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VORCOR - A Computer Program for Calculating Characteristics of Wings With Edge Vortex Separation by Using a Vortex Filament and Core Model

Jenn-Louh Pao

UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.
The Flight Research Laboratory
Lawrence, Kansas 66045

Sudhir C. Mehrotra

VIGYAN RESEARCH ASSOCIATES, INC.
Hampton, Virginia 23666

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C. Edward Lan

UNIVERSITY OF KANSAS CENTER FOR RESEARCH, INC.
The Flight Research Laboratory
Lawrence, Kansas 66045

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INTRODUCTION

This report is a supplement to reference 1 and describes the usage of a computer program implementing an improved vortex-core method described in reference 1. The method is applicable to cambered wings, straked wings or wings with leading-edge vortex flaps at subsonic speeds. The prediction of lifting pressure distribution and the computer time based on the diffused vortex-filament method in reference 2 have been improved by using a pair of concentrated vortex cores above the wing surface.

In the following, the program capabilities, input format and output format are described. Then, input data of two sample test cases (a delta wing with conical camber and a double delta wing) and the corresponding output, as well as the program listing are given.

PROGRAM CAPABILITIES

This program has the following main features:

- (1) Arbitrary camber shapes may be defined at ten or less spanwise stations. Option for exactly defining leading-edge flap geometry is also provided.
- (2) Eight spanwise strips are usually used for simple wings (such as delta wings) and nine spanwise strips for double delta wings.
- (3) The side-edge vortex system is incorporated.
- (4) In the core model method, the starting solution for wings at angles of attack less than 20 degrees is taken to be the initial shape at 20-degrees angle of attack.

INPUT DATA FORMAT

Group 1 Format (16A5)

TTL(I) Any title identifying the case to be run. END in first three columns terminates the job.

N83-70599 #

Group 2 Format (6I5)

2

- NCW Number of chordwise vortex elements on the wing surface. Limited to nine.
- NBRR Number of constant x-locations where the spanwise lifting pressures are to be interpolated. Limited to twenty-five.
- NCONTS = 0, if initial locations of free elements are calculated in the program.
= 1, if initial locations of free elements are to be read from data cards. For wings at angles of attack less than 20 degrees, the initial shape at 20 degrees is to be used.
- MITER Maximum number of iterations to be performed (usually between 7 and 9).
- IPUNCH = 0, if coordinates of free elements after the last iteration are not to be punched out.
= 1, if coordinates of free elements after the last iteration are to be punched out.
- KU1 = 2, two iterations to be performed in the vortex filament model.

Note: If KU1 is greater than MITER, the vortex filament model is to be run in the entire iteration process.

Group 3 Format (6I5)

- NC Number of spanwise sections on the right wing (bounded by points of discontinuities in geometry, such as change in sweep). Limited to two. (See sketch 1).
- M1(I) Number of spanwise strips in each spanwise section plus one. Limited to twenty.
- ICAM = 0, for non-cambered airfoils.
= 1, if cambered ordinates are to be read in.
= 2, if camber slopes are defined analytically in subroutine ZCDX.
= 3, if there are flat leading-edge flaps attached to a non-cambered wing.

IST Number of y-stations at which camber ordinates are read in. Limited to ten. If ICAM=3, IST is the number of leading-edge flap segments; for example, IST would be 1 for a simple flat leading-edge flap. If ICAM=1, at least two y stations are needed, one being at the root and the other being at the tip.

ITERS = 0, for wings at angles of attack greater than 20 degrees and NCONTS=0.

= 3, for wings at angles of attack less than 20 degrees and NCONTS=1.

Group 4 Format (2I5)

ISPAN = 0, if the leading-edge free elements start from the center line of geometry.

= 1, if the leading-edge free elements do not start from the center line of geometry.

Use 0 always in the present version of the program.

ITRAKE = 1, for one vortex-core system on the right wing.

= 2, for two vortex-core system on the right wing.

Group 5 Format (8F10.5)

ALPHA Angle of attack (in degrees)

AMACH Mach number. Limited to subsonic flow.

DELTA Length of a segment of leading-edge free vortex elements (may be taken as $0.15 c_R$, where c_R is the root chord).

DL Length of a segment of wake elements (may be taken as $0.15 c_R$).

XEND x-coordinate beyond which free vortex elements from the leading edge and the wake are represented by a single element going to infinity.

CBAR Reference chord.

AREA Total reference wing area.

CLS Reference lift coefficient.

Note: The reference lift coefficient CLS for use in adjusting the core move-

ment is based on the suction analogy as implemented by Lan (reference 3).

Group 6 Format (9I5)

NFSH(I) Number of segments along each vortex element on the leading-edge free vortex sheet.
 = 5, if ITERS = 0.
 = 6, if ITERS = 3.

Omit Groups 7, 8 and 9 if ICAM \neq 1. Repeat Group 7, 8, 9 IST times.

Group 7 Format (4F10.6)

YT(I) y-station at which camber ordinates are read in.
 XNUM Number of camber ordinates to be read in. Limited to 21.
 CURV(I) = 0, if camber is to be formed by connecting straight segments, with first segment being regarded as flat leading-edge flap.
 = 1, if cubic spline interpolation is used.
 = 2, if cubic spline interpolation is used, with first segment being flat leading-edge flap.
 CHND(I) Chord length at YT(I) station.

Group 8 Format (8F10.6)

XT(I,J) x/c values at which camber ordinates are read in for YT(I) station.

Group 9 Format (8F10.6)

CA(J) z/c values of camber ordinates at the corresponding XT(I,J) locations.

Omit Groups 10, 11 and 12 if ICAM \neq 3. Repeat IST times.

Group 10 Format (2F10.6)

YLEF(I,1) Extreme inboard y-coordinate of I-th flat leading-edge flap segment.
 YLEF(I,2) Extreme outboard y-coordinate of I-th flat leading-edge flap segment.

Group 11 Format (6F10.6)

XLF(I,1) } First corner point coordinates of I-th flat leading-edge flap seg-
 YLF(I,1) } ment. (see sketch 2)
 Z1 }

$\left. \begin{array}{l} \text{XLF(I,2)} \\ \text{YLF(I,2)} \\ \text{Z2} \end{array} \right\} \text{ Second corner point coordinates of I-th flat leading-edge flap segment.}$

Group 12 Format (6F10.6)

$\left. \begin{array}{l} \text{XLF(I,3)} \\ \text{YLF(I,3)} \\ \text{Z3} \end{array} \right\} \text{ Third corner point coordinates of I-th flat leading-edge flap segment.}$

$\left. \begin{array}{l} \text{XLF(I,4)} \\ \text{YLF(I,4)} \\ \text{Z4} \end{array} \right\} \text{ Fourth corner point coordinates of I-th flat leading-edge flap segment.}$

Note: The flat flap must be inside the boundary of planform described in Group 13.

Group 13 Format (6F10.5)

Corner-point coordinates of a spanwise section (See sketch 3).

XXL(1) Leading-edge x-coordinate of the inboard chord.
 XXT(1) Trailing-edge x-coordinate of the inboard chord.
 YL(1) y-coordinate of the inboard chord.
 XXL(2) Leading-edge x-coordinate of the outboard chord.
 XXT(2) Trailing-edge x-coordinate of the outboard chord.
 YL(2) y-coordinate of the outboard chord.

Omit Groups 14, 15, 16, 17, 18 and 19 if NCONTS = 0.

Group 14 Format (10I2)

NELM(I) Number of vortex segments along each vortex element in the leading-edge vortex system.

Group 15 Format (8F10.4)

$\left. \begin{array}{l} \text{XE(J)} \\ \text{YE(J)} \\ \text{ZE(J)} \end{array} \right\} \text{ x-, y- and z-coordinates of endpoints (away from the leading edge) of the leading-edge vortex segments on and above the wing surface.}$

Group 16 Format (10I2)

NNELM(I) Number of vortex segments along each vortex element in the wake

system behind the trailing edge.

