,2)**2                                              VELIN.184
      XC(N,4) = XC(N,2)**3                                              VELIN.185
  210 CONTINUE                                                          VELIN.186
      CALL SMLN(XC,CC,B,4)                                              VELIN.187
      JJ=J                                                              VELIN.188
  219 CONTINUE                                                          VELIN.189
      UR(J) = CC(1)+CC(2)*Y(JJ)+CC(3)*(Y(JJ)**2)+CC(4)*(Y(JJ)**3 )      VELIN.190
  220 CONTINUE                                                          VELIN.191
      KY4 = J-1                                                         VELIN.192
  300 CONTINUE                                                          VELIN.193
      KY4 = JYT(KL) -1                                                  VELIN.194
      US(1) =0.                                                         VELIN.195
C PERFORM THE SMOOTHING.                                                VELIN.196
      US(2) = UR(2)                                                     VELIN.197
      U(2,I) = US(2)                                                    VELIN.198
      IF(KSWAT.LE.1) GO TO 500                                          VELIN.199
      DO 320 LT=1,2                                                     VELIN.200
      DO 330 J=3,KY4                                                    VELIN.201
      IF(LT.EQ.2) GO TO 315                                             VELIN.202
      US(J) = (UR(J-1) + UR(J) + UR(J+1))/3.                            VELIN.203
      GO TO 330                                                         VELIN.204
  315 CONTINUE                                                          VELIN.205
      U(J,I) = (US(J-1) + US(J) + US(J+1))/3.                           VELIN.206
  330 CONTINUE                                                          VELIN.207
      US(KY4+1) = US(KY4)                                               VELIN.208
  320 CONTINUE                                                          VELIN.209
      GO TO 600                                                         VELIN.210
  500 CONTINUE                                                          VELIN.211
      DO 510 J =3,KY4                                                   VELIN.212
      U(J,I) = UR(J)                                                    VELIN.213
  510 CONTINUE                                                          VELIN.214
  600 CONTINUE                                                          VELIN.215
      U(KY4+1,I) = U(KY4,I)                                             VELIN.216
      DO 400 J=1,20                                                     VELIN.217
      YCP(J) = REFC*YCP(J)                                              VELIN.218
      UUC(J) = SQRT(1.-CP(J,1))                                         VELIN.219
  400 CONTINUE                                                          VELIN.220
      UY1 = TBLU1(DLGAP,YCP,UUC,1,20)                                   VELIN.221
      UY1 = SQRT(UY1**2 + WE**2)                                        VELIN.222
      UY2 = TBLU1(DTGAP,YCP,UUC,1,20)                                   VELIN.223
      UY2 = SQRT(UY2**2 + WE**2)                                        VELIN.224
      DO 410 J=2,JMX                                                    VELIN.225
      UEDGE(J) = TBLU1(Y(J),YCP,UUC,1,20)                               VELIN.226
  410 CONTINUE                                                          VELIN.227
      DO 450 J=2,JMX                                                    VELIN.228
      IF(Y(J).GT.YGAP) GO TO 440                                        VELIN.229
      IF(Y(J).GT.DTGAP) GO TO 430                                       VELIN.230
      IF(Y(J).GT.DLGAP) GO TO 420                                       VELIN.231
      URE = SQRT(UEDGE(JMX)**2 + WE**2)                                 VELIN.232
      U(J,I) = U(J,I)*UY1/URE                                           VELIN.233
      GO TO 450                                                         VELIN.234
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```
 420 CONTINUE                                                          VELIN.235
     URATIO = SQRT(UEDGE(J)**2 + WE**2)/URE                            VELIN.236
     U(J,I) = U(J,I)*URATIO                                            VELIN.237
     GO TO 450                                                         VELIN.238
 430 CONTINUE                                                          VELIN.239
     U(J,I) = U(J,I)*UY2/URE                                           VELIN.240
     GO TO 450                                                         VELIN.241
 440 CONTINUE                                                          VELIN.242
     U(J,I) = U(J,I)                                                   VELIN.243
 450 CONTINUE                                                          VELIN.244
     IF(ITR999.LT.IPHIL)GO TO 6001                                     VELIN.245
     WRITE(6,6002)                                                     VELIN.246
6002 FORMAT(1H0,40X,*INITIAL STREAMWISE VELOCITY PROFILE AT SLOT*)     VELIN.247
     WRITE(6,6000) (U(J,3),J=1,JMX)                                    VELIN.248
6000 FORMAT(1H ,10F10.5)                                               VELIN.249
6001 KF = KE                                                           VELIN.250
     RETURN                                                            VELIN.251
     END                                                               VELIN.252
```

```
      SUBROUTINE WRITE                                                 WRITE.2
      COMMON/ SCRAT / ALFS(200),DBETA(200),Y(100),JY(25),JYT(25),DY(25),WRITE.3
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),WRITE.4
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),    WRITE.5
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),WRITE.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),         WRITE.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),   WRITE.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)WRITE.9
     7,A4(100),DUMMY(452)                                              WRITE.10
      COMMON/ GEO / CFI,HI,RTN,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,  WRITE.11
     1 KYG,KX,JMX                                                      WRITE.12
      COMMON /SANGLE/ SANGLE                                           WRITE.13
      COMMON/ XSTART / XSTART                                          WRITE.14
      COMMON/NST/NST,MC,NRU                                            WRITE.15
      KL1 = KL+1                                                       WRITE.16
      KJ = 9999                                                        WRITE.17
      AE = 1000000.                                                    WRITE.18
      CBETA = 0.                                                       WRITE.19
      ALPAN = ALFS(NST)                                                WRITE.20
      CBETA = CBETA*.01745329                                          WRITE.21
      DO 5 J = 1,10                                                    WRITE.22
       BETA(J) = CBETA                                                 WRITE.23
    5 CONTINUE                                                         WRITE.24
      DO 10 J= 11,JMX                                                  WRITE.25
      BETA(J) = CBETA*(1. - (Y(J) - Y(10))/(Y(JMX) - Y(10)))           WRITE.26
   10 CONTINUE                                                         WRITE.27
      BETA(JMX-2) = .8*BETA(JMX-2)                                     WRITE.28
      BETA(JMX-1) = .5*BETA(JMX-1)                                     WRITE.29
      I = 3                                                            WRITE.30
      U(1,I) = 0.                                                      WRITE.31
      W(1,I) = 0.                                                      WRITE.32
      DO 20 J = JMX,KF                                                 WRITE.33
      BETA(J) = BETA(JMX)                                              WRITE.34
   20 CONTINUE                                                         WRITE.35
      DO 95 J=2,KF                                                     WRITE.36
      U(J,I) = U(J,I)*COS(ALPAN + BETA(J))/COS(BETA(J))                WRITE.37
      W(J,I)  = U(J,I)*SIN(ALPAN + BETA(J))/COS(BETA(J))               WRITE.38
   95 CONTINUE                                                         WRITE.39
      RETURN                                                           WRITE.40
      END                                                              WRITE.41
```

```
                OVERLAY(FRIS,3,2)
      PROGRAM DEVELOP                                                    DEVELOP.3
C  THIS OVERLAY CALCULATES DOWNSTREAM BOUNDARY LAYER DEVELOPMENT         DEVELOP.4
                                                                         DEVELOP.5
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),DEVELOP.6
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),DEVELOP.7
     2 GAMI(100),GAMF(100),D(200),US(100),YY(100),UR(100),UUR(100),      DEVELOP.8
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),   DEVELOP.9
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUMMY(200),           DEVELOP.10
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),     DEVELOP.11
     6 UPG(100),WC(100),BETA(100),RTAB(50),T(99),DW(99),A3(100),A31(100)DEVELOP.12
     7,A4(100),DUNCE(452)                                                DEVELOP.13
      COMMON/ GEO / CF1,HI,RTN,UN,UTAX,RO,DELT,THETAI,Z,C,KF,ITER,KL,    DEVELOP.14
     1 KYG,KX,JOB                                                        DEVELOP.15
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                 DEVELOP.16
      COMMON /NPT/ NPT                                                   DEVELOP.17
      COMMON/ XSTART / XSTART                                            DEVELOP.18
      COMMON /SANGLE/ SANGLE                                             DEVELOP.19
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU               DEVELOP.20
      COMMON /TITLE/ TITLE(8)                                            DEVELOP.21
      DIMENSION X(3),U8(3),CF2(3),P(3)                                   DEVELOP.22
      COMMON/SZ3/X,U8                                                    DEVELOP.23
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                   DEVELOP.24
      COMMON/GRID/YCP(20),CP(20,30),YGAP                                 DEVELOP.25
      COMMON/CL/CL,CDT,CDF,CDP,DUM(2),CM                                 DEVELOP.26
      COMMON/SZ7/KRP2                                                    DEVELOP.27
      COMMON/ PRESSUR / P                                                DEVELOP.28
      COMMON/SZ9/ITR                                                     DEVELOP.29
      COMMON/SZ14/NPRF                                                   DEVELOP.30
      COMMON/SZ21/ITRR                                                   DEVELOP.31
      COMMON/VPRF/WVPR                                                   DEVELOP.32
      COMMON/SZTBL/XSW,HSV                                               DEVELOP.33
      COMMON/ DU8X / DU8X                                                DEVELOP.34
      COMMON/DXICR/DXMAX                                                 DEVELOP.35
      COMMON/XMON/TH2,CF3                                                DEVELOP.36
      COMMON/SHAPE/JSP,CNNS,UMX,UMIN,JMN,MCASE                           DEVELOP.37
      COMMON/ CURV1 / R(3)                                               DEVELOP.38
      COMMON/PLUB/ NCPX,NCPY,KCP,  YDELP                                 DEVELOP.39
      COMMON/JAG/LST2                                                    DEVELOP.40
      COMMON/MARY/DXS                                                    DEVELOP.41
      COMMON/DELGFD/DDELT                                                DEVELOP.42
      COMMON/PNTOP/KKZ                                                   DEVELOP.43
      COMMON/STAT/PHREF,UREF                                             DEVELOP.44
      COMMON/STP/KSTP                                                    DEVELOP.45
      COMMON/UVEL/UEND                                                   DEVELOP.46
      COMMON/XTRIP/KCODE,TRIP                                            DEVELOP.47
      COMMON/W8/W8(3)                                                    DEVELOP.48
      COMMON/BLOUT/ HS,THTS,CFS                                          DEVELOP.49
      COMMON/SEG/ NCMPT,NFLAP,NFP,NC(66)                                 DEVELOP.50
      COMMON/ITR/ITRN,ITRMAX                                             DEVELOP.51
      COMMON/KSEP/KSEP                                                   DEVELOP.52
      COMMON/DENSE/ SUD(200),USD(200)                                    DEVELOP.53
      COMMON/UIN/UIN(100)                                                DEVELOP.54
      COMMON/XTB/XTB(30)                                                 DEVELOP.55
      COMMON/NGRID/NGRID                                                 DEVELOP.56
      COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UINF                      DEVELOP.57
      COMMON/RNB/RNB                                                     DEVELOP.58
      EQUIVALENCE (GW(1),W(2,3))                                         DEVELOP.59
      DIMENSION G(99),GW(99)                                             DEVELOP.60
      EQUIVALENCE (G(1),U(2,3))                                          DEVELOP.61
      REWIND 12                                                          DEVELOP.62
      JMX = JOB                                                          DEVELOP.63
      UTAU = UTAX                                                        DEVELOP.64
      WVPR = 6H NO                                                       DEVELOP.65
      DO 1 I=1,NPT                                                       DEVELOP.66
      XPG(I) = SU(I)*REFC                                                DEVELOP.67
      UPG(I) = UIN(I)                                                    DEVELOP.68
    1 CONTINUE                                                           DEVELOP.69
      GNU = UINF*REFC/(12.*RNB)                                          DEVELOP.70
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      CALL DATAIN(XSTART)                                                DEVELOP.71
      CALL SETUP2(LPR,XP,LST1,LST2,ITRR,DX1,DX2,DX,JMX1,JMX,             DEVELOP.72
     1X,XSTART,NPRF,U8,U8IN,P,DU)                                        DEVELOP.73
      R(1)=R(2)=R(3)= 10000000.                                          DEVELOP.74
      KSTP = 2                                                           DEVELOP.75
      UEND = U8(3)                                                       DEVELOP.76
C  VELOCITY PROFILE INPUT                                                DEVELOP.77
      CALL VINPUT                                                        DEVELOP.78
      CALL PRINT(1)                                                      DEVELOP.79
      M         = 1                                                      DEVELOP.80
      LHV = 1                                                            DEVELOP.81
      DXS       =DX                                                      DEVELOP.82
      DDELT     =  0.                                                    DEVELOP.83
      PS(2,3)= -P(3)                                                     DEVELOP.84
   90 CONTINUE                                                           DEVELOP.85
      LDX = 1                                                            DEVELOP.86
      IF((M.EQ.2).AND.(KCP.EQ.1)) GO TO 5346                             DEVELOP.87
      USURF = U8FNT(X(3),U8IN)                                           DEVELOP.88
      U8(3) = USURF                                                      DEVELOP.89
      IF(KWAL.LE.1) U8(3) = USURF/(1.+Y(JMX)/R(3))                       DEVELOP.90
 5346 CONTINUE                                                           DEVELOP.91
      CF3 = CF2(3)                                                       DEVELOP.92
      CALL CFCALC(CF2,Y,U,GNU,X,U8 ,AQ)                                  DEVELOP.93
      IF(KSEP.EQ.1) GO TO 5554                                           DEVELOP.94
      CFSQRT = SQRT(CF2(3))                                              DEVELOP.95
      UTAU = UMX*CFSQRT                                                  DEVELOP.96
      DUDY(1,3) = CF2(2)/AQ                                              DEVELOP.97
CALCULATE BOUNDRY LAYER THICKNESS.                                       DEVELOP.98
      DELTA = THICK(Y,U,U8,JMX)                                          DEVELOP.99
CALCULATE REMAINDER OF U PROFILE FROM EDGE OF B.L. TO OUTER LIMITS       DEVELOP.100
      IF(KCP.EQ.1) GO TO 11                                              DEVELOP.101
      DO 66 J=JMX,100                                                    DEVELOP.102
      U(J,3) = U8(3)                                                     DEVELOP.103
   66 CONTINUE                                                           DEVELOP.104
C ***************************************************************************DEVELOP.105
      GO TO 12                                                           DEVELOP.106
   11 CONTINUE                                                           DEVELOP.107
      JMM = JMX + 3                                                      DEVELOP.108
      DO 67 J = JMM,100                                                  DEVELOP.109
      U(J,3) = U8(3)                                                     DEVELOP.110
   67 CONTINUE                                                           DEVELOP.111
   12 CONTINUE                                                           DEVELOP.112
CALCULATE THE DUDY PROFILE.                                              DEVELOP.113
      CALL DERIV(JMX,DELTA,Y,DUDY,U)                                     DEVELOP.114
164   TH2 = THETA                                                        DEVELOP.115
165   HSV = H                                                            DEVELOP.116
167   KALL      = 1                                                      DEVELOP.117
170   GO TO (10,20), KWAL                                                DEVELOP.118
176    10 CONTINUE                                                       DEVELOP.119
176   R(3)      = TBLU1(X(3),XPG,RTAB,1,NPT)                             DEVELOP.120
202   R(2)      = TBLU1(X(2),XPG,RTAB,1,NPT)                             DEVELOP.121
207    20 CONTINUE                                                       DEVELOP.122
CALCULATE THE DISPLACEMENT THICKNESS AND MOMENTUM THICKNESS, AND THE     DEVELOP.123
C SHAPE FACTOR.                                                          DEVELOP.124
207   H = SHAPE(DELS,THETA,P,Y,U,U8,JMX,X,YYDEL,KALL)                    DEVELOP.125
221   IF(H.LT.1.26)  H=1.26                                              DEVELOP.126
225   IF(KCP.EQ.2) GO TO 5573                                            DEVELOP.127
227   IF(X(3).GT.XSTART) GO TO 5573                                      DEVELOP.128
233   XPZ       = X(3)                                                   DEVELOP.129
234   GO TO (5551,5555), M                                               DEVELOP.130
242  5551 CONTINUE                                                       DEVELOP.131
242   XPZ       = XSTART                                                 DEVELOP.132
244  5555 CONTINUE                                                       DEVELOP.133
CALCULATE THE BOUNDARY-LAYER PRESSURE GRADIENT BASED ON INPUT CP.        DEVELOP.134
244   CALL PFIELD(M,XPZ,P,Y,XTB)                                         DEVELOP.135
252   U(JMX,2) = U8(3)                                                   DEVELOP.136
253   U(JMX,3) = U8(3)                                                   DEVELOP.137
254   W(JMX,2) = W8(3)                                                   DEVELOP.138
256   W(JMX,3) = W8(3)                                                   DEVELOP.139
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      M         = 2                                                          DEVELOP.140
 5573 CONTINUE                                                              DEVELOP.141
      IF(X(3).GT.XSTART)  GO TO 5541                                        DEVELOP.142
      ITR = 1                                                               DEVELOP.143
      CALL EXTRAP(ITR,JMX,U,X,LPR,UP,U8)                                    DEVELOP.144
 5541 CONTINUE                                                              DEVELOP.145
      CALL YPRESS                                                           DEVELOP.146
      UP(JMX) = U8(3)                                                       DEVELOP.147
      WP(JMX) = W8(3)                                                       DEVELOP.148
      LPR  =   LSVFN(X,XSTART,LHV,H,HSV,THETA,TH2,CF2,CF3)                 DEVELOP.149
      NDEL = 1                                                              DEVELOP.150
      CALL HTYDEL(H,YD,2)                                                   DEVELOP.151
      DO 5553 J = 1,JMX                                                     DEVELOP.152
      UTABLE(J) = U(J,3)                                                    DEVELOP.153
 5553 CONTINUE                                                              DEVELOP.154
      UD =  TBLU1(YD,YYDEL,UTABLE,2,JMX)                                    DEVELOP.155
      UD = UMX-UD                                                           DEVELOP.156
      CALL EDDY(GNUT,3,Y,DUDY,P)                                            DEVELOP.157
      CALL VVEL(V,X,LST2,XSTART,Y,U,GNUT,GNU,P,DUDY,VINT,JMX,U8)            DEVELOP.158
      CALL POUT(NPRF,X,XMX,KRTNN,LST2,ITRR,LN,ITR)                          DEVELOP.159
 5554 CONTINUE                                                              DEVELOP.160
      CALL RESULT(CF2,JMX,X,1)                                              DEVELOP.161
      IF(KSEP.EQ.1) KRTNN = 1                                               DEVELOP.162
      CALL ARRANGE(KRTNN)                                                   DEVELOP.163
      GO TO (75,77), KRTNN                                                  DEVELOP.164
   75 CONTINUE                                                              DEVELOP.165
      KALL      = 2                                                         DEVELOP.166
      H = SHAPE(DELS,THETA,P,Y,U,U8,JMX,X,YYDEL,KALL)                       DEVELOP.167
      F1 = .5*(HS + 5.)                                                     DEVELOP.168
      USMAX = SQRT(U8(3)**2 + W8(3)**2)                                     DEVELOP.169
      USINF = U8IN                                                          DEVELOP.170
      UETE = USMAX/USINF                                                    DEVELOP.171
      CDT = 2.*(THTS/REFC)*UETE**F1                                         DEVELOP.172
      CALL PRINT(10)                                                        DEVELOP.173
      DO 5556 J=1,JMX                                                       DEVELOP.174
      US(J) = US(J)/USMAX                                                   DEVELOP.175
 5556 CONTINUE                                                              DEVELOP.176
      NF = NFLAP-NFP+1                                                      DEVELOP.177
      IF(NF.EQ.1) WRITE(12) JMX,(US(J),Y(J),J=1,JMX)                        DEVELOP.178
      REWIND 12                                                             DEVELOP.179
      RETURN                                                                DEVELOP.180
   77 CONTINUE                                                              DEVELOP.181
 7010 CONTINUE                                                              DEVELOP.182
C     IF(X(2)+DX2-XX(KP)) 111,111,109                                       DEVELOP.183
C 109 X(3) = XX(KP)                                                         DEVELOP.184
C     GO TO 113                                                             DEVELOP.185
  111 DX1 = DX2                                                             DEVELOP.186
      X(3) = X(2)+DX1                                                       DEVELOP.187
      IF(KCP.EQ.1) GO TO 5577                                               DEVELOP.188
      USURF = U8FNT(X(3),U8IN)                                              DEVELOP.189
      U8(3) = USURF                                                         DEVELOP.190
      IF(KWAL.LE.1) U8(3) = USURF/(1.+Y(JMX)/R(3))                          DEVELOP.191
      DU8X = TBLU1(X(3),XPG,DU,1,NPT)                                       DEVELOP.192
      DU8X= 12.*DU8X*U8IN                                                   DEVELOP.193
      P(3) = USURF*DU8X                                                     DEVELOP.194
      JP2 = JMX + 3                                                         DEVELOP.195
      JL6 = JMX-6                                                           DEVELOP.196
      DO 81 J = 1,JP2                                                       DEVELOP.197
      GO TO (80,82),KWAL                                                    DEVELOP.198
   80 UEDGE(J) = USURF/(1.+ Y(J)/R(3))                                      DEVELOP.199
      GO TO 81                                                              DEVELOP.200
   82 UEDGE(J) = U8(3)                                                      DEVELOP.201
   81 CONTINUE                                                              DEVELOP.202
      U(JMX+1,3) = UEDGE(JMX+1)                                             DEVELOP.203
      U(JMX+2,3) = UEDGE(JMX+2)                                             DEVELOP.204
      GO TO 5578                                                            DEVELOP.205
 5577 CONTINUE                                                              DEVELOP.206
      XPZ = X(3)                                                            DEVELOP.207
      CALL PFIELD(M,XPZ,P,Y,XTB)                                            DEVELOP.208
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 5578 CONTINUE                                                          DEVELOP.209
  113 DX=X(3)-X(2)                                                      DEVELOP.210
      ITR = 1                                                           DEVELOP.211
  100 CONTINUE                                                          DEVELOP.212
      NPRF = NPRF+1                                                     DEVELOP.213
CALL ROUTINE TO EXAMINE ITERATION COUNTERS CONCERNED WITH INITIAL       DEVELOP.214
C     PROFILE AND INTERMEDIATE PROFILES GENERATED BY THE PROGRAM.       DEVELOP.215
      CALL SPEED(LST2,ITRR,ITR,V,U,JMX,X,Y,LN)                          DEVELOP.216
      IF(LOPT.EQ.2)  GO TO 5999                                         DEVELOP.217
      IF(ITR.LE.1) GO TO 6000                                           DEVELOP.218
 5999 CONTINUE                                                          DEVELOP.219
      DELTA = THICK(Y,U,U8,JMX)                                         DEVELOP.220
      IF(ITR.GT.1) GO TO 6000                                           DEVELOP.221
      GO TO (30,40), KWAL                                               DEVELOP.222
   30 CONTINUE                                                          DEVELOP.223
      R(3)      = TBLU1(X(3),XPG,RTAB,1,NPT)                            DEVELOP.224
   40 CONTINUE                                                          DEVELOP.225
      IF(KCP.EQ.1) GO TO 6001                                           DEVELOP.226
      USURF = U8FNT(X(3),U8IN)                                          DEVELOP.227
      U8(3) = USURF                                                     DEVELOP.228
      IF(KWAL.LE.1) U8(3) = USURF/(1.+Y(JMX)/R(3))                      DEVELOP.229
      DU8X = TBLU1(X(3),XPG,DU,1,NPT)                                   DEVELOP.230
      DU8X = 12.*DU8X*U8IN                                              DEVELOP.231
      P(3) = USURF*DU8X                                                 DEVELOP.232
      DO 83 J = 1,JP2                                                   DEVELOP.233
      GO TO (84,85),KWAL                                                DEVELOP.234
   84 UEDGE(J) = USURF/(1.+Y(J)/R(3))                                   DEVELOP.235
      GO TO 83                                                          DEVELOP.236
   85 UEDGE(J) = U8(3)                                                  DEVELOP.237
   83 CONTINUE                                                          DEVELOP.238
      U(JMX+1,3) = UEDGE(JMX+1)                                         DEVELOP.239
      U(JMX+2,3) = UEDGE(JMX+2)                                         DEVELOP.240
      GO TO 6002                                                        DEVELOP.241
 6001 CONTINUE                                                          DEVELOP.242
      XPZ = X(3)                                                        DEVELOP.243
      CALL PFIELO(M,XPZ,P,Y,XTB)                                        DEVELOP.244
 6002 CONTINUE                                                          DEVELOP.245
 6000 CONTINUE                                                          DEVELOP.246
      IF(LST2.EQ.1) LPR=1                                               DEVELOP.247
      CALL EXTRAP(ITR,JMX,U,X,LPR,UP,U8)                                DEVELOP.248
      DO 5 J = 2,JMX                                                    DEVELOP.249
      IF(ABS(V(J)).GT.U8(3)*.25) GO TO 6                                DEVELOP.250
      GO TO 5                                                           DEVELOP.251
    6 CONTINUE                                                          DEVELOP.252
      IF(V(J)) 7,7,8                                                    DEVELOP.253
    7 V(J) = -.25*U8(3)                                                 DEVELOP.254
      GO TO 5                                                           DEVELOP.255
    8 V(J) =  .25*U8(3)                                                 DEVELOP.256
    5 CONTINUE                                                          DEVELOP.257
      CALL COFISH                                                       DEVELOP.258
      II = 2                                                            DEVELOP.259
      JJ = 1                                                            DEVELOP.260
      CALL MATRIX(B,G,JMX-1,II,JJ)                                      DEVELOP.261
C                                                                       DEVELOP.262
      IF(SANGLE.EQ.0.)GO TO 9058                                        DEVELOP.263
C                                                                       DEVELOP.264
      CALL MATRIX(BW,GW,JMX-1,II,JJ)                                    DEVELOP.265
 9058 CONTINUE                                                          DEVELOP.266
      GO TO (90,9059), LST2                                             DEVELOP.267
 9059 CONTINUE                                                          DEVELOP.268
      CALL TEST(LN,ITR,1,LST2)                                          DEVELOP.269
      U(JMX,3) = U8(3)                                                  DEVELOP.270
      W(JMX,3) = W8(3)                                                  DEVELOP.271
      CALL OPTION(LN,LST2,DX2,DX1,DXMAX,ITR,X,LOPT,KRP2,LDX)            DEVELOP.272
      GO TO (90,100,900), LOPT                                          DEVELOP.273
  900 CALL PRINT(4)                                                     DEVELOP.274
      CALL PRINT(2)                                                     DEVELOP.275
      CALL PRINT(4)                                                     DEVELOP.276
      RETURN                                                            DEVELOP.277
      END                                                               DEVELOP.278
```

```
      SUBROUTINE ALI(X,ARG,VAL,Y,NDIM,EPS,IER)                          ALI.2
                                                                        ALI.3
C                                                                       ALI.4
C                                                                       ALI.5
      DIMENSION ARG(1),VAL(1)                                           ALI.6
      IER=2                                                             ALI.7
      DELT2=0.                                                          ALI.8
      IF(NDIM-1)9,7,1                                                   ALI.9
C                                                                       ALI.10
C     START OF AITKEN-LOOP                                              ALI.11
 1    DO 6 J=2,NDIM                                                     ALI.12
      DELT1=DELT2                                                       ALI.13
      IEND=J-1                                                          ALI.14
      DO 2 I=1,IEND                                                     ALI.15
      H=ARG(I)-ARG(J)                                                   ALI.16
      IF(H)2,13,2                                                       ALI.17
 2    VAL(J)=(VAL(I)*(X-ARG(J))-VAL(J)*(X-ARG(I)))/H                    ALI.18
      DELT2=ABS(VAL(J)-VAL(IEND))                                       ALI.19
      IF(J-2)6,6,3                                                      ALI.20
 3    IF(DELT2-EPS)10,10,4                                              ALI.21
 4    IF(J-5)6,5,5                                                      ALI.22
 5    IF(DELT2-DELT1)6,11,11                                            ALI.23
 6    CONTINUE                                                          ALI.24
C     END OF AITKEN-LOOP                                                ALI.25
C                                                                       ALI.26
 7    J=NDIM                                                            ALI.27
 8    Y=VAL(J)                                                          ALI.28
 9    RETURN                                                            ALI.29
C                                                                       ALI.30
C     THERE IS SUFFICIENT ACCURACY WITHIN NDIM-1 ITERATION STEPS        ALI.31
 10   IER=0                                                             ALI.32
      GOTO 8                                                            ALI.33
C                                                                       ALI.34
C     TEST VALUE DELT2 STARTS OSCILLATING                               ALI.35
 11   IER=1                                                             ALI.36
 12   J=IEND                                                            ALI.37
      GOTO 8                                                            ALI.38
C                                                                       ALI.39
C     THERE ARE TWO IDENTICAL ARGUMENT VALUES IN VECTOR ARG             ALI.40
 13   IER=3                                                             ALI.41
      GOTO 12                                                           ALI.42
      END                                                               ALI.42
     SUBROUTINE ARRANGE(KN)                                             21MAY.81
C  ROUTINE RE ARRANGES BOUNDARY LAYER PARAMETERS FOR INPUT TO SOURCE     21MAY.82
     COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),  21MAY.83
    1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),  21MAY.84
    2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),       21MAY.85
    3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),    21MAY.86
    4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),           21MAY.87
    5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),     21MAY.88
    6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100) 21MAY.89
    7,A4(100),DUMMY(452)                                                21MAY.90
      COMMON/DENSE/SUD(200),USD(200)                                    21MAY.91
      COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UINF                     21MAY.92
      COMMON/BLOUT/HS,THTS,CFS                                          21MAY.93
      COMMON/NPT/NPT                                                    21MAY.94
      COMMON/SZ3/ X(3),U8(3)                                            21MAY.95
      COMMON/XSTART/XSTART                                              21MAY.96
      COMMON/SLOT/HSS(100),TSS(100),DSS(100),CSS(100),USS(100),DTSS(100)5APR.815
      IF(X(3).EQ.XSTART) K=1                                            21MAY.97
      IF(K.EQ.1) GO TO 10                                               21MAY.98
      GO TO 30                                                          21MAY.99
 10   CONTINUE                                                          21MAY.100
      NUS = 200                                                         21MAY.101
      SUD(1) = 0.                                                       21MAY.102
      USD(1) = UPG(1)                                                   21MAY.103
      XSUM = 0.                                                         21MAY.104
      DELX = XPG(NPT)/199.                                              21MAY.105
      K = 2                                                             21MAY.106
      H(1) = HSS(1)                                                     5APR.816
```

```
      THETA(1) = TSS(1)                                                 5APR.817
      CF(1) = CSS(1)                                                    5APR.818
      DO 15 I =2,NUS                                                    21MAY.110
      SUD(I) = SUD(I-1) + DELX/REFC                                     21MAY.111
   15 CONTINUE                                                          21MAY.112
      DO 16 I=2,NUS                                                     21MAY.113
      SSUD = SUD(I)*REFC                                                26APR.72
      USD(I) = TBLU1(SSUD,XPG,UPG,1,NPT)                                26APR.73
   16 CONTINUE                                                          21MAY.115
      DO 20 I =2,NUS                                                    21MAY.116
      XSUM = XSUM + DELX                                                21MAY.117
      IF(XSUM.GT.X(3)) GO TO 100                                        21MAY.118
      H(I) = HSS(I)                                                     5APR.819
      THETA(I) = TSS(I)                                                 5APR.820
      CF(I) = CSS(I)                                                    5APR.821
   20 CONTINUE                                                          21MAY.122
   30 CONTINUE                                                          21MAY.123
      IF(KN.EQ.1.AND.X(3).LT.XPG(NPT)) GO TO 90                         7JUNE.183
      IF(XSUM.GT.X(3)) GO TO 100                                        21MAY.125
      SLOPE = DELX/(X(3)-(XSUM-DELX))                                   21MAY.126
      H(I) = H(I-1) + SLOPE*(HS-H(I-1))                                 21MAY.127
      THETA(I) = THETA(I-1) + SLOPE*(THTS/REFC - THETA(I-1))            21MAY.128
      CF(I) = CF(I-1) + SLOPE*(CFS-CF(I-1))                             21MAY.129
      I = I+1                                                           21MAY.130
      XSUM = XSUM + DELX                                                21MAY.131
      IF(KN.EQ.1) GO TO 90                                              21MAY.132
      GO TO 100                                                         21MAY.133
   90 CONTINUE                                                          21MAY.134
      NBL = I                                                           21MAY.135
      HSLOPE = H(I-1) - H(I-2)                                          21MAY.136
      TSLOPE = THETA(I-1) - THETA(I-2)                                  21MAY.137
      DO 95 I =NBL,NUS                                                  21MAY.138
      H(I) = H(I-1) + HSLOPE                                            21MAY.139
      THETA(I) = THETA(I-1) + TSLOPE                                    21MAY.140
   95 CONTINUE                                                          21MAY.141
  100 CONTINUE                                                          21MAY.142
      RETURN                                                            21MAY.143
      END                                                               21MAY.144