Group 17 Format (8F10.4)

$\left. \begin{array}{l} \text{XXE(J)} \\ \text{YYE(J)} \\ \text{ZZE(J)} \end{array} \right\} \text{ x-, y- and z-coordinates of downstream endpoints of wake vortex} \\ \text{segments behind the trailing edge.}$

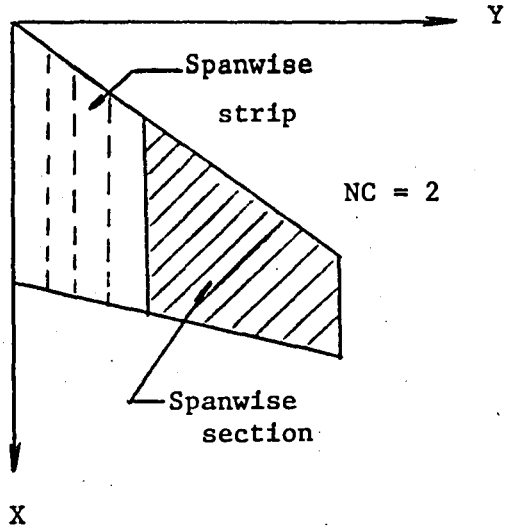
Omit Groups 18 and 19 if the wing planform has a zero tip chord.

Group 18 Format (10I2)

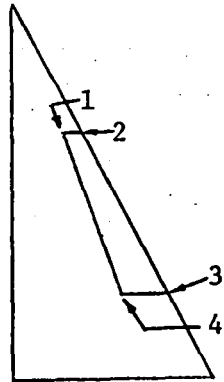
NTLM(I) Number of vortex segments along each vortex element in the side-edge vortex system.

Group 19 Format (8F10.4)

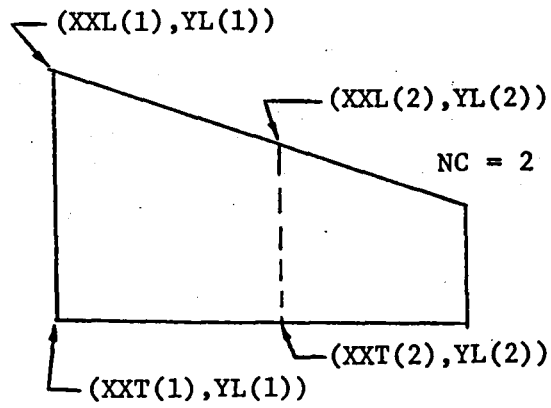
$\left. \begin{array}{l} \text{XTIP(I,J)} \\ \text{YTIP(I,J)} \\ \text{ZTIP(I,J)} \end{array} \right\} \text{ x-, y- and z-coordinates of endpoints (away from the side edge) of} \\ \text{vortex segments on side-edge vortex elements.}$



Sketch 1.



Sketch 2.



Sketch 3.

OUTPUT FORMAT

(1) First, all input data will be printed.

(2) Camber slopes at wing bound elements (with respect to fine grids).

DZDXV } At bound elements
 DZDYV }

(3) Camber slopes at wing control points and bound elements (with respect to coarse grids).

DZDX } At control points
 DZDY }

DZDYV At bound elements.

(4) Camber slopes at leading-edge control points of each spanwise strip.

DZDX } At leading-edge control points.
 DZDY }

(5) Leading-edge vortex element system:

XE } x-, y- and z-coordinates of endpoints (away from the leading
 YE } edge) of vortex segments in the leading-edge vortex element
 ZE } system on and above the wing.

(6) Wake element system:

XXE } x-, y- and z-coordinates of each vortex segment in the wake
 YYE } system behind the trailing edge.
 ZZ E }

(7) Plots of leading-edge free elements above the wing and wake elements behind the trailing edge, on X-Y, X-Z and Y-Z planes respectively.

(8) Wing vortex-density distribution:

X/C Nondimensional x-coordinate, referred to local chord (with respect to coarse grids).

2Y/B nondimensional y-station, referred to wing semi-span.

GAMAY Bound vortex density on the wing (γ_y) at the given (X/C, 2Y/B).

(9) Leading-edge vortex strengths:

2Y/B Nondimensional y-station, referred to wing semi-span.

CAPGAMA Strength of the leading-edge free element (Γ) at the given 2Y/B.

(10) Wing surface lifting-pressure distribution:

X/C Nondimensional x-coordinate, referred to local chord (with respect to fine grids).

2Y/B Nondimensional y-station, referred to wing semi-span.

DELTA-CP The total ΔC_p at the given (X/C, 2Y/B)

(11) Sectional characteristics:

I Spanwise station number (numbered from root to tip).

CLI Sectional lift coefficient.

CMI Sectional pitching moment coefficient about the y-axis.

CDI Sectional induced drag coefficient.

CTI Sectional leading-edge thrust coefficient.

(12) The next group of output variables is the overall aerodynamic characteristics.

(13) Spanwise lifting pressures at constant x-locations:

Y y-coordinate.

2Y/B(LOCAL) Nondimensional y-station, referred to wing local semi-span.

DELTA-CP Total ΔC_p at the given (x,y).

(14) Summary sheet:

ITERATION Iteration number.

CL The total lift coefficient.

CM The total pitching moment coefficient about y-axis.

CD The total induced drag coefficient.

CT The total leading-edge thrust coefficient.

GMSUM Sum of strengths of leading-edge free vortex elements, except the one at the center line.

SFAC Sum of the magnitude of total force acting on the core and free sheet.

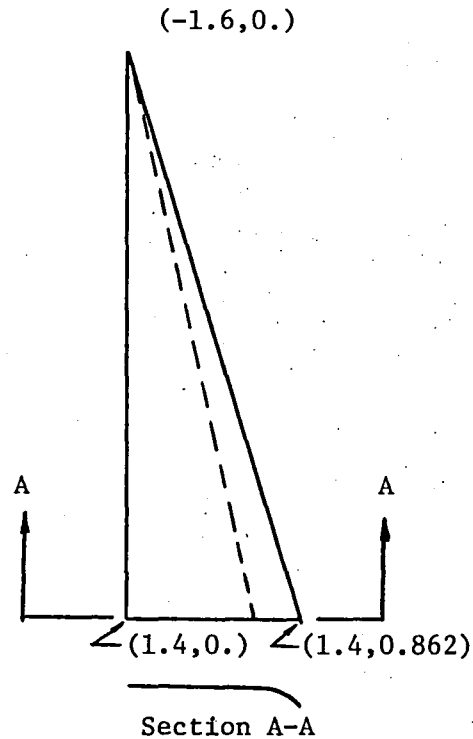
(15) The last portion of the output consists of the converged positions and orientations of free sheet vortex elements and the concentrated core, and aerodynamic characteristics corresponding to the solution in which "SFAC" of (14) reaches a minimum value in the iteration cycle.

1. Input Data of the First Sample Case

C O L U M N N U M B E R
 1111111111122222222223333333333444444444455555555566666666677777777778
 1234567890123456789012345678901234567890123456789012345678901234567890

CARD NUMBER

CARD NUMBER	CONICAL CAMBER WING AT ALPHA 30.7 DEGREES								
1									
2	5	3	0	2	0	2			
3	1	9	2	1	0				
4	0	1							
5	30.7	0.		0.25	0.75	5.5	2.0	2.586	1.297
6	5	5	5	5	5	5			
7	-0.4	0.41		1.205					
8	0.	0.		0.	0.	0.	0.	0.	0.
9	-1.6	1.4		0.	1.4	1.4	0.862		
10	-1.6	1.4		0.	1.4	1.4	0.862		
11	END								



Output of the First Sample Case

INPUT DATA CARDS

CONICAL CAMBER WING AT ALPHA 30.7 DEGREES

6	3	0	R	0	2				
1	9	2	1	0					
0	1								
30.70000		0.00000		.25000	.75000	5.50000	2.00000	2.58600	1.29700
5	5	5	5	5	5				
-.40000		.41000		1.20500					
0.00000		0.00000		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
SAPPHIRE SECTION OF NUMBER 1									
-1.60000		1.40000		0.00000	1.40000	1.40000		.86200	

CAMBER SLOPE AT FINE GRID POINT ELEMENT

0Z0YV	0Z0YV
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
.12741	-.51416
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
.23158	-.89945
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
.29498	-1.12608
.06370	-.26520
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
0.00000	0.00000
.33447	-1.26531
.15297	-.61032
.02880	-.12231
0.00000	0.00000
0.00000	0.00000

0.00000 0.00000
0.00000 0.00000
.35900 -1.35156
.23400 -.91143
.12778 -.51555
.05378 -.22515
.00206 -.00091
0.00000 0.00000
0.00000 0.00000
.37309 -1.40356
.30968 -1.17452
.23187 -.90050
.17034 -.67546
.12696 -.51243
.09950 -.40671
.08616 -.35450
.38199 -1.42144
.36342 -1.36737
.33450 -1.25576
.30408 -1.15429
.27827 -1.06675
.26017 -1.00218
.25094 -.96914

SECTIONWISE SECTION OF NUMBER 1
-1.60000 1.40000 0.00000 1.40000 1.40000 .86200

CAMBER SLOPE AT COARSE GRID BOUND ELEMENT

DZDX	DZDY	DZDYV
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
.02761	-.11734	-.78317
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
.12675	-.51161	-1.04319
0.00000	0.00000	-.09657

0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
.20825	-.81484	-1.21255
.04627	-.19450	-.47312
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
.27813	-1.06627	-1.32243
.14303	-.57334	-.80139
.05378	-.22515	-.38375
0.00000	0.00000	-.09129
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
.33423	-1.26448	-1.39086
.24389	-.94381	-1.10431
.17034	-.67546	-.79915
.12134	-.49097	-.57308
.09354	-.38346	-.42802
.08450	-.34749	-.35685
.37141	-1.39655	-1.42832
.33976	-1.28387	-1.34416
.30408	-1.15829	-1.22015
.27467	-1.05394	-1.10205
.25608	-.98755	-1.01548
.24978	-.96498	-.97064

CAMPER SLOPE AT THE LEADING EDGE CONTROL POINTS

DZDY	DZDY
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024
.38452	-1.44024

END OF INPUT DATA

CONICAL CAMBER WING AT ALPHA 30.7 DEGREES
 ALPHA(DFG.)=30.700 MACH NUMBER= 0.000 ITERATION NUMBER= 0

LEADING EDGE ELEMENTS

**** 1****

1.4000	-1.3639	-1.5624	-1.6000	-1.7500	-1.4500	-1.2350
.0577	.0577	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058

**** 2****

1.4000	-1.0333	-1.3639	-1.3990	-1.5300	-1.2591	-1.0441	-.7941	-.5441	-.2941	-.0441	.2059	.4559	.7059
.9559	1.2059	1.4559	1.7059	1.9559	2.2059	2.4559	2.7059	2.9559	3.2059	3.4559	3.7059	3.9559	4.2059
4.4559	4.7059	4.9559	5.2059	5.4559	5.7059								
.1540	.1540	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577
.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577
.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058

**** 3****

1.4000	-.5878	-1.0333	-1.0642	-1.1874	-.9410	-.7260	-.4760	-.2260	.0240	.2740	.5240	.7740	1.0240
1.2740	1.5240	1.7740	2.0240	2.2740	2.5240	2.7740	3.0240	3.2740	3.5240	3.7740	4.0240	4.2740	4.5240
4.7740	5.0240	5.2740	5.5240										
.2836	.2836	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540
.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540
.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058

**** 4****

1.4000	-.0812	-.5878	-.6130	-.7137	-.5124	-.2974	-.0474	.2026	.4526	.7026	.9526	1.2026	1.4526
1.7026	1.9526	2.2026	2.4526	2.7026	2.9526	3.2026	3.4526	3.7026	3.9526	4.2026	4.4526	4.7026	4.9526
5.2026	5.4526	5.7026											
.4310	.4310	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836
.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836
.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058

**** 5****

1.4000	.4254	-.0812	-.1000	-.1750	-.0250	.1900	.4400	.6900	.9400	1.1900	1.4400	1.6900	1.9400
2.1900	2.4400	2.6900	2.9400	3.1900	3.4400	3.6900	3.9400	4.1900	4.4400	4.6900	4.9400	5.1900	5.4400
5.6900													
.5784	.5784	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310
.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310
.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058

.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058														
**** 6****														
1.4000	.3709	.4254	.4130	.3637	.4624	.6773	.9273	1.1773	1.4273	1.6773	1.9273	2.1773	2.4273	
2.6773	2.9273	3.1773	2.4273	3.6773	3.9273	4.1773	4.4273	4.6773	4.9273	5.1773	5.4273	5.6773	5.9273	
.7000	.7080	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784
.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
**** 7****														
1.4000	1.2016	.8709	.8642	.8374	.8910	1.1059	1.3559	1.6059	1.8559	2.1059	2.3559	2.6059	2.8559	
3.1059	3.2559	3.6059	3.6559	4.1059	4.3559	4.6059	4.8559	5.1059	5.3559	5.6059				
.8043	.8043	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080
.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
**** 8****														
1.4000	1.3008	1.2016	1.1090	1.1890	1.2091	1.4240	1.6740	1.9240	2.1740	2.4240	2.6740	2.9240	3.1740	
3.4240	3.6740	3.9240	4.1740	4.4240	4.6740	4.9240	5.1740	5.4240	5.6740					
.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043
.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043
0.0000	0.0000	0.0000	0.0000	0.0000	.1781	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058
.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058	.3058

WAKE ELEMENTS

**** 1****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 2****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.0577	.0577	.0577	.0577	.0577	.0577	.0577	.0577
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 3****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.1540	.1540	.1540	.1540	.1540	.1540	.1540	.1540
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 4****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.2836	.2836	.2836	.2836	.2836	.2836	.2836	.2836
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 5****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.4310	.4310	.4310	.4310	.4310	.4310	.4310	.4310
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 6****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.5784	.5784	.5784	.5784	.5784	.5784	.5784	.5784
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 7****