      SUBROUTINE CFCALC(CF2,Y,U,GNU,X,U8,AQ)                            CFCALC.2
                                                                        CFCALC.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),CFCALC.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),T(100,3),UT(100),V(100),CFCALC.5
     2 GAM1(100),GAMF(100),DM(200),US(100),YY(100),UR(100),UUR(100),    CFCALC.6
     3 UP(100),W(100,3),R(400),RW(400),YYDEL(100),GNUT(100,3),DU(200),  CFCALC.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUMMY(200),          CFCALC.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    CFCALC.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)CFCALC.10
     7,A4(100),DUNCE(452)                                               CFCALC.11
      COMMON /XIN/    XIN(100),ZIN(100),CPIN(100),SU(100)               CFCALC.12
      COMMON /NPT/ NPT                                                  CFCALC.13
      DIMENSION CF2(3),X(3),U8(3),P(3)                                  CFCALC.14
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                  CFCALC.15
      COMMON/ DU8X / DU8X                                               CFCALC.16
      COMMON/SHAPE/JSP,CNNS,UMX,UMIN,JMN,MCASE                          CFCALC.17
      COMMON/PRANK/KEY                                                  CFCALC.18
      COMMON/ CURV1 / R(3)                                              CFCALC.19
      COMMON/PLUB/ NCPX,NCPY,KCP,YDELP                                  CFCALC.20
      COMMON/ PRESSUR / P                                               CFCALC.21
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,DUM,XMX,DMM              CFCALC.22
      COMMON/KSEP/KSEP                                                  CFCALC.23
      DIMENSION Y(100),U(100,3),DUM(3)                                  CFCALC.24
      UMX = U(1,3)                                                      CFCALC.25
      JSP = 1                                                           CFCALC.26
      KEY      = 1                                                      CFCALC.27
      DO 60 J=2,JMX                                                     CFCALC.28
      UMXS = UMX                                                        CFCALC.29
      UMX = AMAX1(UMX,U(J,3))                                           CFCALC.30
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```
      IF(UMX.NE.UMXS) JSP=J                                                    CFCALC.31
      IF(U(J,3).LE.0.) GO TO 200                                               CFCALC.32
      IF(U(J,3)-UMX) 80,60,60                                                  CFCALC.33
   60 CONTINUE                                                                 CFCALC.34
   80 CONTINUE                                                                 CFCALC.35
      IF(JSP.LT.(JMX-2))  GO TO 110                                            CFCALC.36
C     JSP = JMX                                                                CFCALC.37
      CNNS = .999                                                              CFCALC.38
      MCASE = 1                                                                CFCALC.39
      GO TO 120                                                                CFCALC.40
  110 CONTINUE                                                                 CFCALC.41
      JMN = JSP                                                                CFCALC.42
      UMIN = UMX                                                               CFCALC.43
      DO 115 J=JSP,JMX                                                         CFCALC.44
      UMNS = UMIN                                                              CFCALC.45
      UMIN = AMIN1(UMIN,U(J,3))                                                CFCALC.46
      IF(UMIN.NE.UMNS) JMN=J                                                   CFCALC.47
      IF(U(J,3)-UMIN) 115,115,116                                              CFCALC.48
  115 CONTINUE                                                                 CFCALC.49
C 116 IF(R(3).LE.1.0E+6) GO TO 117                                             CFCALC.50
  116 CONTINUE                                                                 CFCALC.51
      IF(JMN.LT.(JMX-1)) GO TO 118                                             CFCALC.52
C 117 IF (UMIN.LT.U8(3)*.10) GO TO 118                                         CFCALC.53
      IF(UMIN.GE.UMX*.95) GO TO 121                                            CFCALC.54
      MCASE = 2                                                                CFCALC.55
      CNNS  = 1.001                                                            CFCALC.56
      GO TO 120                                                                CFCALC.57
  118 CNNS = .999                                                              CFCALC.58
      MCASE    = 3                                                             CFCALC.59
      IF(ABS(UMX-UMIN)/UMX -.0005) 119,119,120                                 CFCALC.60
  119 KEY = 2                                                                  CFCALC.61
  121 MCASE = 1                                                                CFCALC.62
      CNNS  = .999                                                             CFCALC.63
      JSP       = JMX                                                          CFCALC.64
      JMN       = JMX                                                          CFCALC.65
      UMX       = U8(3)                                                        CFCALC.66
  120 CONTINUE                                                                 CFCALC.67
      AQ = GNU/U8(3)**2                                                        CFCALC.68
      AQ = GNU/(UMX**2)                                                        CFCALC.69
      IF(KCP.EQ.1) GO TO 10                                                    CFCALC.70
      DU8X = TBLU1(X(3),XPG,DU,1,NPT)                                          CFCALC.71
      DU8X= 12.*DU8X*U8IN                                                      CFCALC.72
      GO TO 20                                                                 CFCALC.73
   10 CONTINUE                                                                 CFCALC.74
      DU8X =-PS(2,3)/U8(3)                                                     CFCALC.75
   20 CONTINUE                                                                 CFCALC.76
      XA1 = Y(3)*Y(2)/(Y(2)+Y(3))                                              CFCALC.77
      XA2 = Y(3)*Y(2)*(Y(3)+Y(2))*(Y(2)-Y(3))                                  CFCALC.78
      CF2(1) = AQ*(2.*U(4,3)-9.*U(3,3) + 18.*U(2,3))/(6.*(Y(2)-Y(1)))          CFCALC.79
      CF2(2) =AQ*(-U(3,3) + 4.*U(2,3))/(2.*(Y(2)-Y(1)))                        CFCALC.80
      CF2(3) = (U(3,3)*Y(2)**3 - U(2,3)*Y(3)**3)/XA2                           CFCALC.81
      CF2(3) = CF2(3)  +  U8(3)*DU8X*XA1/(GNU*288.)                            CFCALC.82
      CF2(3) = AQ*CF2(3)                                                       CFCALC.83
      CF2(1) = 12.*CF2(1)                                                      CFCALC.84
      CF2(2) = 12.*CF2(2)                                                      CFCALC.85
      CF2(3) = 12.*CF2(3)                                                      CFCALC.86
      IF(CF2(3)) 200,70,70                                                     CFCALC.87
   70 CONTINUE                                                                 CFCALC.88
      RETURN                                                                   CFCALC.89
  200 CONTINUE                                                                 CFCALC.90
      CALL PRINT(2)                                                            CFCALC.91
      CALL PRINT(8)                                                            CFCALC.92
      KSEP = 1                                                                 CFCALC.93
      RETURN                                                                   CFCALC.94
      END                                                                      CFCALC.95
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```
      FUNCTION CHEBERF(Y)                                                    CHEBERF.2
      DIMENSION B(28),A(26)                                                  CHEBERF.3
      DIMENSION AA(17),BB(19)                                                CHEBERF.4
      DATA AZERO    / 3.887303655222904       /                              CHEBERF.5
      DATA A(1)     /-1.381631420019799       /                              CHEBERF.6
      DATA A(2)     / .647316404854584        /                              CHEBERF.7
      DATA A(3)     /-.305931024422036        /                              CHEBERF.8
      DATA A(4)     /.138679747202030         /                              CHEBERF.9
      DATA A(5)     /-.059247456591259        /                              CHEBERF.10
      DATA A(6)     / .236917518249282E-01    /                              CHEBERF.11
      DATA A(7)     /-.884736263524045E-02    /                              CHEBERF.12
      DATA A(8)     / .308566171136092E-02    /                              CHEBERF.13
      DATA A(9)     /-.100638635123798E-02    /                              CHEBERF.14
      DATA A(10)    /.307546328843079E-03     /                              CHEBERF.15
      DATA A(11)    /-.882619837553631E-04    /                              CHEBERF.16
      DATA A(12)    / .238450961660726E-04    /                              CHEBERF.17
      DATA A(13)    /-.607910028505827E-05    /                              CHEBERF.18
      DATA A(14)    / .146597217338083E-05    /                              CHEBERF.19
      DATA A(15)    /-.033515993427206E-05    /                              CHEBERF.20
      DATA A(16)    / .007280579544232E-05    /                              CHEBERF.21
      DATA A(17)    /-.001505791176668E-05    /                              CHEBERF.22
      DATA A(18)    / .000297094742055E-05    /                              CHEBERF.23
      DATA A(19)    /-.000056021273938E-05    /                              CHEBERF.24
      DATA A(20)    / .000010113162390E-05    /                              CHEBERF.25
      DATA A(21)    /-.175065048SE-10         /                              CHEBERF.26
      DATA A(22)    /.0291038139 E-10         /                              CHEBERF.27
      DATA A(23)    /-.0046532645E-10         /                              CHEBERF.28
      DATA A(24)    / .0007164815E-10         /                              CHEBERF.29
      DATA A(25)    /-.0001063749E-10         /                              CHEBERF.30
      DATA A(26)    / .0000152467E-10         /                              CHEBERF.31
      DATA B(27)    / .0                      /                              CHEBERF.32
      DATA B(28)    / .0                      /                              CHEBERF.33
      IF(Y.GT.4.0)GO TO 2                                                    CHEBERF.34
      X=Y/4.                                                                 CHEBERF.35
      COEFF=4.*X*X-2.                                                        CHEBERF.36
      DO 1 I=1,26                                                            CHEBERF.37
      J=27-I                                                                 CHEBERF.38
    1 B(J)=COEFF*B(J+1)-B(J+2)+A(J)                                          CHEBERF.39
      BZERO=COEFF*B(1)-B(2)+AZERO                                            CHEBERF.40
      CHEBERF=X/2.*(BZERO-B(2))                                              CHEBERF.41
      RETURN                                                                 CHEBERF.42
      DATA AAZERO   / 1.97070527225754        /                              CHEBERF.43
      DATA AA(1)    /-.143397402717750E-01    /                              CHEBERF.44
      DATA AA(2)    / .297361692202619E-03    /                              CHEBERF.45
      DATA AA(3)    /-.980351604336237E-05    /                              CHEBERF.46
      DATA AA(4)    / .043313342034728E-05    /                              CHEBERF.47
      DATA AA(5)    /-.002362150026241E-05    /                              CHEBERF.48
      DATA AA(6)    / .000151549676581E-05    /                              CHEBERF.49
      DATA AA(7)    /-.000011084939856E-05    /                              CHEBERF.50
      DATA AA(8)    / .0904259014E-10         /                              CHEBERF.51
      DATA AA(9)    /-.0080947054E-10         /                              CHEBERF.52
      DATA AA(10)   / .0007853856E-10         /                              CHEBERF.53
      DATA AA(11)   /-.0000817918E-10         /                              CHEBERF.54
      DATA AA(12)   / .90715E-15              /                              CHEBERF.55
      DATA AA(13)   /-.10646E-15              /                              CHEBERF.56
      DATA AA(14)   / .01315E-15              /                              CHEBERF.57
      DATA AA(15)   /-.00170E-15              /                              CHEBERF.58
      DATA AA(16)   / .00023E-15              /                              CHEBERF.59
      DATA AA(17)   /-.00003E-15              /                              CHEBERF.60
      DATA BB(18)   / .0                      /                              CHEBERF.61
      DATA BB(19)   / .0                      /                              CHEBERF.62
    2 X=4./Y                                                                 CHEBERF.63
      COEFF=4.*X*X-2.                                                        CHEBERF.64
      DO 3 I=1,17                                                            CHEBERF.65
      J=18-I                                                                 CHEBERF.66
    3 BB(J)=COEFF*BB(J+1)-BB(J+2)+AA(J)                                      CHEBERF.67
      BBZERO=COEFF*BB(1)-BB(2)+AAZERO                                        CHEBERF.68
      CHEBERF=(BBZERO-BB(2))/(2.*Y*EXP(Y*Y))*.564189583547756                CHEBERF.69
      RETURN                                                                 CHEBERF.70
      END                                                                    CHEBERF.71
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      SUBROUTINE COFISH                                                 COFISH.2
C  ROUTINE CALCULATES MATRIX COEFFICIENTS                               COFISH.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),COFISH.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),COFISH.5
     2 GAMI(100),GAMF(100),D(200),US(100),YY(100),UR(100),UUR(100),     COFISH.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  COFISH.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUMMY(200),          COFISH.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    COFISH.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),T(99),DW(99),A3(100),A31(100)COFISH.10
     7,A4(100),DUNCE(452)                                               COFISH.11
      DIMENSION G(99),GW(99)                                            COFISH.12
      DIMENSION X(3),U8(3),P(3)                                         COFISH.13
      EQUIVALENCE (G(1),U(2,3))                                         COFISH.14
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                  COFISH.15
      COMMON/SZ3/X,U8                                                   COFISH.16
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU              COFISH.17
      COMMON/ PRESSUR / P                                               COFISH.18
      COMMON/ CURV1 / R(3)                                              COFISH.19
      DIMENSION H1(3),H2(3),H3(3)                                       COFISH.20
      COMMON/W8/W8(3)                                                   COFISH.21
      EQUIVALENCE (GW(1),W(2,3))                                        COFISH.22
      RCON = 1.                                                         COFISH.23
C     A2   = WT*P(3) +(1.-WT)*P(2)                                      COFISH.24
      JMX1 = JMX-1                                                      COFISH.25
      DO 100 J=1,JMX                                                    COFISH.26
      A3(J) = GNU + GNUT(J,2)                                           COFISH.27
  100 CONTINUE                                                          COFISH.28
      I = 2                                                             COFISH.29
      DO 110 J=2,JMX                                                    COFISH.30
      A4(J) = DUY(GNUT,I,J,Y)*12.                                       COFISH.31
  110 CONTINUE                                                          COFISH.32
      DO 900 J=2,JMX1                                                   COFISH.33
      IF((KWAL.EQ.2).OR.(R(3)/DELTA.GT.1.0E10))  GO TO 202              COFISH.34
  201 H1(3)    =  R(3)/(R(3)+Y(J))                                      COFISH.35
      H2(3)    =  12./(R(3)+Y(J))                                       COFISH.36
      H1(2)    = R(2)/(R(2)+Y(J))                                       COFISH.37
      H2(2)    = 12./(R(2)+Y(J))                                        COFISH.38
      H3(2) = H2(2)**2                                                  COFISH.39
      H3(3) = H2(3)**2                                                  COFISH.40
      GO TO 210                                                         COFISH.41
  202 H1(3) = 1.                                                        COFISH.42
      H2(3) = 0.                                                        COFISH.43
      H1(2)    = 1.                                                     COFISH.44
      H2(2)    = 0.                                                     COFISH.45
      H3(2) = 0.                                                        COFISH.46
      H3(3) = 0.                                                        COFISH.47
  210 A1       =  (12./(X(3)-X(2)))*(WT*H1(3)*UP(J) + (1.-WT)*H1(I)*    COFISH.48
     1            U(J,I))                                              COFISH.49
C     AW       =  (12./(X(3)-X(2)))*(WT*H1(3)*WP(J) + (1.-WT)*H1(I)*    COFISH.50
C    1            W(J,I))                                              COFISH.51
      H33 = WT*H3(3) + (1.-WT)*H3(2)                                    COFISH.52
      A31(J)   = A3(J) + GNUT(J,2)                                      COFISH.53
      A32 = A3(J)- GNU                                                  COFISH.54
      PS(J,I+1)= PS(J,I) -(P(3)-P(2))                                   COFISH.55
      A5  = V(J)                                                        COFISH.56
      H22 = WT*H2(3) + (1.-WT)*H2(2)                                    COFISH.57
      A8 = RCON*H22*A4(J) +(GNU + RCON*A32)*H33                         COFISH.58
      X2       = A1                                                     COFISH.59
      AW = A1                                                           COFISH.60
      IF(J-2) 305,305,301                                               COFISH.61
  301 IF(J-JMX1) 320,310,310                                            COFISH.62
  305 A6 = (Y(J+1)-Y(J-1))/12.                                          COFISH.63
      A7 = A6**2/4.                                                     COFISH.64
C LOWER BOUNDARY CONDITION.                                             COFISH.65
      X1       = A4(J) + (WT*H2(3)+(1.-WT)*H2(2))*A31(J)                COFISH.66
      X1 = X1/A6 - A5/A6 - A3(J)/A7 - RCON*A32*H22/A6                   COFISH.67
      X3 = A5*H2(3) + 2.*A3(J)/A7 + A8                                  COFISH.68
      X4       = A4(J) + (WT*H2(3) + (1.-WT)*H2(2))*A31(J)              COFISH.69
      X4 = A5/A6 - A3(J)/A7 - X4/A6 + RCON*A32*H22/A6                   COFISH.70
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      X5 = A5*H2(2) + 2.*A3(J)/A7 + A8                                  COFISH.71
C LEFT HAND SIDE.                                                       COFISH.72
      B(1)      = X2    +  WT*X3                                        COFISH.73
      B(2)      = WT*X4                                                 COFISH.74
      BW(1) = AW + WT*2.*A3(J)/A7                                       COFISH.75
      BW(2) = WT*X4                                                     COFISH.76
C RIGHT HAND SIDE.                                                      COFISH.77
      Q0 = 0.                                                           COFISH.78
      QW0 = 0.                                                          COFISH.79
      Q1        =  0.                                                   COFISH.80
      QW1 = 0.                                                          COFISH.81
      Q2        =  X2 - (1.-WT)*X5                                      COFISH.82
      QW2 = AW - (1.-WT)*2.*A3(J)/A7                                    COFISH.83
      Q3        =  -X4*(1.-WT)                                          COFISH.84
      QW3 = -(1.-WT)*X4                                                 COFISH.85
      Q4        = (1.-WT)*H1(2)*PS(J,I)  +  WT*H1(3)*PS(J,I+1)          COFISH.86
      QW4 = 0.                                                          COFISH.87
      GO TO 500                                                         COFISH.88
C UPPER BOUNDARY.                                                       COFISH.89
C UPPER BOUNDRY CONDITION.                                              COFISH.90
  310 DO 312 L=1, LMX                                                   COFISH.91
      IF(J.EQ.JYT(L))  GO TO 315                                        COFISH.92
  312 CONTINUE                                                          COFISH.93
      A6        = (Y(J+1)-Y(J-1))/12.                                   COFISH.94
      A7        = ((Y(J+1)-Y(J))*(Y(J)-Y(J-1)))/144.                    COFISH.95
      JJ        = 4*(J-2)-2                                             COFISH.96
      X1        = A4(J) + (WT*H2(3) + (1.-WT)*H2(2))*A31(J)             COFISH.97
      X1 = X1/A6 - A5/A6 - A3(J)/A7 - RCON*A32*H22/A6                   COFISH.98
C LEFT HAND SIDE  (UPPER B.C.)                                          COFISH.99
      B(JJ+1)  = 0.                                                     COFISH.100
      BW(JJ+1) = 0.                                                     COFISH.101
      B(JJ+2)  = WT*X1                                                  COFISH.102
      BW(JJ+2) = WT*X1                                                  COFISH.103
C RIGHT HAND SIDE(UPPER B.C.)                                           COFISH.104
      Q0        = 0.                                                    COFISH.105
      QW0 = 0.                                                          COFISH.106
      Q1        = -(1.-WT)*X1                                           COFISH.107
      QW1 = - (1.-WT)*X1                                                COFISH.108
      GO TO 317                                                         COFISH.109
  315 CONTINUE                                                          COFISH.110
      A6        = (Y(J+1)-Y(J-2))/12.                                   COFISH.111
      A7        = ((Y(J+1)-Y(J))*(Y(J)-Y(J-2)))/144.                    COFISH.112
      JJ        = 4*(J-2)-2                                             COFISH.113
      X1        = A4(J) + (WT*H2(3) + (1.-WT)*H2(2))*A31(J)             COFISH.114
      X1 = X1/A6 - A5/A6 - A3(J)/A7 - RCON*A32*H22/A6                   COFISH.115
C LEFT HAND SIDE (UPPER B.C.) WHEN STEPSIZE CHANGES.                    COFISH.116
      B(JJ+1)  = WT*X1                                                  COFISH.117
      BW(JJ+1) = WT*X1                                                  COFISH.118
C RIGHT HAND SIDE (UPPER B.C.) WHEN STEP SIZE CHANGES.                  COFISH.119
      B(JJ+2)  = 0.                                                     COFISH.120
      BW(JJ+2) = 0.                                                     COFISH.121
      Q0        = -(1.-WT)*X1                                           COFISH.122
      QW0 = -(1.-WT)*X1                                                 COFISH.123
      Q1        = 0.                                                    COFISH.124
      QW1 = 0.                                                          COFISH.125
  317 CONTINUE                                                          COFISH.126
      X3 = A5*H2(3) + 2.*A3(J)/A7 + A8                                  COFISH.127
      X4        = A4(J) + (WT*H2(3)+ (1.-WT)*H2(2))*A31(J)              COFISH.128
      X4 = A5/A6 - A3(J)/A7 - X4/A6 + RCON*A32*H22/A6                   COFISH.129
      X5 = A5*H2(2) + 2.*A3(J)/A7 + A8                                  COFISH.130
      B(JJ+3)  = X2  +  WT*X3                                           COFISH.131
      BW(JJ+3) = AW + WT*2.*A3(J)/A7                                    COFISH.132
      Q2        = X2  -  (1.-WT)*X5                                     COFISH.133
      QW2 = AW - (1.-WT)*2.*A3(J)/A7                                    COFISH.134
      Q3        = -X4*(1.-WT)                                           COFISH.135
      QW3 = -(1.-WT)*X4                                                 COFISH.136
      Q4        = (1.-WT)*H1(2)*PS(J,I) +WT*H1(3)*PS(J,I+1)             COFISH.137
      Q4        = Q4 + U8(3)*WT*X4                                      COFISH.138
      QW4 = -W8(3)*WT*X4                                                COFISH.139
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C R.H.S.                                                                COFISH.140
      GO TO 500                                                         COFISH.141
  320 DO 400 L=1,LMX                                                    COFISH.142
      IF(J.EQ.JYT(L)) GO TO 420                                         COFISH.143
  400 CONTINUE                                                          COFISH.144
      A6 = (Y(J+1)-Y(J-1))/12.                                          COFISH.145
      A7 = ((Y(J+1)-Y(J))*(Y(J)-Y(J-1)))/144.                           COFISH.146
      JJ =  4*(J-2)-2                                                   COFISH.147
      X1        = A4(J) + (WT*H2(3) + (1.-WT)*H2(2))*A31(J)             COFISH.148
      X1 = X1/A6 - A5/A6 - A3(J)/A7 - RCON*A32*H22/A6                   COFISH.149
C L.H.S.                                                                COFISH.150
      B(JJ+1) = 0.                                                      COFISH.151
      BW(JJ+1) = 0.                                                     COFISH.152
      B(JJ+2) = WT*X1                                                   COFISH.153
      BW(JJ+2) = WT*X1                                                  COFISH.154
C R.H.S.                                                                COFISH.155
      Q0 = 0.                                                           COFISH.156
      QW0 = 0.                                                          COFISH.157
      Q1 = -(1.-WT)*X1                                                  COFISH.158
      QW1 = - (1.-WT)*X1                                                COFISH.159
      GO TO 450                                                         COFISH.160
  420 A6 = (Y(J+1)- Y(J-2))/12.                                         COFISH.161
      A7 = ((Y(J+1)-Y(J))*(Y(J)-Y(J-2)))/144.                           COFISH.162
      JJ = 4*(J-2)-2                                                    COFISH.163
      X1        = A4(J) + (WT*H2(3) + (1.-WT)*H2(2))*A31(J)             COFISH.164
      X1 = X1/A6 - A5/A6 - A3(J)/A7 - RCON*A32*H22/A6                   COFISH.165
C L.H.S.                                                                COFISH.166
      B(JJ+1) = WT*X1                                                   COFISH.167
      BW(JJ+1) = WT*X1                                                  COFISH.168
      B(JJ+2) = 0.                                                      COFISH.169
      BW(JJ+2) = 0.                                                     COFISH.170
C R.H.S.                                                                COFISH.171
      Q0 =-(1.-WT)*X1                                                   COFISH.172
      QW0 = -(1.-WT)*X1                                                 COFISH.173
      Q1 = 0.                                                           COFISH.174
      QW1 = 0.                                                          COFISH.175
  450 CONTINUE                                                          COFISH.176
      X3 = A5*H2(3) + 2.*A3(J)/A7 + A8                                  COFISH.177
      X4        = A4(J) + (WT*H2(3) + (1.-WT)*H2(2))*A31(J)             COFISH.178
      X4 = A5/A6 - A3(J)/A7 - X4/A6 + RCON*A32*H22/A6                   COFISH.179
      X5 = A5*H2(2) + 2.*A3(J)/A7 + A8                                  COFISH.180
C LEFT HAND SIDE.                                                       COFISH.181
      B(JJ+3)   = X2 + WT*X3                                            COFISH.182
      BW(JJ+3) = AW + WT*2.*A3(J)/A7                                    COFISH.183
      B(JJ+4)   = WT*X4                                                 COFISH.184
      BW(JJ+4) = WT*X4                                                  COFISH.185
C R.H.S.                                                                COFISH.186
      Q2        = X2 - (1.-WT)*X5                                       COFISH.187
      QW2 = AW - (1.-WT)*2.*A3(J)/A7                                    COFISH.188
      Q3        = -X4*(1.-WT)                                           COFISH.189
      QW3 = -(1.-WT)*X4                                                 COFISH.190
      Q4        = (1.-WT)*H1(2)*PS(J,I)  +  WT*H1(3)*PS(J,3)            COFISH.191
      QW4 = 0.                                                          COFISH.192
  500 CONTINUE                                                          COFISH.193
      IF(J-2) 510,510,520                                               COFISH.194
  510 QR = 0.                                                           COFISH.195
      QRW = 0.                                                          COFISH.196
      GO TO 530                                                         COFISH.197
  520 QR = Q0*U(J-2,2)                                                  COFISH.198
      QRW = QW0*W(J-2,2)                                                COFISH.199
  530 CONTINUE                                                          COFISH.200
      G(J-1)    = QR  +  Q1*U(J-1,2)  + Q2*U(J,2)  + Q3*U(J+1,2) - Q4   COFISH.201
      GW(J-1) = QRW + QW1*W(J-1,2) + QW2*W(J,2) + QW3*W(J+1,2) + QW4    COFISH.202
  900 CONTINUE                                                          COFISH.203
      RETURN                                                            COFISH.204
      END                                                               COFISH.205
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      SUBROUTINE DATAIN(XSTART)                                          DATAIN.2
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),DATAIN.3
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),DATAIN.4
     2 GAMI(100),GAMF(100),D(200),US(100),YY(100),UR(100),UUR(100),     DATAIN.5
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  DATAIN.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUMMY(200),          DATAIN.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    DATAIN.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)DATAIN.9
     7,A4(100),DUNCE(452)                                               DATAIN.10
      COMMON /XIN/    XIN(100),ZIN(100),CPIN(100),SU(100)               DATAIN.11
      COMMON /SANGLE/ SANGLE                                            DATAIN.12
      COMMON/GRID/YCP(20),CP(20,30),YGAP                                DATAIN.13
      DIMENSION X(3),U8(3)                                              DATAIN.14
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                  DATAIN.15
      COMMON/SZ3/X,U8                                                   DATAIN.16
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU              DATAIN.17
      DIMENSION CF2(3)                                                  DATAIN.18
      COMMON/SZ7/KRP2                                                   DATAIN.19
      COMMON/SZTBL/XSW,HSV                                              DATAIN.20
      COMMON/ DU8X / DU8X                                               DATAIN.21
      COMMON/DXICR/DXMAX                                                DATAIN.22
      COMMON/TQTQ/CONS,GNEQK,KGNQ                                       DATAIN.23
      COMMON/PLUB/ NCPX,NCPY,KCP, YDELP                                 DATAIN.24
      COMMON/ CURV1 / R(3)                                              DATAIN.25
      COMMON/STAT/PHREF,UREF                                            DATAIN.26
      COMMON/PNTOP/KKZ                                                  DATAIN.27
      COMMON/ITR/ITR,ITRMAX                                             DATAIN.28
      COMMON/NPT/NPT                                                    DATAIN.29
      COMMON/XTB/XTB(30)                                                DATAIN.30
      COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UINF                     DATAIN.31
      COMMON/NGRID/NGRID                                                DATAIN.32
      COMMON/NST/NST,MC,NRU                                             DATAIN.33
      DIMENSION RIN(50)                                                 DATAIN.34
      COMMON/XTRIP/KCODE,TRIP                                           DATAIN.35
      COMMON/SEG/ NCMPT,NFLAP,NFP,NC(66)                                DATAIN.36
      COMMON/CURVES/ RC(30,2)                                           DATAIN.37
      NF = NFLAP-NFP+1                                                  DATAIN.38
      IF(NF.GT.1) GO TO 20                                              DATAIN.39
      REWIND 11                                                         DATAIN.40
      KGNQ = 1                                                          DATAIN.41
      GO TO 21                                                          DATAIN.42
   20 KGNQ = 3                                                          DATAIN.43
   21 CONTINUE                                                          DATAIN.44
      UTS = 1.                                                          DATAIN.45
      WT = .55                                                          DATAIN.46
      KWAL = 1                                                          DATAIN.47
      NP = 4                                                            DATAIN.48
      CONS = .02                                                        DATAIN.49
      XMX = (SU(NPT) - SU(1))*REFC                                      DATAIN.50
      XSW = XMX                                                         DATAIN.51
      U8IN = UINF                                                       DATAIN.52
      KRP2 = 1                                                          DATAIN.53
      IF(ITR.GT.1) GO TO 10                                             DATAIN.54
      READ(5,1) DX,DXMAX,Z,BLTRIP                                       DATAIN.55
      BLTRIP = BLTRIP*REFC                                              DATAIN.56
      IF(BLTRIP.LT.TRIP) TRIP = BLTRIP                                  DATAIN.57
   10 CONTINUE                                                          DATAIN.58
      ITRMX = 2                                                         DATAIN.59
      UREF = U8IN                                                       DATAIN.60
      PHREF = 0.                                                        DATAIN.61
      IF(KWAL.NE.1)  GO TO 350                                          DATAIN.62
      IF(ITR.GT.1) GO TO 11                                             DATAIN.63
      DO 22 I=1,NRU                                                     DATAIN.64
      RIN(I) = ABS(RC(I,NF)*REFC)                                       DATAIN.65
   22 CONTINUE                                                          DATAIN.66
      WRITE(11) DX,DXMAX,Z,BLTRIP,NRU,(RIN(I),I=1,NRU)                  DATAIN.67
      GO TO 12                                                          DATAIN.68
   11 CONTINUE                                                          DATAIN.69
      READ(11)  DX,DXMAX,Z,BLTRIP,NRU,(RIN(I),I=1,NRU)                  DATAIN.70
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 12   CONTINUE                                                          DATAIN.71
      KKZ = INT(Z)                                                      DATAIN.72
      N = NPT-NRU                                                       DATAIN.73
      IF(N) 2,3,6                                                       DATAIN.74
  2   NN = ABS(N)                                                       DATAIN.75
      GO TO 4                                                           DATAIN.76
  3   NN = 0                                                            DATAIN.77
  4   DO 5 I =1,NPT                                                     DATAIN.78
      RTAB(I) = RIN(I+NN)                                               DATAIN.79
  5   CONTINUE                                                          DATAIN.80
      GO TO 9                                                           DATAIN.81
  6   DO 7 I =1,N                                                       DATAIN.82
      RTAB(I) = RIN(1)                                                  DATAIN.83
  7   CONTINUE                                                          DATAIN.84
      NN = N+1                                                          DATAIN.85
      DO 8 I =NN,NPT                                                    DATAIN.86
      RTAB(I) = RIN(I-NN+1)                                             DATAIN.87
  8   CONTINUE                                                          DATAIN.88
  9   CONTINUE                                                          DATAIN.89
 350  CONTINUE                                                          DATAIN.90
      KCP = 1                                                           DATAIN.91
      NCPX = NGRID                                                      DATAIN.92
      NCPY = 20                                                         DATAIN.93
      KCODE = 1                                                         DATAIN.94
      IF(KCP.GT.1) GO TO 450                                            DATAIN.95
      YDELP = YCP(20)                                                   DATAIN.96
CALCULATE U FROM CP.                                                    DATAIN.97
      DO 410 I=1,NCPX                                                   DATAIN.98
      DO 410 J=1,NCPY                                                   DATAIN.99
      UUC(J,I) = SQRT(1. - CP(J,I)) * U8IN                              DATAIN.100
 410  CONTINUE                                                          DATAIN.101
      DO 420 I=1,NCPX                                                   DATAIN.102
      XTB(I) = XPG(I+NST-1)                                             DATAIN.103
 420  CONTINUE                                                          DATAIN.104
      CALL DUDS(XTB,UUC,NCPX,NCPY,DXD)                                  DATAIN.105
      DO 430 I=1,NCPX                                                   DATAIN.106
      DO 430 J=1,NCPY                                                   DATAIN.107
      PPC(J,I) = .5 UUC(J,I)*DXD(J,I)*12.                               DATAIN.108
 430  CONTINUE                                                          DATAIN.109
 450  CONTINUE                                                          DATAIN.110
      RETURN                                                            DATAIN.111
    1 FORMAT( 7E10.3)                                                   DATAIN.112
      END                                                               DATAIN.113