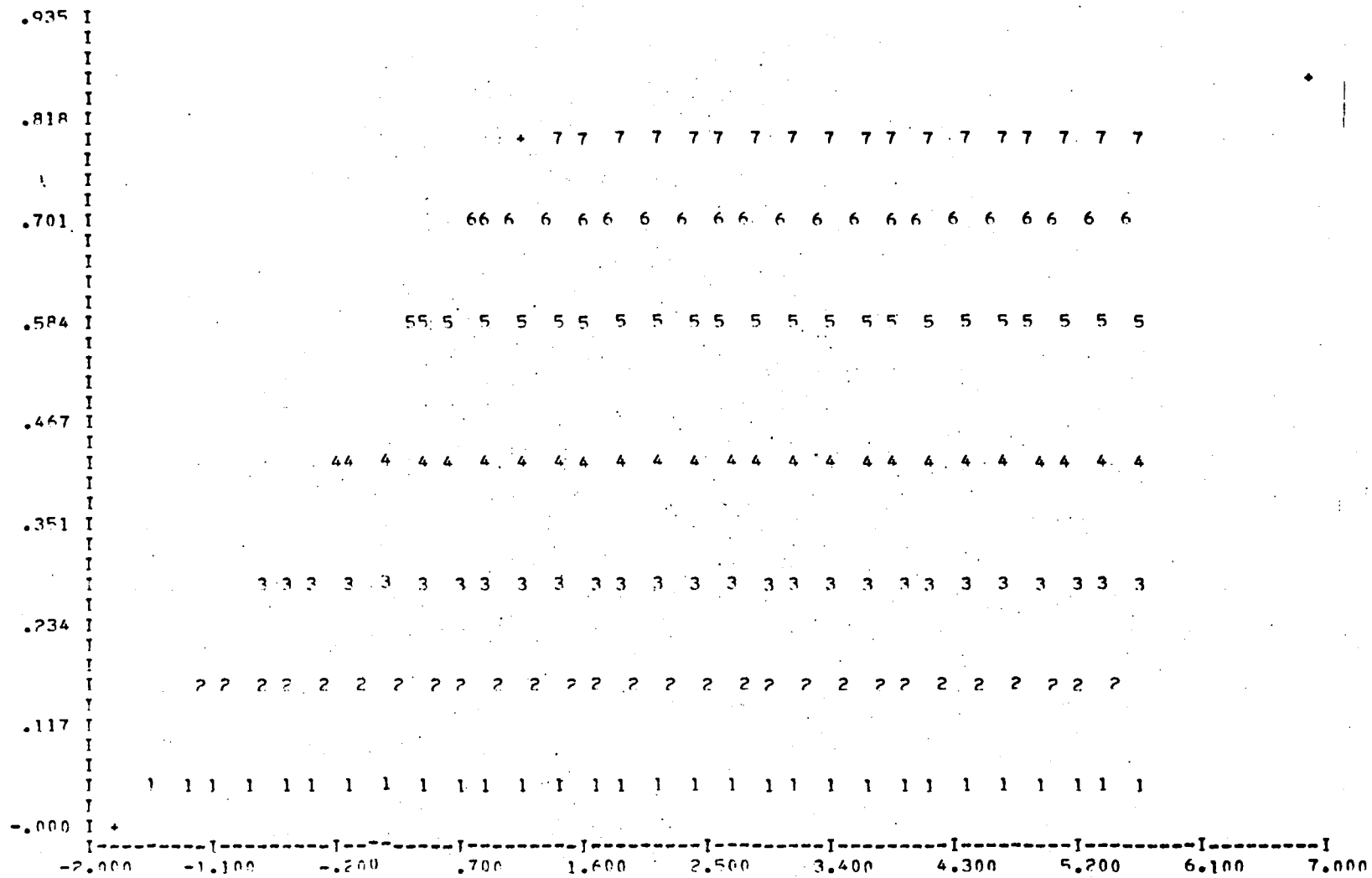
1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.7080	.7080	.7080	.7080	.7080	.7080	.7080	.7080
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 8****

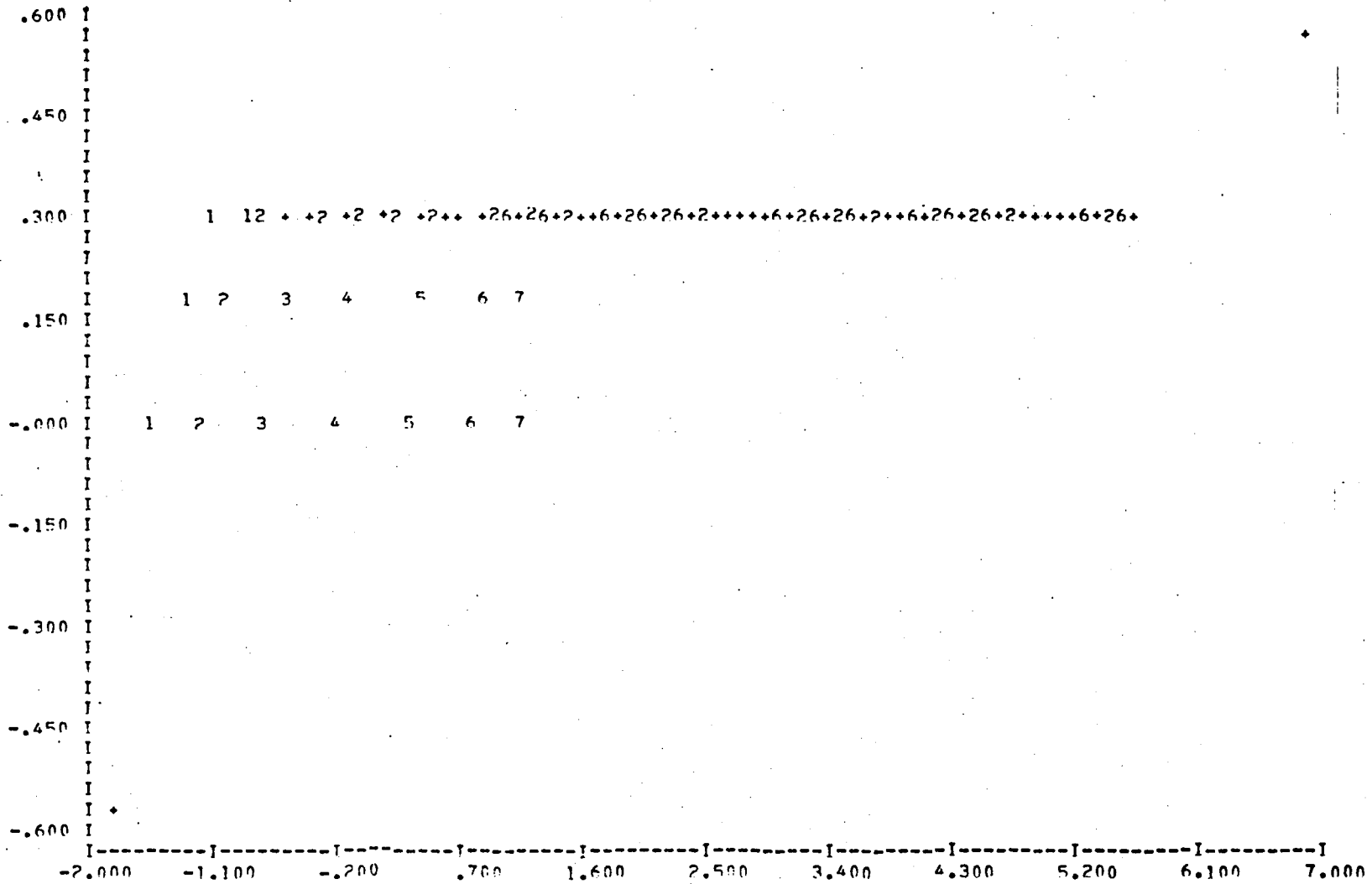
1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.8043	.8043	.8043	.8043	.8043	.8043	.8043	.8043
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 9****

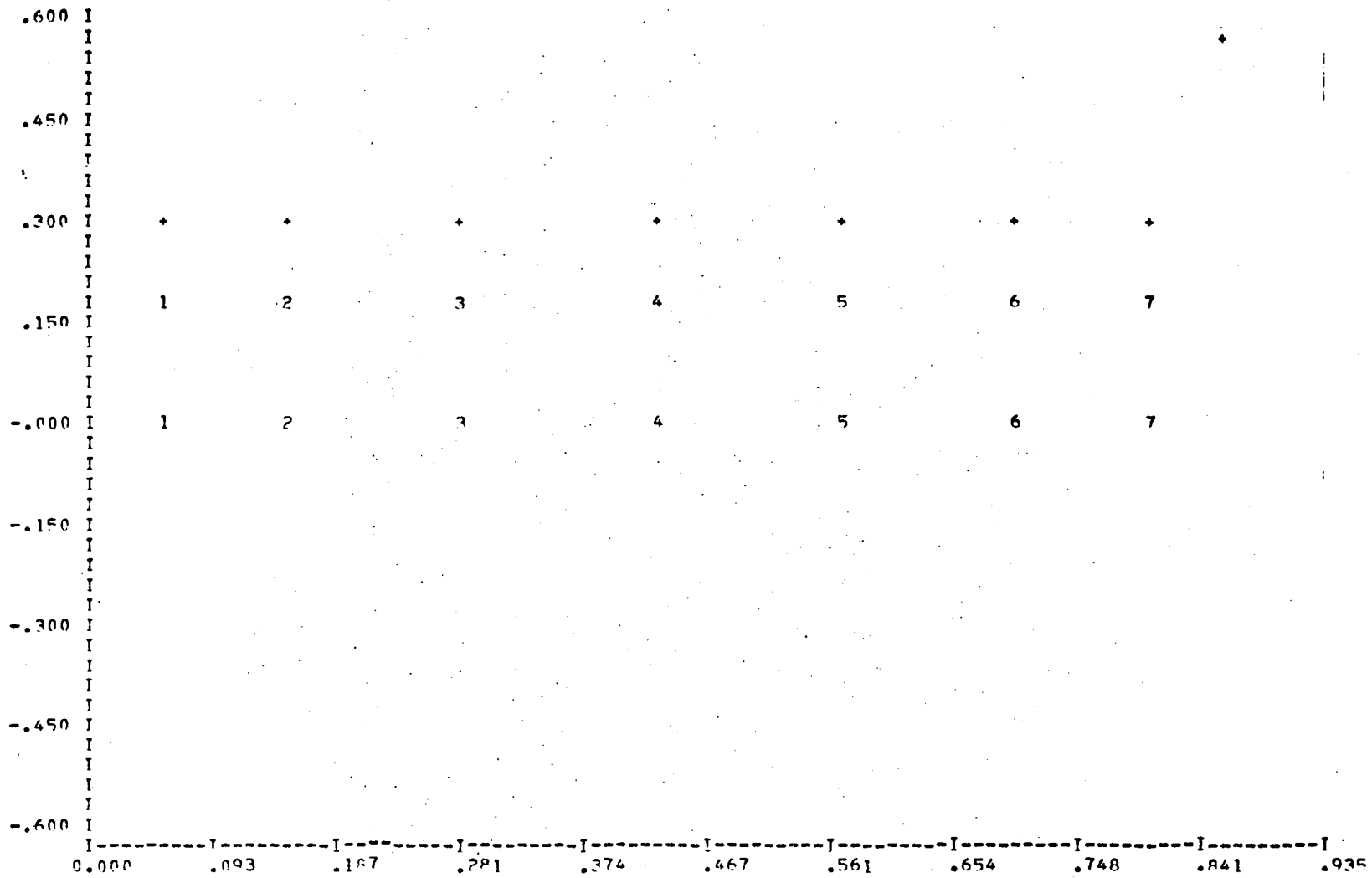
1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
.8555	.8555	.8555	.8555	.8555	.8555	.8555	.8555
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