       SUBROUTINE DERIV(JMX,DELTA,Y,DUDY,U)                             DERIV.2
       DIMENSION Y(1),DUDY(100,3),U(100,3)                              DERIV.3
       COMMON/SZ1/JJ,LMX                                                DERIV.4
       DO 70 J=2,JMX                                                    DERIV.5
       IF(Y(J)-DELTA) 81,81,82                                          DERIV.6
    81 CONTINUE                                                         DERIV.7
       DUDY(J,3) = DUY(U,3,J,Y)                                         DERIV.8
       GO TO 83                                                         DERIV.9
    82 DUDY(J,3) = 0.                                                   DERIV.10
    83 CONTINUE                                                         DERIV.11
    70 CONTINUE                                                         DERIV.12
       RETURN                                                           DERIV.13
       END                                                              DERIV.14

        SUBROUTINE DUDS(XF,SIGF,NT,NY,SIGMF)                            DUDS.2
        DIMENSION XF(50), SIGF(20,20), SIGMF(20,20)                     DUDS.3
        DO 200  J= 1,NY                                                 DUDS.4
        DO 100 I=1,NT                                                   DUDS.5
        IF(I.GT.1) GO TO 20                                             DUDS.6
  C FIRST POINT.  USE FORWARD DIFFERENCES (LAGRANGE).                   DUDS.7
        DX1       = XF(I+1)-XF(I)                                       DUDS.8
        DX2       = XF(I+2)-XF(I+1)                                     DUDS.9
        DX        = DX1 + DX2                                           DUDS.10
        DS1       = SIGF(J,I+1) - SIGF(J,I)                             DUDS.11
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```
      DS2       =SIGF(J,I+2) - SIGF(J,I+1)                                    DUDS.12
      A         = DS1*(DX2/DX1+2.)                                            DUDS.13
      B         = DS2*(DX1/DX2)                                               DUDS.14
      SIGMF(J,I)  = (A-B)/DX                                                  DUDS.15
      GO TO  100                                                              DUDS.16
   20 IF(I.EQ.NT) GO TO 40                                                    DUDS.17
C ANY OTHER POINT. USE CENTRAL DIFFERENCES.                                   DUDS.18
      DX1       = XF(I) -XF(I-1)                                              DUDS.19
      DX2       = XF(I+1) - XF(I)                                             DUDS.20
      DX        = DX1 + DX2                                                   DUDS.21
      DS1       = SIGF(J,I) - SIGF(J,I-1)                                     DUDS.22
      DS2       = SIGF(J,I+1) - SIGF(J,I)                                     DUDS.23
      A         = DS2*DX1/DX2                                                 DUDS.24
      B         = DS1*DX2/DX1                                                 DUDS.25
      SIGMF(J,I)  =  (A+B)/DX                                                 DUDS.26
      GO  TO  100                                                             DUDS.27
   40 CONTINUE                                                                DUDS.28
C LAST POINT.  USE BACKWARD DIFFERENCES.                                      DUDS.29
      DX1       = XF(I-1)-XF(I-2)                                             DUDS.30
      DX2       = XF(I)  -XF(I-1)                                             DUDS.31
      DX        = DX1 +DX2                                                    DUDS.32
      DS1       = SIGF(J,I-1) - SIGF(J,I-2)                                   DUDS.33
      DS2       = SIGF(J,I)   - SIGF(J,I-1)                                   DUDS.34
      A         = DS2*(DX1/DX2 + 2.)                                          DUDS.35
      B         = DS1*(DX2/DX1)                                               DUDS.36
      SIGMF(J,I)  = (A-B)/DX                                                  DUDS.37
  100 CONTINUE                                                                DUDS.38
  200 CONTINUE                                                                DUDS.39
      RETURN                                                                  DUDS.40
      END                                                                     DUDS.41
```



```
      FUNCTION DUY(U,I,J,Y)                                                   DUY.2
                                                                              DUY.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),      DUY.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),DUM(300),UT(100),V(100),      DUY.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),           DUY.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),        DUY.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),                DUY.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),          DUY.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)      DUY.10
     7,A4(100),DUMMY(452)                                                     DUY.11
      DIMENSION Y(100),U(100,3)                                               DUY.12
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                        DUY.13
      IF(J.EQ.1) GO TO 300                                                    DUY.14
      IF(J.EQ.JMX) GO TO 400                                                  DUY.15
      DO 100 L=1,LMX                                                          DUY.16
      KM = JYT(L)                                                             DUY.17
      IF (J.EQ.KM) GO TO 200                                                  DUY.18
  100 CONTINUE                                                                DUY.19
      DY = Y(J+1)-Y(J-1)                                                      DUY.20
      DUY = (U(J+1,I)-U(J-1,I))/DY                                            DUY.21
      RETURN                                                                  DUY.22
  200 CONTINUE                                                                DUY.23
      DY = Y(J+1)-Y(J-2)                                                      DUY.24
      DUY = (U(J+1,I)-U(J-2,I))/DY                                            DUY.25
      RETURN                                                                  DUY.26
  300 CONTINUE                                                                DUY.27
      DY = Y(J+1)-Y(J)                                                        DUY.28
      DUY =(U(J+1,I)-U(J,I))/DY                                               DUY.29
      RETURN                                                                  DUY.30
  400 CONTINUE                                                                DUY.31
      DY = Y(J)  -Y(J-1)                                                      DUY.32
      DUY = (U(J,I)-U(J-1,I))/DY                                              DUY.33
      RETURN                                                                  DUY.34
      END                                                                     DUY.35
```

```
      SUBROUTINE EDDY(GNUT,I,Y,DUDY,P)                                  EDDY.2
C  ROUTINE TO CALCULATE THE EDDY VISCOSITY PROFILE                      EDDY.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),EDDY.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),EDDY.5
     2 GAMI(100),GAMF(100),T(200),US(100),YY(100),UR(100),UUR(100),     EDDY.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),DUMM(100,3),DU(200),  EDDY.7
     4 UTABLE(100),DUUM(100,3),PS(100,3),SP(100,3),DUMMY(200),          EDDY.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    EDDY.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)EDDY.10
     7,A4(100),DUNCE(452)                                               EDDY.11
      COMMON/ XSTART / XSTART                                           EDDY.12
      DIMENSION DUDY(100,3), Y(100),GNUT(100,3)                         EDDY.13
      COMMON/SZ1/JMX,LMX                                                EDDY.14
      COMMON/ SZ3 / X(3),U8(3)                                          EDDY.15
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU              EDDY.16
      DIMENSION CF2(3),P(3)                                             EDDY.17
      COMMON/SZTBL/XSW,HSV                                              EDDY.18
      COMMON/SHAPE/JSP,CNNS,UMX,UMIN,JMN,MCASE                          EDDY.19
      COMMON/ DU8X / DU8X                                               EDDY.20
      COMMON/TQTQ/CONS,GNEQK,KGNQ                                       EDDY.21
      COMMON/PRANK/KEY                                                  EDDY.22
      COMMON/ CURV1 / R(3)                                              EDDY.23
      COMMON/XTRIP/KCODE,TRIP                                           EDDY.24
      COMMON/KSEP/KSEP                                                  EDDY.25
      GNUT(1,I) = 0.                                                    EDDY.26
      JDY = 1                                                           EDDY.27
      KSEP = 0                                                          EDDY.28
      RAD = 1.                                                          EDDY.29
      AA = 312.                                                         EDDY.30
      KH = 1                                                            EDDY.31
      DO 7 J = 2,JMX                                                    EDDY.32
      IF(U(J,3))8,8,7                                                   EDDY.33
    7 CONTINUE                                                          EDDY.34
      GO TO 9                                                           EDDY.35
    8 CALL PRINT(2)                                                     EDDY.36
      KSEP = 1                                                          EDDY.37
      RETURN                                                            EDDY.38
    9 CONTINUE                                                          EDDY.39
      IF(X(I)-XSTART)  1,1,2                                            EDDY.40
    1 KAP      =1                                                       EDDY.41
      XLAST = 0.                                                        EDDY.42
      KFLAT =1                                                          EDDY.43
      KCORE = 1                                                         EDDY.44
    2 CONTINUE                                                          EDDY.45
      GNUT4 = 0.                                                        EDDY.46
      IF(X(I)-XSW) 10,20,20                                             EDDY.47
   10 CONTINUE                                                          EDDY.48
      CALL HTYBAR(H,YB,2)                                               EDDY.49
      CALL HTSIG(H,SIGD,2)                                              EDDY.50
      GO TO 30                                                          EDDY.51
   20 CONTINUE                                                          EDDY.52
      CALL HTYBRE(H,YB,2)                                               EDDY.53
      CALL HTSIR(H,SIGD,2)                                              EDDY.54
   30 CONTINUE                                                          EDDY.55
      SIGMA = SIGD*DELS/12.                                             EDDY.56
      DX = X(I)-X(I-1)                                                  EDDY.57
      CGT = 14.5                                                        EDDY.58
      GNUEQ =(UD*SIGMA/CGT)                                             EDDY.59
      IF(MCASE.GE.2) GNUEQ = 2.*GNUEQ                                   EDDY.60
      IF(KAP.GE.2) GO TO 6                                              EDDY.61
      IF(KEY.EQ.2) GO TO 5                                              EDDY.62
      GO TO 6                                                           EDDY.63
    5 GNULT    = GNULTB                                                 EDDY.64
      KAP      = 2                                                      EDDY.65
    6 CONTINUE                                                          EDDY.66
      IF(X(I)-XSTART) 40,40,35                                          EDDY.67
   35 CONTINUE                                                          EDDY.68
      GO TO (36,42,42),MCASE                                            EDDY.69
   36 CONTINUE                                                          EDDY.70
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C     IF(CNNS.GT.1.) GO TO 40                                                  EDDY.71
      GNUT2 =(GNULT +CONS*DX*(GNUEQ-GNULT)/DELS)*RAD                           EDDY.72
      GO TO 45                                                                 EDDY.73
   40 CONTINUE                                                                 EDDY.74
      GO TO (42,41,42), KGNQ                                                   EDDY.75
   41 GNUT2 = GNEQK                                                            EDDY.76
      GO TO 45                                                                 EDDY.77
   42 GNUT2 = GNUEQ                                                            EDDY.78
   45 GNULT = GNUT2                                                            EDDY.79
      B = 1./(1.41421*SIGD)                                                    EDDY.80
      GO TO (49,43,38), MCASE                                                  EDDY.81
   38 CONTINUE                                                                 EDDY.82
      UDC= .76*U8(3)                                                           EDDY.83
      SIGMAB    = .127*DELTA/12.                                               EDDY.84
      GNUEQB = UDC*SIGMAB/CGT*.65                                              EDDY.85
      YBB    =  .95*DELTA/DELS                                                 EDDY.86
      SIGB      =  12.*SIGMAB/DELS                                             EDDY.87
      GO TO 39                                                                 EDDY.88
   43 CONTINUE                                                                 EDDY.89
      UDDN = U(JSP,3)-U(JMX,3)                                                 EDDY.90
      URN = U(JMX,3)/UDDN                                                      EDDY.91
      CALL UDUNYB(URN,YBB,2)                                                   EDDY.92
      YBB = YBB*X(I)/DELS + Y(JSP)/DELS                                        EDDY.93
      IF(R(3).LE.1.0E+6) YBB =YBB + 3.*Y(JSP)/DELS                             EDDY.94
      CALL UDUNSG(URN,SIGB,2)                                                  EDDY.95
      SIGMAB = SIGB*X(I)/12.                                                   EDDY.96
      GNUEQB = (UDDN*SIGMAB/CGT)*2.3                                           EDDY.97
   39 CONTINUE                                                                 EDDY.98
      IF(X(I)-XSTART) 47,47,46                                                 EDDY.99
   46 CONTINUE                                                                 EDDY.100
      GNUT4 =(GNULTB + 10.*CONS*DX*(GNUEQB-GNULTB)/DELTA)*RAD                  EDDY.101
      GO TO 48                                                                 EDDY.102
   47 CONTINUE                                                                 EDDY.103
      GO TO (51,51,52), KGNQ                                                   EDDY.104
   51 GNUT4 = GNUEQB                                                           EDDY.105
      GO TO 48                                                                 EDDY.106
   52 GNUT4 = GNEQK                                                            EDDY.107
   48 GNULTB = GNUT4                                                           EDDY.108
      GNEQK = GNUT4                                                            EDDY.109
      B2    = 1./(1.41421*SIGB)                                                EDDY.110
      GO TO (49,37,49), MCASE                                                  EDDY.111
   37 CONTINUE                                                                 EDDY.112
      B2 =B2*DELS/X(I)                                                         EDDY.113
   49 CONTINUE                                                                 EDDY.114
      DO 300 J=2,JMX                                                           EDDY.115
      GO TO (50,70), KH                                                        EDDY.116
   50 CONTINUE                                                                 EDDY.117
      AY = UTAU**2                                                             EDDY.118
      AZ =  -PS(J,3)*Y(J)/12.                                                  EDDY.119
      IF(AZ.GT.AY*.5) AZ = .5*AY                                               EDDY.120
      UTTT = SQRT(AY-AZ)                                                       EDDY.121
      A = AA*GNU/UTTT                                                          EDDY.122
      GNT1 =(.001312)*(1.-EXP(-Y(J)/A))**2                                     EDDY.123
      GNT1= GNT1*(Y(J)**2)*ABS(DUDY(J,1))*12.                                  EDDY.124
   70 CONTINUE                                                                 EDDY.125
      YD = YYDEL(J)                                                            EDDY.126
   90 CONTINUE                                                                 EDDY.127
      ARG = B*(YD-YB)                                                          EDDY.128
      GO TO (71,72,72), MCASE                                                  EDDY.129
   72 CONTINUE                                                                 EDDY.130
      ARG2 = B2*(YD-YBB)                                                       EDDY.131
   71 CONTINUE                                                                 EDDY.132
      IF(ABS(ARG).GT.27.) GO TO 91                                             EDDY.133
      GAMMA =  .5*(1.-CHEBERF(ARG))                                            EDDY.134
      GO TO 93                                                                 EDDY.135
   91 GAMMA  = 1.                                                              EDDY.136
   93 CONTINUE                                                                 EDDY.137
      GO TO (96,82,82), MCASE                                                  EDDY.138
   82 CONTINUE                                                                 EDDY.139
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      IF(ABS(ARG2).GT.27.) GO TO 94                                          EDDY.140
      GAMMA2 = .5*(1.-CHEBERF(ARG2))                                         EDDY.141
      GO TO 96                                                               EDDY.142
   94 GAMMA2 = 1.                                                            EDDY.143
   96 CONTINUE                                                               EDDY.144
   98 CONTINUE                                                               EDDY.145
      GNUTA = GNUT4                                                          EDDY.146
      GO TO (83,84,84), MCASE                                                EDDY.147
   84 CONTINUE                                                               EDDY.148
      GNUTA = GNUT2                                                          EDDY.149
      GNUTB = GNUT4                                                          EDDY.150
      GO TO 85                                                               EDDY.151
   83 CONTINUE                                                               EDDY.152
      GNUTA = GNUT2 *GAMMA                                                   EDDY.153
   85 CONTINUE                                                               EDDY.154
   95 CONTINUE                                                               EDDY.155
      GO TO (97,100), KH                                                     EDDY.156
   97 CONTINUE                                                               EDDY.157
      PI        = 3.14159265                                                 EDDY.158
      B1B       = .5*(GNUTB-GNUTA)                                           EDDY.159
      GO TO (101,102,103), MCASE                                             EDDY.160
  102 CONTINUE                                                               EDDY.161
      YGNA  =  Y(J)                                                          EDDY.162
      YDNM  =  Y(JSP)- YGNA                                                  EDDY.163
      GO TO 101                                                              EDDY.164
  103 CONTINUE                                                               EDDY.165
      YGNA = Y(J)                                                            EDDY.166
      YDNM = Y(JMN) - YGNA                                                   EDDY.167
  101 CONTINUE                                                               EDDY.168
      IF(GNUTA-GNT1)  100,200,200                                            EDDY.169
  100 CONTINUE                                                               EDDY.170
      GO TO (504,500,502), MCASE                                             EDDY.171
  500 CONTINUE                                                               EDDY.172
      THHTA     = -PI*(Y(JSP)-Y(J))/YDNM                                     EDDY.173
      GO TO 504                                                              EDDY.174
  502 CONTINUE                                                               EDDY.175
      THHTA     = -PI*(Y(JMN)-Y(J))/YDNM                                     EDDY.176
  504 CONTINUE                                                               EDDY.177
      GO TO (120,112,111), MCASE                                             EDDY.178
  110 CONTINUE                                                               EDDY.179
      IF(Y(J)-Y(JSP)) 120,120,111                                            EDDY.180
  111 IF(Y(J)-Y(JMN)) 130,130,140                                            EDDY.181
  112 IF(Y(J)-Y(JSP)) 131,140,140                                            EDDY.182
  120 GNUT(J,I) = GNUTA                                                      EDDY.183
      GO TO 150                                                              EDDY.184
C 130 GNT(J,I) = GNUTA + (GNUTB-GNUTA)*(Y(J)-.50*Y(JSP))/(.75*Y(JSP))       EDDY.185
  131 GNUT(J,I) = GNUTA + (GNUTB-GNUTA)*(Y(J)-YGNA)/YDNM                     EDDY.186
      GO TO 150                                                              EDDY.187
  130 GNUT(J,I) = (GNUTA + B1B) + B1B*COS(THHTA)                             EDDY.188
      GO TO 150                                                              EDDY.189
  140 GNUT(J,I) = GNUTB*GAMMA2                                               EDDY.190
  150 CONTINUE                                                               EDDY.191
      KH = 2                                                                 EDDY.192
      GO TO 300                                                              EDDY.193
  200 GNUT(J,I)=GNT1                                                         EDDY.194
  300 CONTINUE                                                               EDDY.195
      IF(KCODE.LE.0) GO TO 620                                               EDDY.196
      GO TO (605,613),KCORE                                                  EDDY.197
  605 CONTINUE                                                               EDDY.198
      IF(X(3).GE.TAUP) GO TO 606                                             EDDY.199
      GO TO 607                                                              EDDY.200
  606 CONTINUE                                                               EDDY.201
      KCORE = 2                                                              EDDY.202
      GO TO 613                                                              EDDY.203
  607 CONTINUE                                                               EDDY.204
      GO TO (610,610,600),MCASE                                              EDDY.205
  600 CONTINUE                                                               EDDY.206
      XLAST = X(3)                                                           EDDY.207
      DO 601 J=2,JSP                                                         EDDY.208
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      GNUT(J,I) = 0.                                                    EDDY.209
  601 CONTINUE                                                          EDDY.210
  613 CONTINUE                                                          EDDY.211
      JMM = JSP+1                                                       EDDY.212
      DO 603 J = JMM,JMN                                                EDDY.213
      IF(U(J,I).LE.UMX*.95) GO TO 604                                   EDDY.214
  603 CONTINUE                                                          EDDY.215
  604 CONTINUE                                                          EDDY.216
      JDY = J                                                           EDDY.217
      IF(JDY.LE.(JSP+2))KFLAT = 2                                       EDDY.218
      IF(KFLAT.GE.2) GO TO 610                                          EDDY.219
C     IF(JDY.EQ.JMN) GO TO 610                                          EDDY.220
      IF(KCORE.LE.1) GO TO 617                                          EDDY.221
      FAD = .5*GNUTA                                                    EDDY.222
      KSP = JSP-4                                                       EDDY.223
      DO 615 J =KSP,JSP                                                 EDDY.224
      THH1 = PI*(Y(JSP)-Y(J))/(Y(JSP)-Y(KSP))                           EDDY.225
      GNUT(J,I) = FAD - FAD*COS(THH1)                                   EDDY.226
  615 CONTINUE                                                          EDDY.227
  617 CONTINUE                                                          EDDY.228
      JDY1 = JDY-1                                                      EDDY.229
      DO 614 J = JMM,JDY1                                               EDDY.230
      GNUT(J,I) = 0.                                                    EDDY.231
  614 CONTINUE                                                          EDDY.232
      JMN2 = JDY + 4                                                    EDDY.233
      DAD = .5*GNUT(JMN2,I)                                             EDDY.234
      DO 616 J = JDY,JMN2                                               EDDY.235
      THH2 = (-PI*(Y(JMN2)-Y(J)))/(Y(JMN2)-Y(JDY))                      EDDY.236
      GNUT(J,I) = DAD + DAD*COS(THH2)                                   EDDY.237
  616 CONTINUE                                                          EDDY.238
      IF(KCORE.EQ.2) GO TO 610                                          EDDY.239
      GO TO 620                                                         EDDY.240
  610 CONTINUE                                                          EDDY.241
      IF(X(3).LT.TRIP) GO TO 620                                        EDDY.242
      GO TO (620,620,611),MCASE                                         EDDY.243
  611 CONTINUE                                                          EDDY.244
      XFAST = XLAST + .1                                                EDDY.245
      IF(X(3).GE.XFAST) GO TO 621                                       EDDY.246
      SAD = -5.*PI*(XFAST-X(3))                                         EDDY.247
      DO 612 J = 2,JSP                                                  EDDY.248
      GAD = .5*GNUT(J,I)                                                EDDY.249
      GNUT(J,I) = GAD + GAD*COS(SAD)                                    EDDY.250
  612 CONTINUE                                                          EDDY.251
      GO TO 620                                                         EDDY.252
  621 CONTINUE                                                          EDDY.253
      IF(KFLAT.GE.2) KCODE = 0                                          EDDY.254
  620 CONTINUE                                                          EDDY.255
      RETURN                                                            EDDY.256
  400 STOP                                                              EDDY.257
      END                                                               EDDY.258