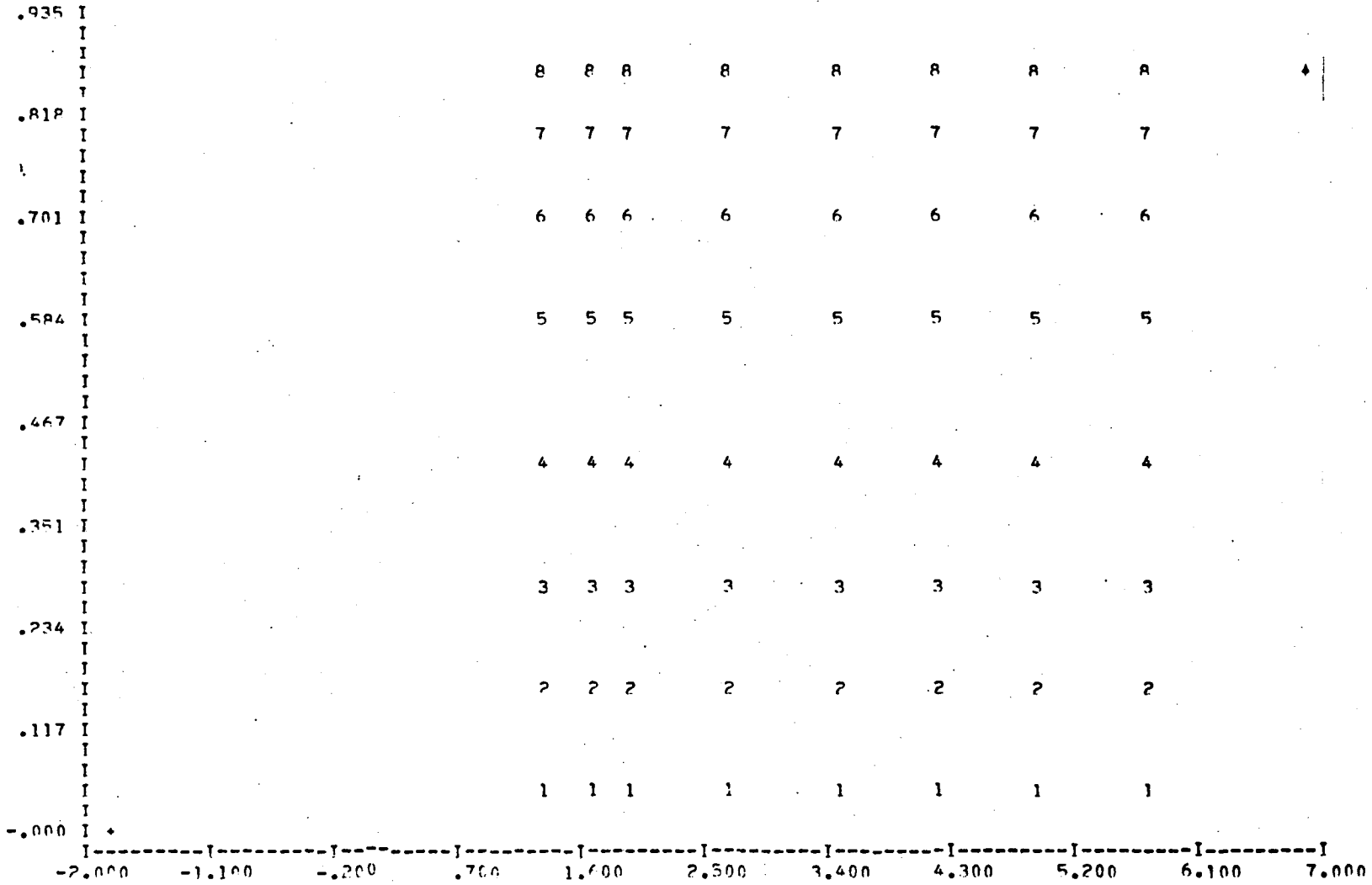
X VS Y



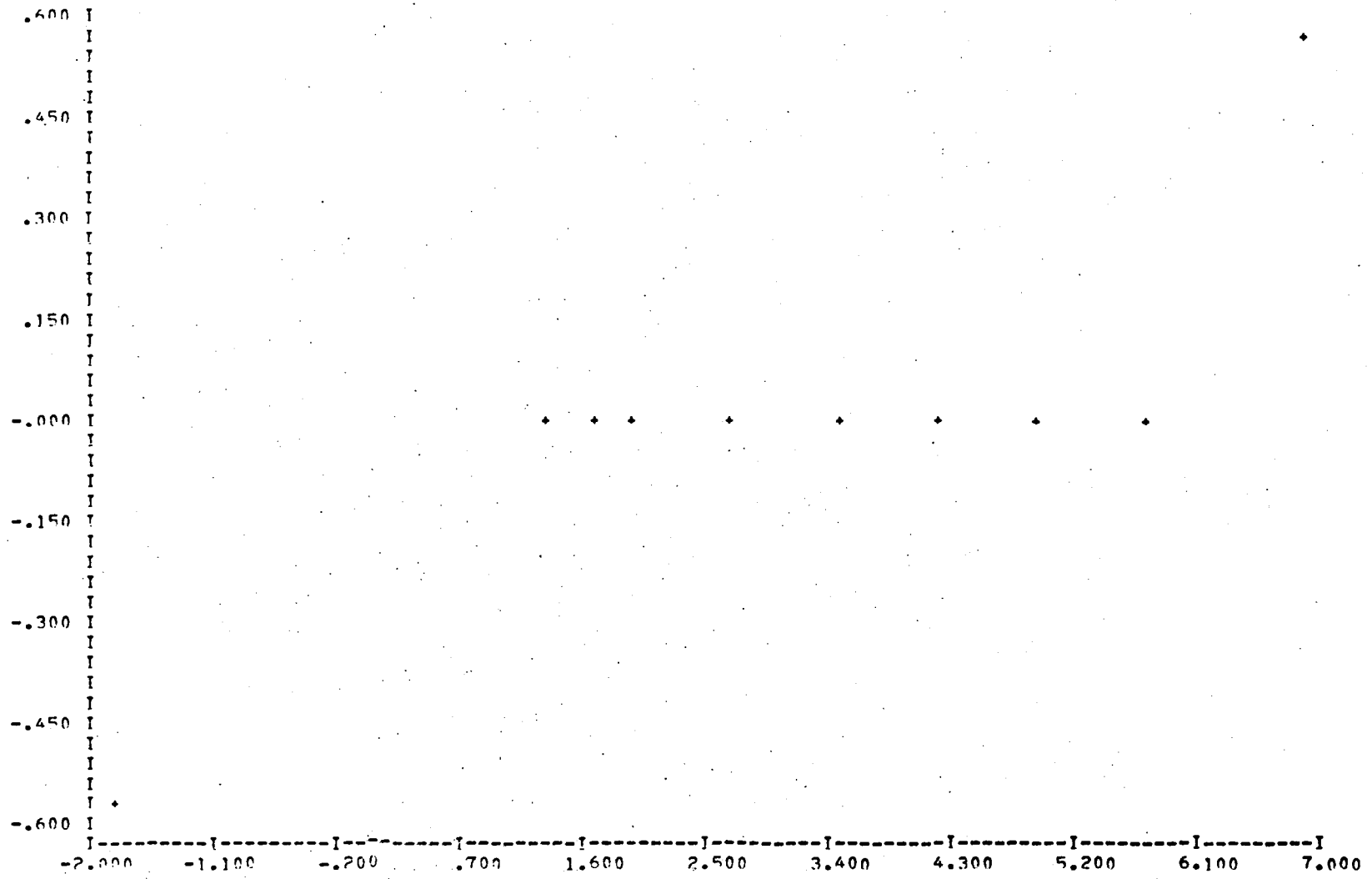
X VS 7



Y VS X

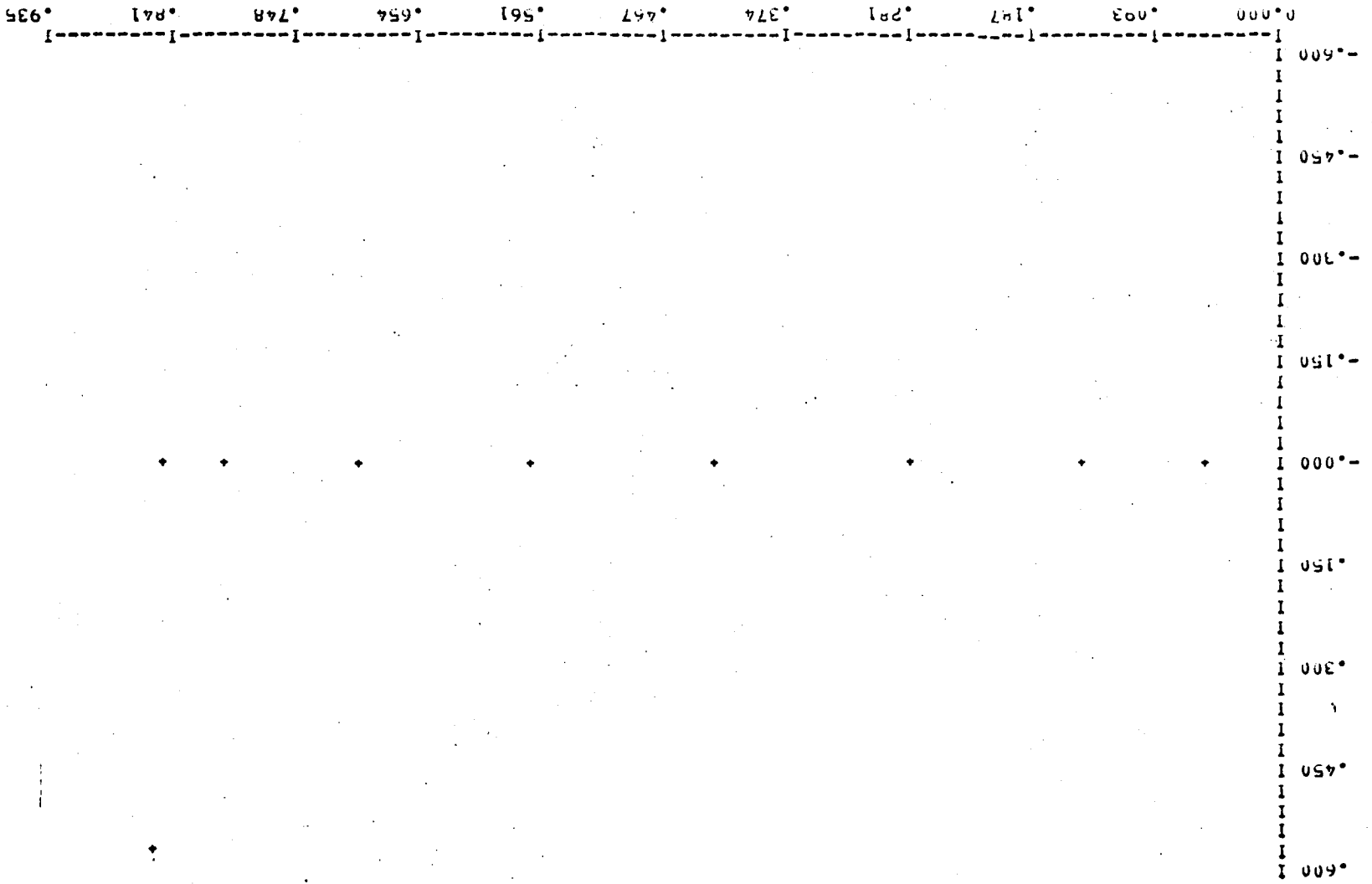


X VS Y



X VS Z

v vs 2



WING VORTEX STRENGTHS

X/C	2Y/B	GAMAY
***	****	*****
.01704	.03015	8.38200
.14645	.03015	1.01076
.37059	.03015	.57752
.62941	.03015	.33881
.85355	.03015	.18110
.98296	.03015	.05805
.01704	.11698	4.07479
.14645	.11698	.84278
.37059	.11698	.57724
.62941	.11698	.34876
.85355	.11698	.18796
.98296	.11698	.05825
.01704	.25000	3.28290
.14645	.25000	.80222
.37059	.25000	.52637
.62941	.25000	.34960
.85355	.25000	.19354
.98296	.25000	.05759
.01704	.41318	3.61828
.14645	.41318	.81333
.37059	.41318	.49334
.62941	.41318	.35042
.85355	.41318	.20046
.98296	.41318	.05876
.01704	.58682	4.41056
.14645	.58682	.79837
.37059	.58682	.52246
.62941	.58682	.37033
.85355	.58682	.21309
.98296	.58682	.06273
.01704	.75000	5.32481
.14645	.75000	.76511
.37059	.75000	.64004
.62941	.75000	.42758
.85355	.75000	.22763
.98296	.75000	.07622
.01704	.88302	6.59845
.14645	.88302	.84702
.37059	.88302	.68324
.62941	.88302	.50084
.85355	.88302	.29713
.98296	.88302	.09346

.01704	.06985	10.70191
.14645	.06985	1.14758
.37059	.06985	.77293
.62041	.06985	.61814
.85355	.06985	.41942
.98296	.06985	.15140

LEADING-EDGE VORTICES STRENGTHS

2Y/R	CARGAMA
****	*****
.03015	1.12870
.11698	.50160
.25000	.36111
.41318	.32146
.58682	.28186
.75000	.20867
.88302	.12942
.96985	.05129

DELTA-CP DISTRIBUTION

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*****
X/C      2Y/R      DELTA-CP
***      ****      *
.01254   .03015   .93644
.10908   .03015   1.58236
.28306   .03015   1.87504
.50000   .03015   .58962
.71694   .03015   .68475
.89092   .03015   .16296
.98746   .03015   .24880
.01254   .11698  10.46179
.10908   .11698   2.57370
.28306   .11698   .84952
.50000   .11698   1.03587
.71694   .11698   .50033
.89092   .11698   .54141
.98746   .11698   .17776
.01254   .25000   5.87619
.10908   .25000   1.19066
.28306   .25000   .76001
.50000   .25000   1.26132
.71694   .25000   .75740
.89092   .25000   .83658
.98746   .25000   .46474
.01254   .41318   5.66503
.10908   .41318   1.70542
.28306   .41318   .78709
.50000   .41318   1.18534
.71694   .41318   .92751
.89092   .41318   .86911
.98746   .41318   .56234
.01254   .58682   4.91002
.10908   .58682   3.88938
.28306   .58682   .83959
.50000   .58682   .57190
.71694   .58682   .76038
.89092   .58682   .49984
.98746   .58682   .39999
.01254   .75000   4.85511
.10908   .75000   4.20697
.28306   .75000   1.03926
.50000   .75000   .57927
.71694   .75000   .27819
.89092   .75000   .21812
.98746   .75000   -.07403
.01254   .88302   5.57029

```

.10000	.00302	4.99757
.20306	.00302	1.76241
.50000	.00302	1.00360
.71694	.00302	.00520
.90002	.00302	-.04567
.98746	.00302	-.63635
.01254	.96905	6.46223
.10000	.96905	6.35060
.20306	.96905	2.11451
.50000	.96905	1.84298
.71694	.96905	.57079
.80002	.96905	.35000
.98746	.96905	-.50505

SECTIONAL PROPERTIES

I	CL	CM	CU	CT
*	**	**	**	**
1	.81962	.23934	.48666	0.00000
2	1.24389	.40657	.67017	0.00000
3	.98137	-.02578	.52479	0.00000
4	1.02978	-.19773	.53115	0.00000
5	1.05218	-.21272	.47921	0.00000
6	.93987	-.41111	.34639	0.00000
7	1.01671	-.56347	.27208	0.00000
8	1.35887	-.87514	.28420	0.00000

TOTAL LIFT COEFFICIENT= 1.01587
 TOTAL PITCHING MOMENT COEFFICIENT= -.03066
 TOTAL DRAG COEFFICIENT= .51375
 TOTAL THRUST COEFFICIENT= 0.00000

SPANWISE PRESSURE AT CONSTANT X=, -.40000

Y	2Y/R (LOCAL)	DELTA-CP
.02500	.07538	1.22605
.10083	.29244	.84703
.21550	.62500	.65597

SPANWISE PRESSURE AT CONSTANT X=, .41000

Y	2Y/R (LOCAL)	DELTA-CP
.02500	.04501	.58400
.10083	.17459	.70256
.21550	.37313	1.19617
.35616	.61668	1.10947
.50584	.87586	1.04922

SPANWISE PRESSURE AT CONSTANT X=, 1.20500

Y	2Y/R (LOCAL)	DELTA-CP
.02500	.03225	.40304
.10083	.12511	.64089
.21550	.26738	.89761
.35616	.44100	.86490
.50584	.62762	.54287
.64650	.90214	.31995
.76117	.94441	1.10036

Results for iterations 1 and 2 are omitted.

Initial Shape of the Free Sheet and Concentrated Core is shown in Iteration 3.

CONICAL CAMBER WING AT ALPHA 30.7 DEGREES
 ALPHA(DEG.)=30.700 MACH NUMBER= 0.000 TREFATION NUMBER= 3

LEADING EDGE ELEMENTS

*** 1****													
1.4000	-1.7429	-1.5624	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.2316	-.6755
-.0974	.6895	1.6399	2.3086	3.0289	3.7492								
.0577	.0577	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0656	.1647
.2755	.4079	.5344	.5344	.5344	.5344								
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0805	.1151
.1926	.2852	.4035	.4868	.5765	.6662								
*** 2****													
1.4000	-1.0223	-1.3639	-1.3990	-1.5390	-1.5251	-1.5108	-1.4959	-1.4801	-1.2316	-1.2316	-1.2316	-.6755	-.0534
.6895	1.6399	2.3086	3.0289	3.7492									
.1540	.1540	.0577	.0577	.0577	.0723	.0819	.0818	.0720	.0656	.0656	.0656	.1647	.2755
.4079	.5344	.5344	.5344	.5344									