      SUBROUTINE EXTRAP(ITR,JMX,U,X,LPR,UP,U8)                          EXTRAP.2
C  ROUTINE TO LINEARIZE THE MOMENTUM EQUATION                           EXTRAP.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),EXTRAP.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),D(100,3),UT(100),V(100),EXTRAP.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),     EXTRAP.6
     3DMP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  EXTRAP.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),          EXTRAP.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    EXTRAP.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)EXTRAP.10
     7,A4(100),DUMMY(452)                                               EXTRAP.11
      DIMENSION X(3),U(100,3),UP(100),U8(3)                             EXTRAP.12
      COMMON/ DU8X / DU8X                                               EXTRAP.13
      COMMON/W8/W8(3)                                                   EXTRAP.14
      JMX1 = JMX-1                                                      EXTRAP.15
      JMM = JMX + 3                                                     EXTRAP.16
      JMM1 = JMM - 1                                                    EXTRAP.17
      JMX2 = JMX + 1                                                    EXTRAP.18
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      UP(JMX) = U8(3)                                                    EXTRAP.19
      WP(JMX) = W8(3)                                                    EXTRAP.20
      DO 40 J = JMX2,JMM1                                                EXTRAP.21
      UP(J) = U(J,3)                                                     EXTRAP.22
      WP(J) = W(J,3)                                                     EXTRAP.23
   40  CONTINUE                                                          EXTRAP.24
      DO 50 J = JMM,100                                                  EXTRAP.25
      UP(J)    =  U8(3)                                                  EXTRAP.26
      WP(J) = W8(3)                                                      EXTRAP.27
   50  CONTINUE                                                          EXTRAP.28
      IF(ITR-1) 200,200,100                                              EXTRAP.29
  100 DO 150 J=1,JMX1                                                    EXTRAP.30
      UP(J) = .75*U(J,3) + .25*UP(J)                                     EXTRAP.31
      WP(J) = .75*W(J,3) + .25*WP(J)                                     EXTRAP.32
  150 CONTINUE                                                           EXTRAP.33
      RETURN                                                             EXTRAP.34
  200 GO TO (210,300), LPR                                               EXTRAP.35
  210 DO 220 J=1,JMX1                                                    EXTRAP.36
      UP(J) = U(J,2) + (DU8X/12.)*(X(3)-X(2))                            EXTRAP.37
      WP(J) = W(J,2)                                                     EXTRAP.38
  220 CONTINUE                                                           EXTRAP.39
      UP(1) = 0.                                                         EXTRAP.40
       WP(1) = 0.                                                        EXTRAP.41
      RETURN                                                             EXTRAP.42
  300 DX1 = X(3)-X(2)                                                    EXTRAP.43
      DX2 = X(2)-X(1)                                                    EXTRAP.44
      DO 350 J=1,JMX1                                                    EXTRAP.45
      DU = U(J,2)-U(J,1)                                                 EXTRAP.46
      DW = W(J,2) - W(J,1)                                               EXTRAP.47
      UP(J) = U(J,2) + DU*DX1/DX2                                        EXTRAP.48
      WP(J) = W(J,2) + DW*DX1/DX2                                        EXTRAP.49
  350 CONTINUE                                                           EXTRAP.50
      RETURN                                                             EXTRAP.51
      END                                                                EXTRAP.52
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REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

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      FUNCTION FF(A)                                                     FF.2
                                                                         FF.3
      EQUIVALENCE (KA,AA)                                                FF.4
      AA = A                                                             FF.5
      FF = FLOAT(KA)                                                     FF.6
      RETURN                                                             FF.7
      END                                                                FF.8
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      SUBROUTINE HTABLE(H,DEL,NDEG)                                      HTABLE.2
      DIMENSION UDUNT(41),SIGBT(41),YBBT(41)                             HTABLE.3
      DIMENSION HT(78), YBARDT(78), YBAREC(78), YDT(78), SIGDT(78)       HTABLE.4
      DIMENSION SIGRE(78)                                                HTABLE.5
      DATA (HT(I),I=1,78)/1.26,1.28,1.30,1.32,1.34,1.36,1.38,1.40,       HTABLE.6
     1               1.42,1.44,1.46,1.48,1.50,1.52,1.54,1.56,1.58,       HTABLE.7
     2               1.60,1.62,1.64,1.66,1.68,1.70,1.72,1.74,1.76,       HTABLE.8
     3               1.78,1.80,1.82,1.84,1.86,1.88,1.90,1.92,1.94,       HTABLE.9
     4               1.96,1.98,2.00,2.02,2.04,2.06,2.08,2.10,2.12,       HTABLE.10
     5               2.14,2.16,2.18,2.20,2.22,2.24,2.26,2.28,2.30,       HTABLE.11
     6               2.32,2.34,2.36,2.38,2.40,2.42,2.44,2.46,2.48,       HTABLE.12
     7               2.50,2.52,2.54,2.56,2.58,2.60,2.62,2.64,2.66,       HTABLE.13
     8               2.68,2.70,2.72,2.74,2.76,2.78,2.80/                 HTABLE.14
      DATA(YBARDT(I), I=1,78)/11.8,10.15,9.,8.2,7.4,6.82,6.36,6.,        HTABLE.15
     1                 5.7,5.43,5.23,5.04,4.86,4.71,4.59,4.49,4.38,     HTABLE.16
     2                 4.3,4.2,4.13,4.05,3.99,3.91,3.85,3.8,3.74,       HTABLE.17
     3                 3.69,3.64,3.59,3.53,3.49,3.46,3.41,3.38,3.33,    HTABLE.18
     4               3.29,3.26,3.22,3.2,3.18,3.16,3.13,3.1,3.09,        HTABLE.19
     5               3.07,3.05,3.03,3.01,3.,2.99,2.97,2.95,2.93,        HTABLE.20
     6               2.92,2.91,2.9,2.89,21*2.88/                        HTABLE.21
      DATA(YBAREC(I), I=1,78)/8.5, 7.85,7.3, 6.75,6.3, 5.87,5.5,         HTABLE.22
     1               5.21,5.,  4.75,4.52,4.37,4.2, 4.07,3.95,3.82,      HTABLE.23
     2               3.74,3.64,3.57,3.5, 3.44,3.37,3.31,3.29,3.23,      HTABLE.24
     3               3.19,3.14,3.1, 3.04,3.,  2.95,2.9, 2.88,2.84,      HTABLE.25
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4              2.81,2.79,2.75,2.71,2.69,2.66,2.63,2.61,2.59,        HTABLE.26
5              2.58,2.56,2.54,2.52,2.5, 2.48,2.46,2.44,2.42,        HTABLE.27
6              2.41,2.4, 2.39,2.38,2.37,2.36,2.35,19*2.34/          HTABLE.28
 DATA(YDT(I), I=1,78)/1.2, 1.2, 1.2, 1.2, 1.2, 1.2, 1.1, 1.01,      HTABLE.29
1           .915,.83, .758,.696,.645,.588,.544,.503,.47, .435,      HTABLE.30
2           .402,.372,.345,.32, .296,.277,.261,.246,.235,.222,      HTABLE.31
3           .214,.205,.199,.191,.186,.182,.179,.174,.171,.169,      HTABLE.32
4           .165,.162,.16, .159,.158,.157,.156,.155,.154,31*.153/   HTABLE.33
 DATA(SIGDT(I), I=1,78)/2.8, 2.34,1.94,1.62,1.41,1.25,1.14,1.05,    HTABLE.34
1            .99, .93, .885,.84, .805,.775,.75, .725,.705,.68,     HTABLE.35
2            .66, .645,.63, .615,.6,  .59, .575,.565,.555,.545,    HTABLE.36
3            .535,.53, .525,.518,.512,.505,.5,  .495,.49, .486,    HTABLE.37
4            .48, .478,.475,.47, .465,.46, .458,.455,.45, .443,    HTABLE.38
5            .44, .437,.432,.428,.425,.422,.421,.419,.418,.417,    HTABLE.39
6            .415,.412,.408,17*.405/                               HTABLE.40
 DATA(SIGRE(I), I=1,78)/2.8, 2.54,2.3, 2.11,1.93,1.78,1.65,1.53,    HTABLE.41
1            1.43,1.34,1.27,1.21,1.15,1.1, 1.06,1.02,.98, .95,     HTABLE.42
2            .92, .89, .86, .84, .81, .79, .768,.748,.725,.705,    HTABLE.43
3            .69, .675,.658,.645,.63, .62, .605,.595,.585,.575,    HTABLE.44
4            .567,.56, .553,.548,.54, .537,.53, .522,.518,.515,    HTABLE.45
5            .508,.505,.5,  .498,.495,.492,.49, .488,.482,.48,     HTABLE.46
6            .478,.476,.474,.472,16*.47/                           HTABLE.47
 DATA (UDUNT(I), I=1,41)/.0,.1,.2,.3,.4,.5,.6,.7,.8,.9,1.0,1.1,     HTABLE.48
1                    1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,2.0,2.1,2.2,   HTABLE.49
2                        2.3,2.4,2.5,2.6,2.7,2.8,2.9,3.0,3.1,3.2,   HTABLE.50
3                        3.3,3.4,3.5,3.6,3.7,3.8,3.9,4.0/           HTABLE.51
 DATA (SIGBT(I), I=1,41)/.0224,.01875,.0175,.0158,.01445,.0136,     HTABLE.52
1                        .0131,.0128,.01255,.0123,.012,.01175,      HTABLE.53
2                        .01145,.0112,.0109,.0106,.01038,.01,.00975HTABLE.54
3                       ,.0095,.0092,.0089,.00865,.00835,.00807,    HTABLE.55
4                       .0078,.0075,.00725,.0069,.0066,.0064,.00607,HTABLE.56
5                       .0058,.0055,.0052,.0049,.0046,.00416,.0041, HTABLE.57
6                       .00378,.00353/                              HTABLE.58
 DATA (YBBT(I), I=1,41)/.1325,.115,.1015,.0915,.084,.0775,.0719,    HTABLE.59
1                      .0676,.064,.0606,.0578,.0555,.0531,.0513,    HTABLE.60
2                      .0495,.048,.0466,.0453,.044,.043,.0416,.0406,HTABLE.61
3                      .0399,.0389,.0382,.0375,.0367,.036,.0355,    HTABLE.62
4                      .0349,.0343,.0337,.0331,.0327,.0321,.0318,   HTABLE.63
5                      .0313,.031, .0309,.0304,.03/                 HTABLE.64
 ENTRY UDUNYB                                                       HTABLE.65
 DEL = TBLU1(H,UDUNT,YBBT,NDEG,41)                                  HTABLE.66
 RETURN                                                             HTABLE.67
 ENTRY UDUNSG                                                       HTABLE.68
 DEL = TBLU1(H,UDUNT,SIGBT,NDEG,41)                                 HTABLE.69
 RETURN                                                             HTABLE.70
 ENTRY HTSIG                                                        HTABLE.71
 DEL = TBLU1(H,HT,SIGDT,NDEG,78)                                    HTABLE.72
 RETURN                                                             HTABLE.73
 ENTRY HTYBAR                                                       HTABLE.74
 DEL = TBLU1(H,HT,YBARDT,NDEG,78)                                   HTABLE.75
 RETURN                                                             HTABLE.76
 ENTRY HTYDEL                                                       HTABLE.77
 DEL = TBLU1(H,HT,YDT,NDEG,78)                                      HTABLE.78
 RETURN                                                             HTABLE.79
 ENTRY HTSIR                                                        HTABLE.80
 DEL = TBLU1(H,HT,SIGRE,NDEG,78)                                    HTABLE.81
 RETURN                                                             HTABLE.82
 ENTRY HTYBRE                                                       HTABLE.83
 DEL = TBLU1(H,HT,YBAREC,NDEG,78)                                   HTABLE.84
 RETURN                                                             HTABLE.85
 END                                                                HTABLE.86

    SUBROUTINE ITSM(X,XC,IX,KX,NX)                                    ITSM.2
    DIMENSION XC(1),IX(1)                                             ITSM.3
    B=1.E30                                                           ITSM.4
    DO 2 I=1,NX                                                       ITSM.5
    A=ABS(XC(I)-X)                                                    ITSM.6
    IF (B-A)2,1,1                                                     ITSM.7
```

```
1     B=A                                                              ITSM.8
      N=I                                                              ITSM.9
2     CONTINUE                                                         ITSM.10
      L=N-1                                                            ITSM.11
      IX(1)=N                                                          ITSM.12
      N=N+1                                                            ITSM.13
      DO 7 I=1,KX                                                      ITSM.14
      IF (L)6,6,3                                                      ITSM.15
3     IF (N-NX)4,4,5                                                   ITSM.16
4     A=ABS(XC(L)-X)                                                   ITSM.17
      B=ABS(XC(N)-X)                                                   ITSM.18
      IF (A-B)5,5,6                                                    ITSM.19
5     IX(I+1)=L                                                        ITSM.20
      L=L-1                                                            ITSM.21
      GO TO 7                                                          ITSM.22
6     IX(I+1)=N                                                        ITSM.23
      N=N+1                                                            ITSM.24
7     CONTINUE                                                         ITSM.25
      RETURN                                                           ITSM.26
      END                                                              ITSM.27

      FUNCTION LSVFN(X,XSTART,LHV,H,HSV,THETA,TH2,CF2,CF3)             LSVFN.2
C FUNCTION TO GET LPR, HSV, ETC.                                       LSVFN.3
      DIMENSION X(3),CF2(3)                                            LSVFN.4
      IF(X(3)-XSTART) 61,61,63                                         LSVFN.5
   61 LPR = 1                                                          LSVFN.6
      GO TO 64                                                         LSVFN.7
   63 LPR = 2                                                          LSVFN.8
   64 CONTINUE                                                         LSVFN.9
      GO TO (71,74), LHV                                               LSVFN.10
71    HSV = H                                                          LSVFN.11
      TH2 = THETA                                                      LSVFN.12
      CF3 = CF2(3)                                                     LSVFN.13
      LHV = 2                                                          LSVFN.14
74    CONTINUE                                                         LSVFN.15
      LSVFN = LPR                                                      LSVFN.16
      RETURN                                                           LSVFN.17
      END                                                              LSVFN.18

      SUBROUTINE MATRIX(B,G,JMX,II,JJ)                                 MATRIX.2
      DIMENSION B(1),       G(1)                                       MATRIX.3
      JMX1      =  JMX-1                                               MATRIX.4
      JMX2      =  JMX-2                                               MATRIX.5
      JP = JJ                                                          MATRIX.6
      KK = II*JJ+1                                                     MATRIX.7
      DO 400 I=1,JMX1                                                  MATRIX.8
  100 LL = KK*(I-1)+1                                                  MATRIX.9
      IF(I-(JMX-JJ)) 115,110,110                                       MATRIX.10
  110 JP = JMX1  -I                                                    MATRIX.11
  115 W  = 1./B(LL)                                                    MATRIX.12
      IF(JP) 200,200,120                                               MATRIX.13
  120 DO 150 L=1,JP                                                    MATRIX.14
  150 B(LL+L) = W*B(LL+L)                                              MATRIX.15
  200 G(I) = W*G(I)                                                    MATRIX.16
      IQ = II                                                          MATRIX.17
      IF(I-(JMX-II)) 220,210,210                                       MATRIX.18
  210 IQ = (JMX1) -I                                                   MATRIX.19
  220 IF(IQ) 400,400,300                                               MATRIX.20
  300 DO 380 L=1,IQ                                                    MATRIX.21
      N  = (KK-1)*L + LL                                               MATRIX.22
      DO 360 LS=1,JP                                                   MATRIX.23
  360 B(N+LS) = B(N+LS)-B(N)*B(LL+LS)                                  MATRIX.24
  380 G(L+I)  = G(L+I) - B(N)*G(I)                                     MATRIX.25
  400 CONTINUE                                                         MATRIX.26
      L  = KK*JMX2+1                                                   MATRIX.27
  500 DO 600 M=1,JMX2                                                  MATRIX.28
      I = JMX2-(M-1)                                                   MATRIX.29
      L  = L-KK                                                        MATRIX.30
```

```
      JP = JJ                                                          MATRIX.31
      IF(I-(JMX-JJ)) 520,510,510                                       MATRIX.32
  510 JP = JMX1-I                                                      MATRIX.33
  520 IF(JP) 550,550,530                                               MATRIX.34
  530 DO 540 LS=1,JP                                                   MATRIX.35
  540 G(I) = G(I)-B(L,LS)*G(I+LS)                                      MATRIX.36
  550 CONTINUE                                                         MATRIX.37
  600 CONTINUE                                                         MATRIX.38
      RETURN                                                           MATRIX.39
      END                                                              MATRIX.40

      SUBROUTINE OPTION(LN,LST2,DX2,DX1,DXMAX,ITR,X,LOPT,KRP2,LDX)     OPTION.2
      DIMENSION X(3)                                                   OPTION.3
      GO TO (250,90,300,400), LN                                       OPTION.4
   90 LOPT = 1                                                         OPTION.5
      RETURN                                                           OPTION.6
  250 CONTINUE                                                         OPTION.7
      GO TO (90,251), LST2                                             OPTION.8
  251 CONTINUE                                                         OPTION.9
      DX2 = DX1*2.                                                     OPTION.10
      IF(DX2 - DXMAX) 260,260,255                                      OPTION.11
  255 DX1  = DXMAX                                                     OPTION.12
      DX2 = DX1                                                        OPTION.13
  260 CONTINUE                                                         OPTION.14
      GO TO 90                                                         OPTION.15
  300 CONTINUE                                                         OPTION.16
      KRP2 = 1                                                         OPTION.17
  303 GO TO (310,320), KRP2                                            OPTION.18
  310 CONTINUE                                                         OPTION.19
C 310 CALL PRINT(5)                                                    OPTION.20
  320 ITR = ITR+1                                                      OPTION.21
      LOPT = 2                                                         OPTION.22
      RETURN                                                           OPTION.23
  400 CONTINUE                                                         OPTION.24
      ITR = 1                                                          OPTION.25
      GO TO (420,410), LST2                                            OPTION.26
  410 CONTINUE                                                         OPTION.27
      LDX = LDX+1                                                      OPTION.28
      X(3) = X(3)-DX1/2.                                               OPTION.29
      DX1 = .5*DX1                                                     OPTION.30
      DX2 = DX1                                                        OPTION.31
  420 CONTINUE                                                         OPTION.32
      IF(LDX-16) 800,900,900                                           OPTION.33
  800 LOPT = 2                                                         OPTION.34
      RETURN                                                           OPTION.35
  900 LOPT = 3                                                         OPTION.36
      RETURN                                                           OPTION.37
      END                                                              OPTION.38

      SUBROUTINE PFIELD(L,X,P,Y,XTB)                                   PFIELD.2
C  ROUTINE TO CALCULATE THE EXTERNAL PRESSURE FIELD                    PFIELD.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),PFIELD.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),PFIELD.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),    PFIELD.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),PFIELD.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),         PFIELD.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),   PFIELD.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)PFIELD.10
     7,A4(100),DUMMY(452)                                              PFIELD.11
      DIMENSION P(3),Y(100),XTB(30)                                    PFIELD.12
      COMMON/PLUB/ NCPX,NCPY,KCP, YDELP                                PFIELD.13
      COMMON/SZ1/JMX                                                   PFIELD.14
      COMMON/ SZ3/DUDM(3),U8(3)                                        PFIELD.15
      COMMON/JAG/LST2                                                  PFIELD.16
      COMMON/STAT/PHREF,UREF                                           PFIELD.17
      COMMON/GRID/YCP(20),CP(20,30),YGAP                               PFIELD.18
      COMMON/STP/KSTP                                                  PFIELD.19
      COMMON/UVEL/UEND                                                 PFIELD.20
```

```
      JMX1 = JMX - 1                                                    PFIELD.21
      GO TO(30,40),KSTP                                                 PFIELD.22
   30 CONTINUE                                                          PFIELD.23
      DO 20 J = 1,JMX1                                                  PFIELD.24
      PS(J,3) = -TBLU2(Y(J),X,YCP,XTB,PPC,1,1,NCPY,NCPX,20,30)          PFIELD.25
   20 CONTINUE                                                          PFIELD.26
   40 CONTINUE                                                          PFIELD.27
      P(3) = TBLU2(Y(JMX),X,YCP,XTB,PPC,1,1,NCPY,NCPX,20,30)            PFIELD.28
      JMM = JMX + 4                                                     PFIELD.29
      JML = JMX-6                                                       PFIELD.30
      GO TO (60,50),KSTP                                                PFIELD.31
   50 CONTINUE                                                          PFIELD.32
      DO 10 J = 1,JMM                                                   PFIELD.33
      UEDGE(J) = TBLU2(Y(J),X,YCP,XTB,UUC,1,1,NCPY,NCPX,20,30)          PFIELD.34
   10 CONTINUE                                                          PFIELD.35
      UEND = UEDGE(JMX1)                                                PFIELD.36
      U8(3) = UEDGE(JMX)                                                PFIELD.37
      U(JMX+1,3) = UEDGE(JMX+1)                                         PFIELD.38
      U(JMX+2,3) = UEDGE(JMX+2)                                         PFIELD.39
   60 CONTINUE                                                          PFIELD.40
      GO TO (200,300), L                                                PFIELD.41
  200 CONTINUE                                                          PFIELD.42
      P(2) = P(3)                                                       PFIELD.43
      P(1) = P(3)                                                       PFIELD.44
      U8(2)    =  U8(3)                                                 PFIELD.45
      U8(1)    =  U8(3)                                                 PFIELD.46
  300 RETURN                                                            PFIELD.47
      END                                                               PFIELD.48
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      SUBROUTINE POUT(NPRF,X,XMX,KRTNN,LST2,ITRR,LN,ITR)                POUT.2
      DIMENSION X(3)                                                    POUT.3
      COMMON/PNTOP/KKZ                                                  POUT.4
      COMMON/XFND/XFIND(20),NXFIND                                      POUT.5
      DATA KXFIND/1/                                                    POUT.6
      IF(KXFIND.GT.NXFIND)GO TO 200                                     POUT.7
      IF(X(3).LT.XFIND(KXFIND))GO TO 200                                POUT.8
      CALL PRINT(2)                                                     POUT.9
      KXFIND=KXFIND+1                                                   POUT.10
  200 CONTINUE                                                          POUT.11
C     IF(ABS(X(3)-XX(KP))-1.E-06) 102,102,101                           POUT.12
      IF(NPRF.EQ.1) GO TO 103                                           POUT.13
  101 KNPRT    =  MOD(NPRF,KKZ)                                         POUT.14
      IF(KNPRT.EQ.0) GO TO 103                                          POUT.15
      GO TO 105                                                         POUT.16
C 102 KP = KP+1                                                         POUT.17
  103 CALL PRINT(2)                                                     POUT.18
  105 IF(X(3)-XMX) 108,106,106                                          POUT.19
  106 CALL PRINT(2)                                                     POUT.20
      KRTNN = 1                                                         POUT.21
      RETURN                                                            POUT.22
  108 CONTINUE                                                          POUT.23
      KRTNN = 2                                                         POUT.24
      GO TO (95,97), LST2                                               POUT.25
   95 ITRR=ITRR+1                                                       POUT.26
      CALL TEST(LN,ITR,2,LST2)                                          POUT.27
   97 GO TO (80,98), LST2                                               POUT.28
   80 CALL SORT(2)                                                      POUT.29
C PERFORM SORT, BUT NOT FOR X.                                          POUT.30
C PRINTOUT THE NEW V.                                                   POUT.31
      CALL PRINT(2)                                                     POUT.32
      GO TO 84                                                          POUT.33
C PERFORM USUAL SORT.                                                   POUT.34
   98 CALL SORT(1)                                                      POUT.35
   84 CONTINUE                                                          POUT.36
      RETURN                                                            POUT.37
      END                                                               POUT.38
```

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      SUBROUTINE PRINT(L)                                                    PRINT.2
C  ROUTINE TO PRINT BOUNDARY LAYER OUTPUT                                     PRINT.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),     PRINT.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),     PRINT.5
     2 GAMI(100),GAMF(100),D(200),US(100),YY(100),DM(100),UUR(100),          PRINT.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),       PRINT.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUNCE(200),               PRINT.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),         PRINT.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)     PRINT.10
     7,A4(100),UR(100,3),DUMMY(152)                                          PRINT.11
      COMMON /TITLE/ TITLE(8)                                                PRINT.12
      DIMENSION X(3),U8(3),P(3),CF2(3)                                       PRINT.13
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                       PRINT.14
      COMMON/SZ3/X,U8                                                        PRINT.15
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU                   PRINT.16
      COMMON/ PRESSUR / P                                                    PRINT.17
      COMMON/SZ9/ITR                                                         PRINT.18
      COMMON/SZ14/NPRF                                                       PRINT.19
      COMMON/SZ21/ITRR                                                       PRINT.20
      COMMON/VPRF/WVPR                                                       PRINT.21
      COMMON/SZTBL/XSW,HSV                                                   PRINT.22
      COMMON/XMON/TH2,CF3                                                    PRINT.23
      COMMON/XMPR/UTEST,UTJ,UTSS,UTRR                                        PRINT.24
      COMMON/CL/CL,CDT,CDF,CDP,DUM(2),CM                                     PRINT.25
      COMMON/ CURV1 / R(3)                                                   PRINT.26
      COMMON/STAT/PHREF,UREF                                                 PRINT.27
      COMMON/SANGLE/SANGLE                                                   PRINT.28
      COMMON/PHIL/IPHIL                                                      PRINT.29
      COMMON/ITR/ITR999,ITRM99                                               PRINT.30
      COMMON/PARAM/MACH,ALPHA,REFA,MATIN,REFC,UIN,REFX,REFZ,CREF             PRINT.31
      DIMENSION YNORM(100),UNORM(100),WNORM(100)                             PRINT.32
      IF(ITR999.LT.IPHIL)GO TO (75,6001,75,75,6002,75,75,75,75,75),L         PRINT.33
      GO TO (100,200,300,400,500,600,700,800,900,1000), L                    PRINT.34
  100 WRITE(6,1)                                                             PRINT.35
      RETURN                                                                 PRINT.36
  200 CONTINUE                                                               PRINT.37
      WRITE(6,22)                                                            PRINT.38
C NORMAL PRINTOUT                                                            PRINT.39
      WRITE(6,20) (TITLE(I), I=1,8)                                          PRINT.40
      WRITE(6,26) X(3),X(3),DX,UTAU,DELTA,CF2(1),DELS,CF2(2),THETA,          PRINT.41
     1  CF2(3),H,ITR,UC,NPRF,U8(3),R(3)                                      PRINT.42
      WRITE(6,7) X(2),X(3),X(3)                                              PRINT.43
      DO 6666 J=1,JMX                                                        PRINT.44
      YNORM(J)=Y(J)/REFC                                                     PRINT.45
      UNORM(J)=U(J,3)/U(JMX,3)                                               PRINT.46
      WNORM(J) = 0.0                                                         PRINT.47
      IF(W(JMX,3).EQ.0.0)GO TO 6666                                          PRINT.48
      WNORM(J)=W(J,3)/W(JMX,3)                                               PRINT.49
 6666 CONTINUE                                                               PRINT.50
      WRITE(6,9)(YNORM(J),WNORM(J),UNORM(J),UP(J),DUDY(J,3),                 PRINT.51
     , V(J),GNUT(J,3),                                                       PRINT.52
     1 PS(J,3),UEDGE(J), J=1,JMX)                                            PRINT.53
 6001 IF (SANGLE .EQ. 0.) GO TO 55                                           PRINT.54
      CALL RESULT(CF2,JMX,X,2)                                               PRINT.55
   55 CONTINUE                                                               PRINT.56
      RETURN                                                                 PRINT.57
  300 CONTINUE                                                               PRINT.58
      WRITE(6,22)                                                            PRINT.59
C PRINT ITERATION NUMBER                                                     PRINT.60
      WRITE(6,5) ITR                                                         PRINT.61
      RETURN                                                                 PRINT.62
C PRINT TERMINATION MESSAGE.                                                 PRINT.63
  400 WRITE(6,12)                                                            PRINT.64
      RETURN                                                                 PRINT.65
  500 CONTINUE                                                               PRINT.66
      WRITE(6,22)                                                            PRINT.67
      WRITE(6,15) X(3)                                                       PRINT.68
      WRITE(6,14) X(3),DELTA,DELS,THETA,H,UD,UTAU,CF2(1),CF2(2),CF2(3),      PRINT.69
     1ITR,NPRF,U8(3)                                                         PRINT.70
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```
 6002 DO 520 J = 1,JMX                                                          PRINT.71
      UR(J,2) = UP(J)                                                           PRINT.72
  520 UR(J,3) = U(J,3)                                                          PRINT.73
      ITRM1 = ITR-1                                                             PRINT.74
C PRINT LAST TWO ITERATIONS.                                                    PRINT.75
      WRITE(6,16)   ITRM1,ITR                                                   PRINT.76
      WRITE(6,17) (Y(J), (UR(J,I), I=2,3), DUDY(J,3), V(J),GNUT(J,3),           PRINT.77
     1    PS(J,3), J=1,JMX)                                                     PRINT.78
      RETURN                                                                    PRINT.79
  600 CONTINUE                                                                  PRINT.80
      WRITE(6,22)                                                               PRINT.81
C PRINT NO CONVERGENCE MESSAGE.                                                 PRINT.82
      WRITE(6,21) ITRR                                                          PRINT.83
      RETURN                                                                    PRINT.84
  700 CONTINUE                                                                  PRINT.85
      WRITE(6,22)                                                               PRINT.86
C PRINT ARRAY OVERFLOW MESSAGE.                                                 PRINT.87
      WRITE(6,30) JMX                                                           PRINT.88
      WRITE(6,22)                                                               PRINT.89
      RETURN                                                                    PRINT.90
  800 CONTINUE                                                                  PRINT.91
C PRINT SEPARATION MESSAGE.                                                     PRINT.92
      WRITE(6,35)                                                               PRINT.93
      WRITE(6,22)                                                               PRINT.94
      RETURN                                                                    PRINT.95
  900 CONTINUE                                                                  PRINT.96
      WRITE(6,22)                                                               PRINT.97
      RETURN                                                                    PRINT.98
 1000 CONTINUE                                                                  PRINT.99
      WRITE(6,22)                                                               PRINT.100
      WRITE(6,50) DELS,THETA,H                                                  PRINT.101
      WRITE(6,60)                                                               PRINT.102
      WRITE(6,61) CL,CDT                                                        PRINT.103
      WRITE(6,22)                                                               PRINT.104
   75 RETURN                                                                    PRINT.105
    1 FORMAT(1H1,20X,*CALCULATED VELOCITY FIELD FOR FLAP UPPER SURFACE*)        PRINT.106
    5 FORMAT(1H ,20X,20H** NO CONVERGENCE IN,I4,16H  ITERATIONS. **/)           PRINT.107
    7 FORMAT(1H ,14X,3HX =F12.8,3X,3HX =F12.8,3X,3HX =F12.8/1H ,2X,1HY,1       PRINT.108
     13X,1HH,17X,1HU,17X,2HUP,10X,5HDU/DY,7X,1HV,11X,4HEDDY,8X,6HP-GRAD,       PRINT.109
     1 8X,10HU-INVISCID)                                                        PRINT.110
    9 FORMAT(1H ,F9.5,2X,E12.3,6X,E12.3,6X,6E12.3)                              PRINT.111
   12 FORMAT(1H0//1H0,30X,16HCASE TERMINATED.)                                  PRINT.112
   14 FORMAT(1H ,72X,13HVALUES AT X =,F12.8/73X,7HDELTA =E12.3/73X,7HDELPRINT.113
     1*  =E12.3/73X,7HTHETA =E12.3/73X,7HH.... =E12.3/73X,7HUD... =E12.3PRINT.114
     2/73X,7HUTAU  =E12.3/73X,7HCF(1) =E12.3/ 73X,7HCF(2) =E12.3/73X,7HCPRINT.115
     3F(3) =E12.3/73X,7HITER  =,I4/73X,7HPRF.NO=,I5/73X7HU      =,E12.3) PRINT.116
   15 FORMAT(1H ,30X,38HRESULTS FOR LAST TWO ITERATIONS AT X =,F12.8)           PRINT.117
   16 FORMAT(1H ,14X, 6HITER =I2,10X,6HITER =I2,18X,17HOTHER VALUES USEDPRINT.118
     1/1H ,2X,1HY,13X,5HU/UFS,13X,5HU/UFS,13X,5HDU/DY,7X,1HV,11X,4HGNUT,PRINT.119
     2          14X,2HPS,8X,7HSTAT-PR)                                         PRINT.120
   17 FORMAT(1H ,F8.6,3X,E12.3,6X,E12.3,6X,3E12.3,5X,E12.3)                     PRINT.121
   20 FORMAT(1H ,20X,8A10,10X,A10,A2)                                           PRINT.122
   21 FORMAT(1H0, 25HNO PROFILE CONVERGENCE IN, I3,12H ITERATIONS.)             PRINT.123
   22 FORMAT(1H0/1H0,15X,100(1H*)///)                                           PRINT.124
   24 FORMAT(1H ,41X,28HRESULTS-LAST THREE PROFILES.)                           PRINT.125
   26 FORMAT(8H AT X  =,F12.8,54X,8H AT X  =,F12.8/8H0DX     =,E11.3,56X,PRINT.126
     1       7HUTAU  =,E11.3/8H DELTA =,E11.3,56X,7HCF2(1)=,E11.3/          PRINT.127
     1       8H DELS  =,E11.3,56X,7HCF2(2)=,E11.3/8H THETA =,E11.3,56X,     PRINT.128
     1       7HCF2(3)=,E11.3/8H H      =,E11.3,56X,7HITER  =,I3/8H UD       PRINT.129
     1=,E11.3,56X,7HPRF NO=,I4/8H   U    =,E11.3,56X,7HR(3)  =,E11.3//)      PRINT.130
   30 FORMAT(1H0, 33HDIMENSION LIMITS EXCEEDED.  JMX =,I4,                      PRINT.131
     12X,16HCASE TERMINATED.)                                                   PRINT.132
   35 FORMAT(20X,30HSEPARATION. - CASE TERMINATED.)                             PRINT.133
   50 FORMAT(1H0,20X,*VALUES OF DISPLACEMENT THICKNESS, MOMENTUM THICKNEPRINT.134
     1SS,*/21X,*AND SHAPE FACTOR FOR THE WHOLE BOUNDARY LAYER (LAST PROFPRINT.135
     2ILE).*//21X,*DELS =*,E10.3,4X,*THETA =*,E10.3,4X,*H =*,E10.3)       PRINT.136
   60 FORMAT(1H0,20X,*LIFT COEFFICIENT* 10X *PROFILE DRAG COEFFICIENT*/)PRINT.137
   61 FORMAT(1H0,20X,*CL  =*,E10.3,12X,*CD  =*,E10.3)                           PRINT.138
      END                                                                       PRINT.139
```

```
      SUBROUTINE RESULT(CF2,JMX,X,L)                                    RESULT.2
C  CALCULATION OF STREAMWISE AND CROSSFLOW VELOCITY                     RESULT.3
C  PROFILES FOR PRINTOUT                                                RESULT.4
      COMMON/ SCRAT / ALFS(200),DBETA(200),Y(100),JY(25),JYT(25),DY(25),RESULT.5
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),RESULT.6
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),     RESULT.7
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  RESULT.8
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),          RESULT.9
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    RESULT.10
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)RESULT.11
     7,A4(100),DUMMY(452)                                               RESULT.12
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                RESULT.13
      COMMON /SANGLE/ SANGLE                                            RESULT.14
      COMMON /NPT/ NPT                                                  RESULT.15
      COMMON/W8/W8(3)                                                   RESULT.16
      COMMON/ SZ3 / DUM,U8                                              RESULT.17
      COMMON/PHIL/IPHIL                                                 RESULT.18
      COMMON/ITR/ITR999,ITRM99                                          RESULT.19
      DIMENSION DUM(3),U8(3),X(3),CF2(3)                                RESULT.20
      COMMON/CFR/CFR,CFS,CFC                                            RESULT.21
      COMMON/BLOUT/ HS,THTS,CFST                                        RESULT.22
       UR(1) = 0.                                                       RESULT.23
      US(1) = 0.                                                        RESULT.24
      WC(1) = 0.                                                        RESULT.25
      DELS = 0.                                                         RESULT.26
      THTS = 0.                                                         RESULT.27
      I = 3                                                             RESULT.28
      ALPAN = TBLU1(X(3),XPG,ALFS,1,NPT)                                RESULT.29
      USMAX = SQRT(U8(3)**2 + W8(3)**2)                                 RESULT.30
      USMAX2 = USMAX**2                                                 RESULT.31
      DO 10 J = 2,JMX                                                   RESULT.32
      UR(J) = SQRT(U(J,I)**2 + W(J,I)**2)                               RESULT.33
      BETA(J) = ACOS(U(J,I)/UR(J)) - ALPAN                              RESULT.34
      US(J) = UR(J)*COS(BETA(J))                                        RESULT.35
      WC(J) = UR(J)*SIN(BETA(J))                                        RESULT.36
      DDY = Y(J) - Y(J-1)                                               RESULT.37
      UAV = .5*(US(J) + US(J-1))                                        RESULT.38
      UAV2 = UAV**2                                                     RESULT.39
      DELS = DELS + (1.-UAV/USMAX)*DDY                                  RESULT.40
      THTS = THTS    + UAV*DDY/USMAX - UAV2*DDY/USMAX2                  RESULT.41
   10 CONTINUE                                                          RESULT.42
      BETA(1) = 2.*BETA(2) - BETA(3)                                    RESULT.43
      HS = DELS/THTS                                                    RESULT.44
      CBETA = BETA(1)                                                   RESULT.45
      CFR = CF2(3)/COS(ALPAN + CBETA)                                   RESULT.46
      CFS = CFR*COS(CBETA)                                              RESULT.47
      CFST = CFS                                                        RESULT.48
      CFC = CFR*SIN(CBETA)                                              RESULT.49
      CBETA = CBETA*57.29578                                            RESULT.50
      ALPAN = ALPAN*57.29578                                            RESULT.51
      IF(ITR999.LT.IPHIL) GO TO 100                                     RESULT.52
      GO TO(100,200),L                                                  RESULT.53
  200 CONTINUE                                                          RESULT.54
      WRITE(6,6300)                                                     RESULT.55
 6300 FORMAT(1H0,5X,1HJ,10X,2HUR,12X,4HBETA,15X,2HUS,13X,2HWC)          RESULT.56
      WRITE(6,6000)(J,UR(J),BETA(J), US(J),WC(J),J=1,JMX)               RESULT.57
 6000 FORMAT(I5,5X,E12.4,5X,E12.4,5X,E12.4,5X,E12.4)                    RESULT.58
      WRITE(6,6200)                                                     RESULT.59
      WRITE(6,6100) X(3),CBETA,CF2(3),CFR,CFS,CFC,W8(3),ALPAN           RESULT.60
 6200 FORMAT(1H0,5X,1HX,10X,5HCBETA,10X,6HCF2(3),12X,3HCFR,12X,3HCFS,   RESULT.61
     1   12X,3HCFC,15X,5HW8(3),15X,5HALPAN)                             RESULT.62
 6100 FORMAT(1H0,F8.4,5X,F8.4,6(5X,E12.4))                              RESULT.63
      WRITE(6,6400)                                                     RESULT.64
 6400 FORMAT(1H0,5X,1HH,7X,10HDELTA-STAR,5X,5HTHETA)                    RESULT.65
      WRITE(6,6500) HS,DELS,THTS                                        RESULT.66
 6500 FORMAT(1H0,F8.4,2(5X,E12.4))                                      RESULT.67
  100 CONTINUE                                                          RESULT.68
      RETURN                                                            RESULT.69
      END                                                               RESULT.70
```

```
      SUBROUTINE SETUP2(LPR,KP,LST1,LST2,ITRR,DX1,DX2,DX,JMX1,JMX,      SETUP2.2
     1X,XSTART,NPRF,U8,U8IN,P,DU)                                       SETUP2.3
      DIMENSION X(1),U8(1),P(1),DU(200)                                 SETUP2.4
      COMMON/ DU8X / DU8X                                               SETUP2.5
      COMMON /NPT/ NPT                                                  SETUP2.6
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                SETUP2.7
      LPR = 1                                                           SETUP2.8
      KP  = 1                                                           SETUP2.9
      LST1 = 1                                                          SETUP2.10
      LST2 = 1                                                          SETUP2.11
      ITRR = 0                                                          SETUP2.12
      DX1 = DX                                                          SETUP2.13
      DX2 = DX                                                          SETUP2.14
      JMX1=JMX-1                                                        SETUP2.15
      X(3) = XSTART                                                     SETUP2.16
      X(2) = X(3)-DX                                                    SETUP2.17
      X(1) = X(2)-DX                                                    SETUP2.18
      XSTART = X(2)                                                     SETUP2.19
      XSTART = X(3)                                                     SETUP2.20
      NPRF = 1                                                          SETUP2.21
      U8(1) = U8FNT(X(1),U8IN)                                          SETUP2.22
      U8(2) = U8FNT(X(2),U8IN)                                          SETUP2.23
      U8(3) = U8FNT(X(3),U8IN)                                          SETUP2.24
      P(1) = 0.                                                         SETUP2.25
      P(2) = 0.                                                         SETUP2.26
      P(3)      = U8(3)*12.*U8IN*TBLU1(X(3),XIN,DU,1,NPT)               SETUP2.27
      RETURN                                                            SETUP2.28
      END                                                               SETUP2.29
```



```
      FUNCTION SHAPE(DELS,THETA,P,Y,U,U8,JMX,X,YYDEL,KALL)              SHAPE.2
C  ROUTINE TO CALCULATE THE INTEGRAL BOUNDARY LAYER PARAMETERS          SHAPE.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),SHAPE.4
     1 XX(25),YPL(100),YD(100),CF(200),YOD(100),T(100,3),UT(100),V(100),SHAPE.5
     2 GAMI(100),GAMF(100),Z(200),US(100),YY(100),UR(100),UUR(100),     SHAPE.6
     3 UP(100),W(100,3),B(400),BW(400),DUNCE(100),GNUT(100,3),DU(200),  SHAPE.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUMMM(200),          SHAPE.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    SHAPE.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)SHAPE.10
     7,A4(100),DUMMY(452)                                               SHAPE.11
      COMMON/ SZ4 / DUNNY(5),DELTA                                      SHAPE.12
      DIMENSION P(1),Y(1),U(100,3),U8(1),X(1),YYDEL(100)                SHAPE.13
      COMMON/ XSTART / XSTART                                           SHAPE.14
      COMMON/SHAPE/JSP,CNNS,UMX                                         SHAPE.15
      COMMON/ CURV1 / R(3)                                              SHAPE.16
CALCULATE UMAX, AND FIND JSP.                                           SHAPE.17
      I  =  3                                                           SHAPE.18
      IF(JSP.GT.JMX)  JSP = JMX                                         SHAPE.19
      DELS = 0.                                                         SHAPE.20
      THETA = 0.                                                        SHAPE.21
      IF(KALL.EQ.2)  UMX = U8(3)                                        SHAPE.22
      IF(KALL.EQ.2) JSP=JMX                                             SHAPE.23
      IF((KWAL.EQ.2)  .OR. (R(3).GT.(DELTA*1.E10)))  GO TO 50           SHAPE.24
      UPW       = UMX*(1.+Y(JSP)/R(I))                                  SHAPE.25
C     UPW = UEDGE(1)                                                    SHAPE.26
      GO TO 60                                                          SHAPE.27
   50 CONTINUE                                                          SHAPE.28
      UPW       = UMX                                                   SHAPE.29
   60 CONTINUE                                                          SHAPE.30
      JLIM      = JSP                                                   SHAPE.31
      IF(KALL.EQ.2) JLIM = JMX                                          SHAPE.32
      DO 80 J=2,JLIM                                                    SHAPE.33
      PY        = Y(J) + Y(J-1)                                         SHAPE.34
      DDY = Y(J)-Y(J-1)                                                 SHAPE.35
      DUD = U(J,3) + U(J-1,3)                                           SHAPE.36
      UAV       = .5*DUD                                                SHAPE.37
      UPS   =  UPW/(1. + PY/(2.*R(I)))                                  SHAPE.38
C     UP = UEDGE(J)                                                     SHAPE.39
      Q         = DDY*(UPS-UAV)/UPW                                     SHAPE.40
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      THETA     = THETA  +  Q*UAV/UPW                                        SHAPE.41
      DELS      = DELS   +  0                                                SHAPE.42
   80 CONTINUE                                                             SHAPE.43
      H = DELS/THETA                                                       SHAPE.44
      DO 99 J=1,JMX                                                        SHAPE.45
   99 YYDEL(J) = Y(J)/DELS                                                 SHAPE.46
      SHAPE = H                                                            SHAPE.47
      RETURN                                                               SHAPE.48
      END                                                                  SHAPE.49

       SUBROUTINE SORT(L)                                                   SORT.2
       COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),   SORT.3
      1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),   SORT.4
      2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),        SORT.5
      3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),     SORT.6
      4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),             SORT.7
      5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),       SORT.8
      6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)   SORT.9
      7,A4(100),DUMMY(452)                                                  SORT.10
       DIMENSION X(3),U8(3),P(3)                                            SORT.11
       COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                     SORT.12
       COMMON/SZ3/X,U8                                                      SORT.13
       COMMON/ PRESSUR / P                                                  SORT.14
       COMMON/W8/W8(3)                                                      SORT.15
       COMMON/PLUB/ NCPX,NCPY,KCP, YDELP                                    SORT.16
       COMMON/ CURV1 / R(3)                                                 SORT.17
       GO TO (100,200), L                                                   SORT.18
  100 CONTINUE                                                              SORT.19
       DO 150 K = 1,2                                                       SORT.20
       X(K) = X(K+1)                                                        SORT.21
       P(K) = P(K+1)                                                        SORT.22
       U8(K) = U8(K+1)                                                      SORT.23
       R(K) = R(K+1)                                                        SORT.24
       W8(K) = W8(K+1)                                                      SORT.25
  150 CONTINUE                                                              SORT.26
  200 CONTINUE                                                              SORT.27
       DO 250 K = 1,2                                                       SORT.28
       DO 260 J = 1,100                                                     SORT.29
       U(J,K) = U(J,K+1)                                                    SORT.30
       PS(J,K) = PS(J,K+1)                                                  SORT.31
       W(J,K) = W(J,K+1)                                                    SORT.32
  260 CONTINUE                                                              SORT.33
  250 CONTINUE                                                              SORT.34
       DO 270 J = 1,100                                                     SORT.35
       GNUT(J,2) = GNUT(J,3)                                                SORT.36
       DUDY(J,2) = DUDY(J,3)                                                SORT.37
  270 CONTINUE                                                              SORT.38
       RETURN                                                               SORT.39
       END                                                                  SORT.40

      SUBROUTINE SPEED(LST2,ITRR,ITR,V,U,JMX,X,Y,LN)                        SPEED.2
      DIMENSION V(100), U(100,3), X(3), Y(100)                              SPEED.3
      COMMON/MARY/DXS                                                       SPEED.4
      COMMON/ XSTART / XSTART                                               SPEED.5
      GO TO (8000,8002), LST2                                               SPEED.6
 8000 IF(ITRR-2) 8002,8002,8001                                             SPEED.7
 8001 CALL PRINT(6)                                                         SPEED.8
      LST2 = 2                                                              SPEED.9
 8002 CONTINUE                                                              SPEED.10
      IF(ITR-2) 130,120,120                                                 SPEED.11
  120 V(1) = 0.                                                             SPEED.12
      GO TO (8006,130), LST2                                                SPEED.13
 8006 ITRR = ITRR+1                                                         SPEED.14
      CALL TEST(LN,ITR,2,LST2)                                              SPEED.15
      GO TO (8008,130), LST2                                                SPEED.16
 8008 CALL SORT(2)                                                          SPEED.17
  130 CONTINUE                                                              SPEED.18
      RETURN                                                                SPEED.19
      END                                                                   SPEED.20
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```
      SUBROUTINE TEST(LN,ITR,L,LST2)                                    TEST.2
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),TEST.3
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),TEST.4
     2 GAMI(100),GAMF(100),D(200),US(100),YY(100),UR(100),UUR(100),     TEST.5
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  TEST.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUNCE(200),          TEST.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    TEST.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)TEST.9
     7,A4(100),DUMMY(452)                                               TEST.10
      COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU              TEST.11
      DIMENSION X(3),U8(3),CF2(3),P(3)                                  TEST.12
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                  TEST.13
      COMMON/SZ3/X,U8                                                   TEST.14
      COMMON/ PRESSUR / P                                               TEST.15
      COMMON/SZT8L/XSW,HSV                                              TEST.16
      COMMON/XMON/TH2,CF3                                               TEST.17
      COMMON/XMPR/UTEST                                                 TEST.18
      COMMON/ CURV1 / R(3)                                              TEST.19
      GO TO (90,1000), L                                                TEST.20
   90 CONTINUE                                                          TEST.21
      UTEST = ABS( U(NP,3)-UP(NP))*1.E+5/U8(3)                          TEST.22
      IF(UTEST-UTS*20.)100,100,300                                      TEST.23
  100 CONTINUE                                                          TEST.24
      IF(UTEST-UTS) 200,200,110                                         TEST.25
  110 LN=2                                                              TEST.26
      RETURN                                                            TEST.27
  200 LN=1                                                              TEST.28
      RETURN                                                            TEST.29
  300 IF(ITR-ITRMX) 310,400,400                                         TEST.30
  310 CONTINUE                                                          TEST.31
      LN = 3                                                            TEST.32
      RETURN                                                            TEST.33
  380 CONTINUE                                                          TEST.34
  400 CONTINUE                                                          TEST.35
      LN = 4                                                            TEST.36
      RETURN                                                            TEST.37
 1000 CONTINUE                                                          TEST.38
      LST2 = 2                                                          TEST.39
      RETURN                                                            TEST.40
      END                                                               TEST.41
```



```
      FUNCTION TBLU2 (X,Y,XC,YC,ZC,KX,KY,NX,NY,MX,MY)                   TBLU2.2
      DIMENSION XC(1),YC(1),ZC(MX,MY)                                   TBLU2.3
      DIMENSION IX(5),IY(5),ARG(5),VAL(5),YY(5)                         TBLU2.4
      CALL ITSM (X,XC,IX,KX,NX)                                         TBLU2.5
      CALL ITSM (Y,YC,IY,KY,NY)                                         TBLU2.6
      M=KX+1                                                            TBLU2.7
      N=KY+1                                                            TBLU2.8
      EPS=1.E-5                                                         TBLU2.9
      DO 2 I=1,M                                                        TBLU2.10
      DO 1 J=1,N                                                        TBLU2.11
      K = IX(I)                                                         TBLU2.12
      L = IY(J)                                                         TBLU2.13
      ARG(J) = YC(L)                                                    TBLU2.14
    1 VAL(J) = ZC(K,L)                                                  TBLU2.15
    2 CALL ALI(Y,ARG,VAL,YY(I),N,EPS,IER)                               TBLU2.16
      DO 3 I=1,M                                                        TBLU2.17
      J = IX(I)                                                         TBLU2.18
    3 ARG(I) = XC(J)                                                    TBLU2.19
      CALL ALI(X,ARG,YY,A,M,EPS,IER)                                    TBLU2.20
      TBLU2=A                                                           TBLU2.21
      RETURN                                                            TBLU2.22
      END                                                               TBLU2.23
```

```
      FUNCTION THICK(Y,U,U8,JMX)                                          THICK.2
C  ROUTINE TO CALCULATE THE BOUNDARY LAYER THICKNESS                      THICK.3
      COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),  THICK.4
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),T(100,3),UT(100),V(100),  THICK.5
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),       THICK.6
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),    THICK.7
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),            THICK.8
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),      THICK.9
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)  THICK.10
     7,A4(100),DUMMY(452)                                                 THICK.11
      DIMENSION Y(1),U(100,3),U8(1)                                       THICK.12
      COMMON/SZ1/ JXX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                    THICK.13
      COMMON/ SZ3 / X(3)                                                  THICK.14
      COMMON/SHAPE/JSP,CNNS,UMX,UMIN,JMN,MCASE                            THICK.15
      COMMON/ XSTART / XSTART                                             THICK.16
      COMMON/DELGFD/DDELT                                                 THICK.17
      COMMON/UVEL/UEND                                                    THICK.18
C     IF(X(3).EQ.XSTART) JMAXM = JMX                                      THICK.19
      IF(X(3).EQ.XSTART) JMAXM = JMX                                      THICK.20
      UFINAL = 0.                                                         THICK.21
      K = -1                                                              THICK.22
      CANS = .001                                                         THICK.23
      JMM = JMX + 1                                                       THICK.24
      JML = JMX - 5                                                       THICK.25
C     GO TO (6,5) KWAL                                                    THICK.26
C    5 CONTINUE                                                           THICK.27
C     DO 7 J=JML,JMM                                                      THICK.28
C     UEDGE(J) = U(JMX,3)                                                 THICK.29
C    7 CONTINUE                                                           THICK.30
C    6 CONTINUE                                                           THICK.31
C     IF(X(3)-XSTART) 83,83,81                                            THICK.32
C   81 CONTINUE                                                           THICK.33
      IF(MCASE.EQ.2) GO TO 11                                             THICK.34
      JM2 = JMX + 2                                                       THICK.35
      DO 10 J=2,JM2                                                       THICK.36
      IF(U(J,3).GT.UEDGE(J)) U(J,3) = UEDGE(J)                            THICK.37
   10 CONTINUE                                                            THICK.38
   11 CONTINUE                                                            THICK.39
      DO 1 J=JMM,JML,K                                                    THICK.40
      IF(U(J,3).EQ.UEDGE(J)) GO TO 1                                      THICK.41
      GO TO 2                                                             THICK.42
    1 CONTINUE                                                            THICK.43
    2 CONTINUE                                                            THICK.44
      ULAST = UFINAL                                                      THICK.45
      UFINAL = ABS((UEDGE(J)-U(J,3))/UEDGE(J))                            THICK.46
      IF(UFINAL.GE.CANS) GO TO 3                                          THICK.47
      J=J-1                                                               THICK.48
      GO TO 2                                                             THICK.49
    3 CONTINUE                                                            THICK.50
      DELTA = Y(J+1) -((CANS-ULAST)*(Y(J+1)-Y(J)))/(UFINAL-ULAST)         THICK.51
      JMX = J+1                                                           THICK.52
      IF(X(3).LE.XSTART) GO TO 84                                         THICK.53
      DX = X(3)-X(2)                                                      THICK.54
      DDELT = (DELTA-DELOLD)/DX                                           THICK.55
      DELNEW = DELTA + DDELT*DX                                           THICK.56
      DSTEP = Y(J) + .90*(Y(J+1)-Y(J))                                    THICK.57
C     IF(DELNEW.GT.DSTEP) JMX=JMX+1                                       THICK.58
      IF(DELTA.GT.DSTEP) JMX = JMX + 1                                    THICK.59
      DDELT = .5*(DDELT+DDOLD)                                            THICK.60
      GO TO 84                                                            THICK.61
C  83 CONTINUE                                                            THICK.62
C     DELTA = Y(JMX-2)                                                    THICK.63
C     JMX = JMX-1                                                         THICK.64
   84 CONTINUE                                                            THICK.65
C     IF(JMX.LT.JMAXM) JMX = JMAXM                                        THICK.66
      IF(JMX.LT.JMAXM) JMX = JMAXM                                        THICK.67
      U8(3) = UEDGE(JMX)                                                  THICK.68
      IF(JMX-99) 99,98,99                                                 THICK.69
   98 CONTINUE                                                            THICK.70
```

```
      ODOLD = ODELT                                                    THICK.71
      DELOLD = DELTA                                                   THICK.72
      THICK = DELTA                                                    THICK.73
      RETURN                                                           THICK.74
   99 CALL PRINT(7)                                                    THICK.75
      CALL PRINT(2)                                                    THICK.76
      CALL PRINT(7)                                                    THICK.77
      STOP                                                             THICK.78
      END                                                              THICK.79
```



```
       SUBROUTINE VELY(V,U,I,X,Y)                                      VELY.2
       DIMENSION U(100,3), V(2), X(1), Y(1)                            VELY.3
       COMMON/ SCRAT / ALFS(200),CBETA(200),D(100),JY(25),JYT(25),DY(25),VELY.4
      1 XX(25),YPL(100),YD(100),CF(200),YDD(100),T(100,3),UT(100),Z(100),VELY.5
      2 GAMI(100),GAMF(100),HD(200),US(100),YY(100),UR(100),UUR(100),  VELY.6
      3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),VELY.7
      4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),DUNCE(200),        VELY.8
      5 DXQ(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),  VELY.9
      6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)VELY.10
      7,A4(100),DUMMY(452)                                             VELY.11
       COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                VELY.12
       COMMON/ SZ4 / UTAU,UD,DELS,THETA,H,DELTA,CF2,XMX,GNU             VELY.13
       COMMON/VPRF/WVPR                                                VELY.14
       COMMON/ CURV1 / R(3)                                            VELY.15
       WVPR     = 6H VELY                                              VELY.16
       V(1)     =  0.                                                  VELY.17
       DO 100 J=2,JMX                                                  VELY.18
       DY       = (Y(J)-Y(J-1))/12.                                    VELY.19
       DUDX1    = DUX(U,I,J,X)                                         VELY.20
       DUDX2    = DUX(U,I,J-1,X)                                       VELY.21
       YAV      =  .5*(Y(J)+Y(J-1))                                    VELY.22
       DELTAX   = DELTA*1.E+10                                         VELY.23
       IF( (KWAL.EQ.2) .OR. (R(I).GT.DELTAX) )  GO TO 60               VELY.24
       H1M = R(I)/(R(I) + Y(J))                                        VELY.25
       H2M = (R(I) + Y(J-1))/(R(I) + Y(J))                             VELY.26
       GO TO 70                                                        VELY.27
    60 H1M      =  1.                                                  VELY.28
       H2M = 1.                                                        VELY.29
    70 CONTINUE                                                        VELY.30
       V(J) = V(J-1)*H2M - .5*H1M*DY*(DUDX1 + DUDX2)                   VELY.31
   100 CONTINUE                                                        VELY.32
       RETURN                                                          VELY.33
       END                                                             VELY.34
```

```
       FUNCTION U8FNT(X,U8IN)                                          U8FNT.2
       COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)              U8FNT.3
       COMMON/UIN/UIN(100)                                             U8FNT.4
       COMMON/PARAM/ MACH,ALPHA,REFA,MATIN,REFC,UINF                   U8FNT.5
       DIMENSION XSU(30)                                               U8FNT.6
       COMMON /NPT/ NPT                                                U8FNT.7
        DO 10 I =1,NPT                                                 U8FNT.8
       XSU(I) = SU(I)*REFC                                             U8FNT.9
    10 CONTINUE                                                        U8FNT.10
       U8 = TBLU1(X,XSU,UIN,1,NPT)                                     U8FNT.11
       U8FNT = U8*U8IN                                                 U8FNT.12
       RETURN                                                          U8FNT.13
       END                                                             U8FNT.14
```

```
      SUBROUTINE VINPUT                                                 VINPUT.2
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),VINPUT.3
     1 XX(25),YPL(100),YD(100),CF(200),YDD(100),U(100,3),UT(100),V(100),VINPUT.4
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),     VINPUT.5
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  VINPUT.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),          VINPUT.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    VINPUT.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)VINPUT.9
     7,A4(100),DUMMY(452)                                               VINPUT.10
      COMMON /NPT/ NPT                                                  VINPUT.11
      COMMON/ GEO / CFI,HI,RTN,UN,UTAU,RD,DELS,THETAI,Z,C,KF,ITER,KL,   VINPUT.12
     1 KYG,KX,JOB                                                       VINPUT.13
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                VINPUT.14
      DIMENSION X(3),U8(3),P(3)                                         VINPUT.15
      COMMON/W8/W8(3)                                                   VINPUT.16
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                  VINPUT.17
      COMMON/SZ3/X,U8                                                   VINPUT.18
      COMMON/ CURV1 / R(3)                                              VINPUT.19
      COMMON/PLUB/NCPX,NCPY,KCP,YDELP                                   VINPUT.20
      COMMON/ PRESSUR / P                                               VINPUT.21
      COMMON/SANGLE/SANGLE                                              VINPUT.22
      COMMON/XTB/XTB(30)                                                VINPUT.23
      GO TO (10,20) KCP                                                 VINPUT.24
   10 CONTINUE                                                          VINPUT.25
      XPZ = X(3)                                                        VINPUT.26
      CALL PFIELD(1,XPZ,P,Y,XTB)                                        VINPUT.27
      USURF = U8(3)                                                     VINPUT.28
      GO TO 30                                                          VINPUT.29
   20 CONTINUE                                                          VINPUT.30
      USURF = U8FNT(X(3),U8IN)                                          VINPUT.31
      U8(3) = USURF                                                     VINPUT.32
      GO TO (21,22),KWAL                                                VINPUT.33
   21 CONTINUE                                                          VINPUT.34
      R(3) = TBLU1(X(3),XPG,RTAB,1,NPT)                                 VINPUT.35
      R(2) = TBLU1(X(2),XPG,RTAB,1,NPT)                                 VINPUT.36
      U8(3)= USURF/(1.+Y(JMX)/R(3))                                     VINPUT.37
   22 CONTINUE                                                          VINPUT.38
      JP2 = JMX + 3                                                     VINPUT.39
      JL6 = JMX - 6                                                     VINPUT.40
      DO 83 J = 1,JP2                                                   VINPUT.41
      GO TO (84,85),KWAL                                                VINPUT.42
   84 UEDGE(J) = USURF/(1.+Y(J)/R(3))                                   VINPUT.43
      GO TO 83                                                          VINPUT.44
   85 UEDGE(J) = U8(3)                                                  VINPUT.45
   83 CONTINUE                                                          VINPUT.46
      U(JMX+1,3) = UEDGE(JMX+1)                                         VINPUT.47
      U(JMX+2,3) = UEDGE(JMX+2)                                         VINPUT.48
   30 CONTINUE                                                          VINPUT.49
      I = 3                                                             VINPUT.50
      U(1,I) = 0.                                                       VINPUT.51
      W(1,I)= 0.                                                        VINPUT.52
      SINAZ = SIN(SANGLE*0.01745329252)                                 VINPUT.53
      W8(3) = U8IN*SINAZ                                                VINPUT.54
      W8(1) = W8(3)                                                     VINPUT.55
      W8(2) = W8(3)                                                     VINPUT.56
C     USTR = SQRT(U8(3)**2 + W8(3)**2)                                  VINPUT.57
      USTR = SQRT(USURF**2 + W8(3)**2)                                  VINPUT.58
C  INPUT THE INITIAL CHORD AND SPAN WISE VELOCITY PROFILES              VINPUT.59
      DO 310 J=2,JMX                                                    VINPUT.60
      U(J,I) =  USTR*U(J,I)                                             VINPUT.61
      W(J,I) = USTR*W(J,I)                                              VINPUT.62
  310 CONTINUE                                                          VINPUT.63
      J = JMX + 1                                                       VINPUT.64
      DO 315 JJ=J,100                                                   VINPUT.65
      U(JJ,I) = U(J-1,I)                                                VINPUT.66
      W(JJ,I) = W(J-1,I)                                                VINPUT.67
  315 CONTINUE                                                          VINPUT.68
      DO 400 J=1,100                                                    VINPUT.69
      U(J,2)  =  U(J,3)                                                 VINPUT.70
```

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      W(J,2) = W(J,3)                                                   VINPUT.71
  400 CONTINUE                                                          VINPUT.72
      RETURN                                                            VINPUT.73
      END                                                               VINPUT.74

      SUBROUTINE VVEL(V,X,LST2,XSTART,Y,U,GNUT,GNU,P,DUDY,VINT,JMX,U8)  VVEL.2
C ROUTINE TO CALCULATE  V  PROFILE.                                     VVEL.3
      DIMENSION V(1),X(1),Y(1),U(100,3),GNUT(100,3),P(1),DUDY(100,3)    VVEL.4
      DIMENSION U8(1)                                                   VVEL.5
      COMMON/MARY/DXS                                                   VVEL.6
      KVT = 1                                                           VVEL.7
      V(1) = 0.                                                         VVEL.8
      VINT = .003                                                       VVEL.9
      VINT = .0002                                                      VVEL.10
C     GO TO (5066,68), LST2                                             VVEL.11
 5066 CONTINUE                                                          VVEL.12
      IF(X(3)-(XSTART+4.*DXS))  67,67,68                                VVEL.13
   67 CONTINUE                                                          VVEL.14
      V(1)=0.                                                           VVEL.15
      V(JMX)=.0125*U8(3)                                                VVEL.16
      SLOPE = (V(JMX)-V(1))/(Y(JMX)-Y(1))                               VVEL.17
      IF(P(3).LE.0.) KVT = 2                                            VVEL.18
      IF(KVT.LE.1) SLOPE = -SLOPE                                       VVEL.19
      DO 1700 J=1,JMX                                                   VVEL.20
      V(J)= SLOPE*Y(J)                                                  VVEL.21
 1700 CONTINUE                                                          VVEL.22
      GO TO  69                                                         VVEL.23
   68 CALL VELY(V,U,3,X,Y)                                              VVEL.24
   69 CONTINUE                                                          VVEL.25
      RETURN                                                            VVEL.26
      END                                                               VVEL.27

      SUBROUTINE YPRESS                                                 YPRESS.2
      COMMON/ SCRAT / ALFS(200),CBETA(200),Y(100),JY(25),JYT(25),DY(25),YPRESS.3
     1 XX(25),YPL(100),YO(100),CF(200),YDD(100),U(100,3),UT(100),V(100),YPRESS.4
     2 GAMI(100),GAMF(100),H(200),US(100),YY(100),UR(100),UUR(100),     YPRESS.5
     3 UP(100),W(100,3),B(400),BW(400),YYDEL(100),GNUT(100,3),DU(200),  YPRESS.6
     4 UTABLE(100),DUDY(100,3),PS(100,3),SP(100,3),THETA(200),          YPRESS.7
     5 DXD(20,30),PPC(20,30),UUC(20,30),UEDGE(100),WP(100),XPG(100),    YPRESS.8
     6 UPG(100),WC(100),BETA(100),RTAB(50),G(99),GW(99),A3(100),A31(100)YPRESS.9
     7,A4(100),DUMMY(452)                                               YPRESS.10
      COMMON/SZ1/ JMX,LMX,NP,UTS,ITRMX,WT,KWAL,DX,U8IN                  YPRESS.11
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                YPRESS.12
      COMMON/CURPT/KDD                                                  YPRESS.13
      COMMON/ PRESSUR / P                                               YPRESS.14
      COMMON/SZ3/X,U8                                                   YPRESS.15
      COMMON/ CURV1 / R(3)                                              YPRESS.16
      COMMON/DELGFD/DDELT                                               YPRESS.17
      COMMON/STAT/PHREF,UREF                                            YPRESS.18
      COMMON/PLUB/NCPX,NCPY,KCP,YDELP                                   YPRESS.19
      COMMON/STP/KSTP                                                   YPRESS.20
      COMMON/XTB/XTB(30)                                                YPRESS.21
      DIMENSION X(3),U8(3),P(3)                                         YPRESS.22
      JMX1      = JMX-1                                                 YPRESS.23
      PKKP      = 8./3.                                                 YPRESS.24
      KDD = 1                                                           YPRESS.25
      I         = 3                                                     YPRESS.26
      USURF = U8FNT(X(3),U8IN)                                          YPRESS.27
      SPJMX = 1.- (USURF/UREF)**2                                       YPRESS.28
      PS(JMX,I)    =  -P(I)                                             YPRESS.29
      SP(JMX,I) = SPJMX                                                 YPRESS.30
      GO TO (10,20)KWAL                                                 YPRESS.31
   20 CONTINUE                                                          YPRESS.32
      DO 100 J=1,JMX1                                                   YPRESS.33
      PS(J,I) = -P(I)                                                   YPRESS.34
      SP(J,I) = SPJMX                                                   YPRESS.35
  100 CONTINUE                                                          YPRESS.36
      GO TO 910                                                         YPRESS.37
   10 CONTINUE                                                          YPRESS.38
```

```
      DXX       =  (X(I)-X(I-1))/12.                                    YPRESS.39
      DO 901 I = 2,3                                                    YPRESS.40
      SA = 0.                                                           YPRESS.41
      USURF = U8FNT(X(I),U8IN)                                          YPRESS.42
      SPJMX = 1.- (USURF/UREF)**2                                       YPRESS.43
      SP(1,I) = SPJMX                                                   YPRESS.44
      PHIJMX = SPJMX*.5*UREF**2 + PHREF                                 YPRESS.45
      DO 900 J=2,JMX1                                                   YPRESS.46
      GO TO (50,60), KDD                                                YPRESS.47
   50 J1        = J                                                     YPRESS.48
      J2        = J1-1                                                  YPRESS.49
      GO TO 70                                                          YPRESS.50
   60 J1        =  JMX1 - (J-1)                                         YPRESS.51
      J2        = J1 + 1                                                YPRESS.52
   70 CONTINUE                                                          YPRESS.53
      IF(I.LE.2) GO TO 71                                               YPRESS.54
      UINT = .5*(UP(J1)**2 + UP(J2)**2)                                 YPRESS.55
      GO TO 72                                                          YPRESS.56
   71 CONTINUE                                                          YPRESS.57
      UINT = .5*(U(J1,I)**2 + U(J2,I)**2)                               YPRESS.58
   72 CONTINUE                                                          YPRESS.59
      RINT = 1./(R(I) + .5*(Y(J1) + Y(J2)))                             YPRESS.60
      XINT = (Y(J1) - Y(J2))*UINT*RINT                                  YPRESS.61
      SA = SA + XINT                                                    YPRESS.62
      PHI = PHIJMX + SA                                                 YPRESS.63
      SP(J1,I) = (PHI - PHREF)/(.5*UREF**2)                             YPRESS.64
  900 CONTINUE                                                          YPRESS.65
  901 CONTINUE                                                          YPRESS.66
      GO TO(1,2),KCP                                                    YPRESS.67
    2 CONTINUE                                                          YPRESS.68
      DO 902 J = 1,JMX1                                                 YPRESS.69
      PS(J,3) =((SP(J,3) - SP(J,2))/DXX)*.5*UREF**2                     YPRESS.70
  902 CONTINUE                                                          YPRESS.71
      GO TO 910                                                         YPRESS.72
    1 CONTINUE                                                          YPRESS.73
      KSTP = 1                                                          YPRESS.74
      L = 2                                                             YPRESS.75
      XPZ = X(3)                                                        YPRESS.76
      CALL PFIELD(L,XPZ,P,Y,XTB)                                        YPRESS.77
      KSTP = 2                                                          YPRESS.78
  910 CONTINUE                                                          YPRESS.79
      RETURN                                                            YPRESS.80
      END                                                               YPRESS.81
```

```
                  OVERLAY(FRIS,4,0)
      PROGRAM FELOPT                                                    FELOPT.3
      COMMON /PARAM/ MACH,ALPHA,REFA,MATIN                              FELOPT.4
      COMMON /ITR/ ITR,ITRMAX                                           FELOPT.5
      COMMON /JMAX/ JMAX                                                FELOPT.6
      COMMON/NPT/NPT                                                    FELOPT.7
      COMMON /VELCOM/ NPANEL,NPART,IMAX,EX,PRINT                        FELOPT.8
      COMMON /SCRAT/  SINBD(600),COSBD(600),TANBD(600),UL(600),WL(600), FELOPT.9
     1UC(600),WC(600),AC(600),DUM(1200),XPT(600),ZPT(600),              FELOPT.10
     2UCJ(2),WCJ(2),ULJ(2),WLJ(2),DUMMY(1592)                           FELOPT.11
      COMMON/GAMM/GA(600),Q                                             FELOPT.12
      COMMON/POINT/ARRAY(4950)                                          FELOPT.13
      COMMON /SEG/ NCMPT,NFLAP,NFLP,NC(4),TE(4),GTU(4),GTL(4),          FELOPT.14
     1NPU(4),NPL(4),ISTG(4),UCU(4),UCL(4),WCU(4),WCL(4),                FELOPT.15
     2XTE(4),ZTE(4),DELZ(3),NG(3),NPG(4),THKTE(4)                       FELOPT.16
      COMMON /GRID/ ZCP(20),CPI(20,30),ZGAP                             FELOPT.17
      COMMON /XIN/   XIN(100),ZIN(100),CPIN(100),SU(100)                FELOPT.18
      DIMENSION DELTA(600),THET(600),CHORD(600),XP (600),ZP (600),      FELOPT.19
     1XU(30,4),ZU(30,4),XL(30,4),ZL(30,4),XCOR(600),ZCOR(600),          FELOPT.20
     2XGRID(30,3),ZGRID(30,3),DZDX(30,3),Q(600)                         FELOPT.21
      EQUIVALENCE (ARRAY,DELTA),(ARRAY(601),THET),(ARRAY(1201),CHORD),  FELOPT.22
     1(ARRAY(1801),XP ),(ARRAY(2401),ZP ),                              FELOPT.23
     2(ARRAY(3001),XU),(ARRAY(3121),XL),                                FELOPT.24
     3(ARRAY(3241),ZU),(ARRAY(3361),ZL),                                FELOPT.25
```

```
     4(ARRAY(3481),XGRID),(ARRAY(3571),ZGRID),(ARRAY(3661),DZDX),
     5(ARRAY(3751),XCOR),(ARRAY(4351),ZCOR)
      REAL MACH
      EPS=1.0E-6
      PI=3.14159265
      REFA=1.0
      KTE = 0
      DO 1 N =1,NCMPT
      IF(THKTE(N).GT.0.) KTE = 1
    1 CONTINUE
      NCPZ=20
      REWIND 3
      NF=NFLAP-NFLP+1
      NGRID=NG(NF)
      NPP = NCMPT-NFLAP+NF
      NP = NPT-NPU(NPP)+NPG(NPP)-1
      CALL SECOND(TIME)
      WRITE(6,602) TIME
      REWIND 7
      READ(7) ARRAY
      REWIND 7
    5 CONTINUE
      IF(ITR.GT.1) GO TO 8
      DO 7 J=1,JMAX
      Q(J) = 0.
    7 CONTINUE
    8 CONTINUE
      ALP=ALPHA/57.2957795
      COSAL=COS(ALP)
      SINAL=SIN(ALP)
      BT2=1.-MACH*MACH
      RB2=1.0/BT2
      BETA=SQRT(BT2)
      CON=1./(2.*PI)
      BCON=BETA*CON
      XSTART=XGRID(1,NF)
      ZSTART=ZGRID(1,NF)
      DXG=XTE(NF)-XSTART
      DZG=ZTE(NF)-ZSTART
      ZGAP = DZG
      DO 10 M=1,NCPZ
   10 ZCP(M) = DELZ(NF)*FLOAT(M-1)
      DO 50 N=1,NPANEL
      BD=BETA*TAN(DELTA(N))
      TANBD(N)=BD
      COSBD(N)=1./SQRT(1.+BD*BD)
   50 SINBD(N)=BD*COSBD(N)
      I=0
      DO 300 IN=1,NGRID
      I=I+1
      XPT(1)=XGRID(IN,NF)
      ZPT(1)=ZGRID(IN,NF)
      CPI(1,IN)=CPIN(IN,NP)
      UPT=0.
      DZX=DZDX(IN,NF)
      COSD=1.0/SQRT(1.0+DZX*DZX)
      SIND=COSD*DZX
      DO 300 IM=2,NCPZ
      I=I+1
      ZPT(I)=ZGRID(IN,NF)+ZCP(IM)*COSD
      XPT(I)=XGRID(IN,NF)-ZCP(IM)*SIND
      IF(ITR.GT.1.AND.KTE.EQ.0) GO TO 292
      IF(ITR.GT.2) GO TO 292
      XI=XPT(I)
      ZI=ZPT(I)
      J=0
      K=0
      JL=0
      JT=0
```

FELDPT.26
FELDPT.27
FELDPT.28
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      DO 275 N=1,NCMPT                                                  FELDPT.95
      JL=JT+1                                                           FELDPT.96
      JT=JT+NC(N)-2                                                     FELDPT.97
      UCJT=0.                                                           FELDPT.98
      WCJT=0.                                                           FELDPT.99
      DO 250 NSIDE=1,2                                                  FELDPT.100
      IF(NSIDE.EQ.1) NL=NPU(N)-1                                        FELDPT.101
      IF(NSIDE.EQ.2) NL=NPL(N)-1                                        FELDPT.102
      NL1=NL+1                                                          FELDPT.103
      DO 225 L=1,NL                                                     FELDPT.104
      J=J+1                                                             FELDPT.105
      K=K+1                                                             FELDPT.106
      IF(I.GT.1) GO TO 58                                               FELDPT.107
      IF(NSIDE.EQ.2) GO TO 55                                           FELDPT.108
      XC=XU(L+1,N)-XU(L,N)                                              FELDPT.109
      ZC=ZU(L+1,N)-ZU(L,N)                                              FELDPT.110
      GO TO 56                                                          FELDPT.111
   55 XC=XL(L+1,N)-XL(L,N)                                              FELDPT.112
      ZC=ZL(L+1,N)-ZL(L,N)                                              FELDPT.113
   56 CHORD(K)=SQRT(XC*XC+BT2*ZC*ZC)                                    FELDPT.114
   58 DO 100 M=1,2                                                      FELDPT.115
      L1=L+M-1                                                          FELDPT.116
      IF(NSIDE.EQ.2) GO TO 60                                           FELDPT.117
      DX=XI-XU(L1,N)                                                    FELDPT.118
      DZ=(ZI-ZU(L1,N))*BETA                                             FELDPT.119
      GO TO 80                                                          FELDPT.120
   60 DX=XI-XL(L1,N)                                                    FELDPT.121
      DZ=(ZI-ZL(L1,N))*BETA                                             FELDPT.122
   80 XPM=DX*COSBD(K)+DZ*SINBD(K)                                       FELDPT.123
      ZPM=DZ*COSBD(K)-DX*SINBD(K)                                       FELDPT.124
      IF(ABS(XPM).LE.EPS) XPM=0.                                        FELDPT.125
      IF(ABS(ZPM).LE.EPS) ZPM=0.                                        FELDPT.126
      RPM2=XPM*XPM+ZPM*ZPM                                              FELDPT.127
      RPM=0.                                                            FELDPT.128
      IF(RPM2.GT.0.) RPM=SQRT(RPM2)                                     FELDPT.129
      G=0.                                                              FELDPT.130
      IF(RPM.GT.0.) G=ALOG(RPM)                                         FELDPT.131
      F=PI/2.                                                           FELDPT.132
      IF(XPM.EQ.0..AND.ZPM.EQ.0.) GO TO 90                              FELDPT.133
      F=ATAN2(ZPM,XPM)                                                  FELDPT.134
   90 CONTINUE                                                          FELDPT.135
      IF(NSIDE.EQ.2.AND.ZPM.EQ.0.) F=-F                                 FELDPT.136
      UCJ(M)=-F                                                         FELDPT.137
      WCJ(M)=-G                                                         FELDPT.138
      ULJ(M)=-(XPM*F+ZPM*G)/CHORD(K)                                    FELDPT.139
      WLJ(M)= (ZPM*F+XPM*(1.-G))/CHORD(K)                               FELDPT.140
  100 CONTINUE                                                          FELDPT.141
      UCPM=UCJ(1)-ULJ(1)+ULJ(2)                                         FELDPT.142
      WCPM=WCJ(1)-WLJ(1)+WLJ(2)                                         FELDPT.143
      ULPM=ULJ(1)-ULJ(2)-UCJ(2)                                         FELDPT.144
      WLPM=WLJ(1)-WLJ(2)-WCJ(2)                                         FELDPT.145
      USPM=WCJ(2)-WCJ(1)                                                FELDPT.146
      WSPM=UCJ(1)-UCJ(2)                                                FELDPT.147
      UC(J)=(UCPM*COSBD(K)-WCPM*SINBD(K))*CON                           FELDPT.148
      WC(J)=(WCPM*COSBD(K)+UCPM*SINBD(K))*BCON                          FELDPT.149
      UL(J)=(ULPM*COSBD(K)-WLPM*SINBD(K))*CON                           FELDPT.150
      WL(J)=(WLPM*COSBD(K)+ULPM*SINBD(K))*BCON                          FELDPT.151
      USJ=(USPM*COSBD(K)-WSPM*SINBD(K))*BCON                            FELDPT.152
      WSJ=(WSPM*COSBD(K)+USPM*SINBD(K))*CON                             FELDPT.153
      UCJT=UCJT+USJ                                                     FELDPT.154
      WCJT=WCJT+WSJ                                                     FELDPT.155
      IF(NSIDE.EQ.2.AND.L.EQ.1 ) GO TO 160                              FELDPT.156
      IF(L.GT.1) UC(J)=UC(J)+UL(J-1)                                    FELDPT.157
      IF(L.GT.1) WC(J)=WC(J)+WL(J-1)                                    FELDPT.158
      GO TO 200                                                         FELDPT.159
  160 UC(JL)=UC(JL)+UC(J)                                               FELDPT.160
      WC(JL)=WC(JL)+WC(J)                                               FELDPT.161
      UL(J-1)=UL(J)                                                     FELDPT.162
      WL(J-1)=WL(J)                                                     FELDPT.163
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      J=J-1                                                              FELDPT.164
      GO TO 225                                                          FELDPT.165
  200 CONTINUE                                                           FELDPT.166
      IF(L.LT.NL) GO TO 225                                              FELDPT.167
      IF(NSIDE.EQ.2) GO TO 220                                           FELDPT.168
      UCU(N)=UL(J)                                                       FELDPT.169
      WCU(N)=WL(J)                                                       FELDPT.170
      GO TO 225                                                          FELDPT.171
  220 UCL(N)=UL(J)                                                       FELDPT.172
      WCL(N)=WL(J)                                                       FELDPT.173
  225 CONTINUE                                                           FELDPT.174
  250 CONTINUE                                                           FELDPT.175
      J=J+1                                                              FELDPT.176
      UC(JT)=UCJT                                                        FELDPT.177
      WC(JT)=WCJT                                                        FELDPT.178
      IF(THKTE(N).EQ.0..OR.ITR.GT.1) GO TO 275                           FELDPT.179
      UC(JT)=0.                                                          FELDPT.180
      WC(JT)=0.                                                          FELDPT.181
  275 CONTINUE                                                           FELDPT.182
      J=0                                                                FELDPT.183
      K=0                                                                FELDPT.184
      DO 290 N=1,NCMPT                                                   FELDPT.185
      J2=NC(N)                                                           FELDPT.186
      J1=J2-1                                                            FELDPT.187
      JT=J2-2                                                            FELDPT.188
      DO 290 JJ=1,J2                                                     FELDPT.189
      J=J+1                                                              FELDPT.190
      IF(JJ.GT.JT) GO TO 285                                             FELDPT.191
      K=K+1                                                              FELDPT.192
      UL(J)=UC(K)                                                        FELDPT.193
      WL(J)=WC(K)                                                        FELDPT.194
      GO TO 290                                                          FELDPT.195
  285 IF(JJ.EQ.J2) GO TO 286                                             FELDPT.196
      UL(J)=UCU(N)                                                       FELDPT.197
      WL(J)=WCU(N)                                                       FELDPT.198
      GO TO 290                                                          FELDPT.199
  286 UL(J)=UCL(N)                                                       FELDPT.200
      WL(J)=WCL(N)                                                       FELDPT.201
  290 CONTINUE                                                           FELDPT.202
      WRITE(3) (UL(J),WL(J),J=1,JMAX)                                    FELDPT.203
      GO TO 294                                                          FELDPT.204
  292 CONTINUE                                                           FELDPT.205
      READ(3) (UL(J),WL(J),J=1,JMAX)                                     FELDPT.206
  294 CONTINUE                                                           FELDPT.207
      UPT=0.                                                             FELDPT.208
      WPT=0.                                                             FELDPT.209
      DO 295 J=1,JMAX                                                    FELDPT.210
      UPT=UPT+UL(J)*GA(J)-WL(J)*Q(J)*RB2                                 FELDPT.211
  295 WPT=WPT+WL(J)*GA(J)+UL(J)*Q(J)                                     FELDPT.212
      UPT=UPT+COSAL                                                      FELDPT.213
      WPT=WPT+SINAL                                                      FELDPT.214
      CPI(IM,IN)=1.0-UPT*UPT-WPT*WPT                                     FELDPT.215
  300 CONTINUE                                                           FELDPT.216
      CALL SECOND(TIME)                                                  FELDPT.217
      WRITE(6,602) TIME                                                  FELDPT.218
      RETURN                                                             FELDPT.219
  500 FORMAT(11I5)                                                       FELDPT.220
  501 FORMAT(7F10.0)                                                     FELDPT.221
  601 FORMAT(1H ,10F10.5)                                                FELDPT.222
  602 FORMAT(1H ,6HTIME =,F10.5)                                         FELDPT.223
  660 FORMAT(7I5,9F10.5)                                                 FELDPT.224
      END                                                                FELDPT.225
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