0.0000	0.0000	0.0000	0.0000	0.0000	.0265	.0537	.0819	.1046	.1101	.0805	.0805	.1151	.1926
.2852	.4035	.4868	.5765	.6662									
*** 3****													
1.4000	-.5878	-1.0333	-1.0642	-1.1874	-1.0932	-.9969	-.8962	-.7894	-.6755	-.6755	-.6755	-.0534	.6895
1.6399	2.3086	3.0289	3.7492										
.2836	.2836	.1540	.1540	.1540	.1929	.2185	.2182	.1919	.1509	.1509	.1647	.2755	.4079
.5344	.5344	.5344	.5344										
0.0000	0.0000	0.0000	0.0000	0.0000	.0707	.1432	.2184	.2789	.2935	.2104	.1151	.1926	.2852
.4035	.4868	.5765	.6662										
*** 4****													
1.4000	-.0812	-.5878	-.6130	-.7137	-.6025	-.4782	-.3394	-.2001	-.0534	-.0534	-.0534	.6895	1.6399
2.3086	3.0289	3.7492											
.4310	.4310	.2836	.2836	.2836	.3260	.3444	.3262	.2783	.2244	.2244	.2755	.4079	.5344
.5344	.5344	.5344											
0.0000	0.0000	0.0000	0.0000	0.0000	.1107	.2078	.2884	.3609	.3897	.2564	.1926	.2852	.4035
.4868	.5765	.6662											
*** 5****													
1.4000	.4254	-.0812	-.1000	-.1750	-.0450	.1341	.3159	.4958	.6895	.6895	.6895	1.6399	2.3086
3.0289	3.7492												
.5784	.5784	.4310	.4310	.4310	.4689	.4735	.4420	.3800	.3048	.3048	.4079	.5344	.5344
.5344	.5344												
0.0000	0.0000	0.0000	0.0000	0.0000	.1653	.2786	.3865	.4830	.5283	.3049	.2852	.4035	.4868
.5765	.6662												
*** 6****													
1.4000	.8709	.4254	.4130	.3537	.5432	.8194	1.0799	1.3522	1.6399	1.6399	1.6399	2.3086	3.0289
3.7492													
.7080	.7080	.5784	.5784	.5784	.6077	.6042	.5526	.4705	.3837	.3837	.5344	.5344	.5344
.5344													
0.0000	0.0000	0.0000	0.0000	0.0000	.2405	.3891	.5482	.6719	.7466	.3847	.4035	.4868	.5765
.6662													

**** 7****

1.4000	1.2016	.8709	.8642	.2374	1.0374	1.3579	1.6649	1.9755	2.3086	2.3086	2.3086	3.0289	3.7492
.8043	.8043	.7080	.7080	.7080	.7265	.7105	.6434	.5422	.4455	.4455	.5344	.5344	.5344
0.0000	0.0000	0.0000	0.0000	0.0000	.2756	.4571	.6444	.8084	.9240	.5081	.4868	.5765	.6662

**** 8****

1.4000	1.3008	1.2016	1.1990	1.1890	1.4586	1.8571	2.2556	2.6364	3.0289	3.0289	3.0289	3.7492
.8620	.8331	.8043	.8043	.8043	.8302	.8263	.7769	.6450	.4887	.4887	.5344	.5344
0.0000	0.0000	0.0000	0.0000	0.0000	.3231	.5637	.8022	1.0380	1.2372	.6853	.5765	.6662

WAKE ELEMENTS

**** 1****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 2****

1.4000	1.7000	1.9969	2.7369	3.4555	4.1320	4.7960	5.5259
.0577	.0577	.0994	.2185	.3784	.5440	.5655	.6050
0.0000	0.0000	-.0103	.0176	.1606	.4390	.7870	.9552

**** 3****

1.4000	1.7000	1.9876	2.7104	3.4257	4.1248	4.8049	5.4705
.1540	.1540	.2391	.4245	.5716	.6971	.7885	.7780
0.0000	0.0000	-.0060	.0692	.2402	.4809	.7836	1.1292

**** 4****

1.4000	1.7000	1.9716	2.6451	3.3086	4.0065	4.7278	5.4233
.2836	.2836	.4109	.7118	1.0212	1.0775	1.0775	1.0775
0.0000	0.0000	.0064	.1417	.3047	.5733	.7791	1.0596

**** 5****

1.4000	1.7000	1.9690	2.7036	3.3958	4.0762	4.7683	5.4337
.4310	.4310	.5571	.6937	.8938	1.0401	.9303	1.0075
0.0000	0.0000	.0414	.1063	.3147	.5941	.8613	1.1987

**** 6****

1.4000	1.7000	1.9815	2.6673	3.3790	4.1033	4.8165	5.4610
.5784	.5784	.6688	.9291	1.0775	1.0775	1.0775	1.0039
0.0000	0.0000	.0505	.1889	.3809	.5756	.8077	1.1842

**** 7****

1.4000	1.7000	1.9842	2.6744	3.3636	4.0530	4.7559	5.4371
.7080	.7080	.7796	.9909	1.0775	1.0775	1.0775	1.0775
0.0000	0.0000	.0640	.2675	.5505	.8459	1.1076	1.4214

**** 8****

1.4000	1.7000	1.9735	2.6232	3.2764	3.9204	4.5599	5.2008
.8043	.8043	.8669	1.0362	1.0775	1.0452	.9616	.8604
0.0000	0.0000	.1050	.4404	.8067	1.1896	1.5725	1.9486

**** 9****

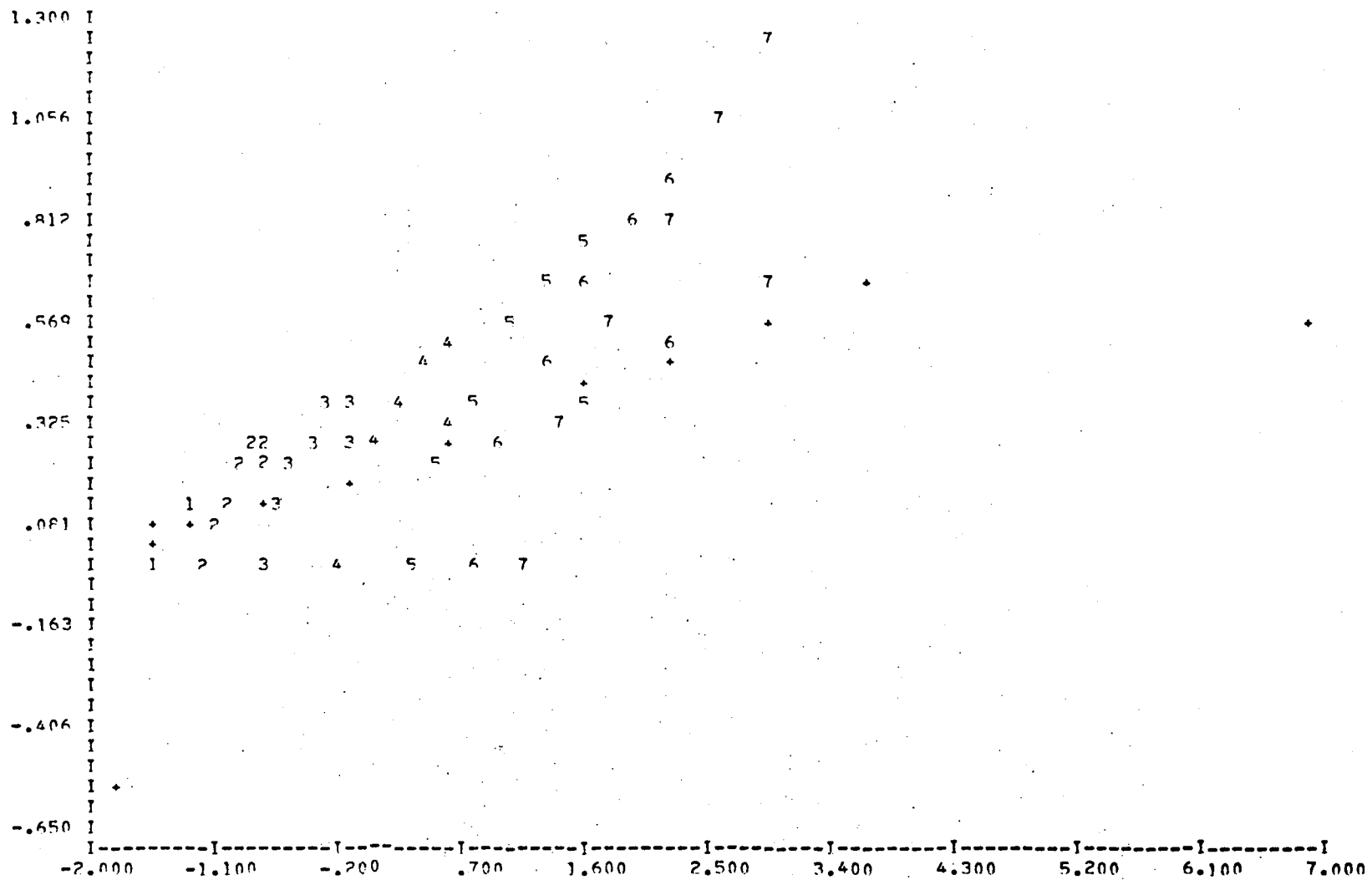
1.4000	1.7000	1.9522	2.5756	3.2153	3.9003	4.5757	5.2731
.8555	.8555	.9096	1.0747	.9933	.8853	.7305	.4737
0.0000	0.0000	.1532	.5361	.9190	1.2048	1.4918	1.5924

X VS Y

-2.000
-1.000
-0.200
.700
1.600
2.500
3.400
4.300
5.200
6.100
7.000

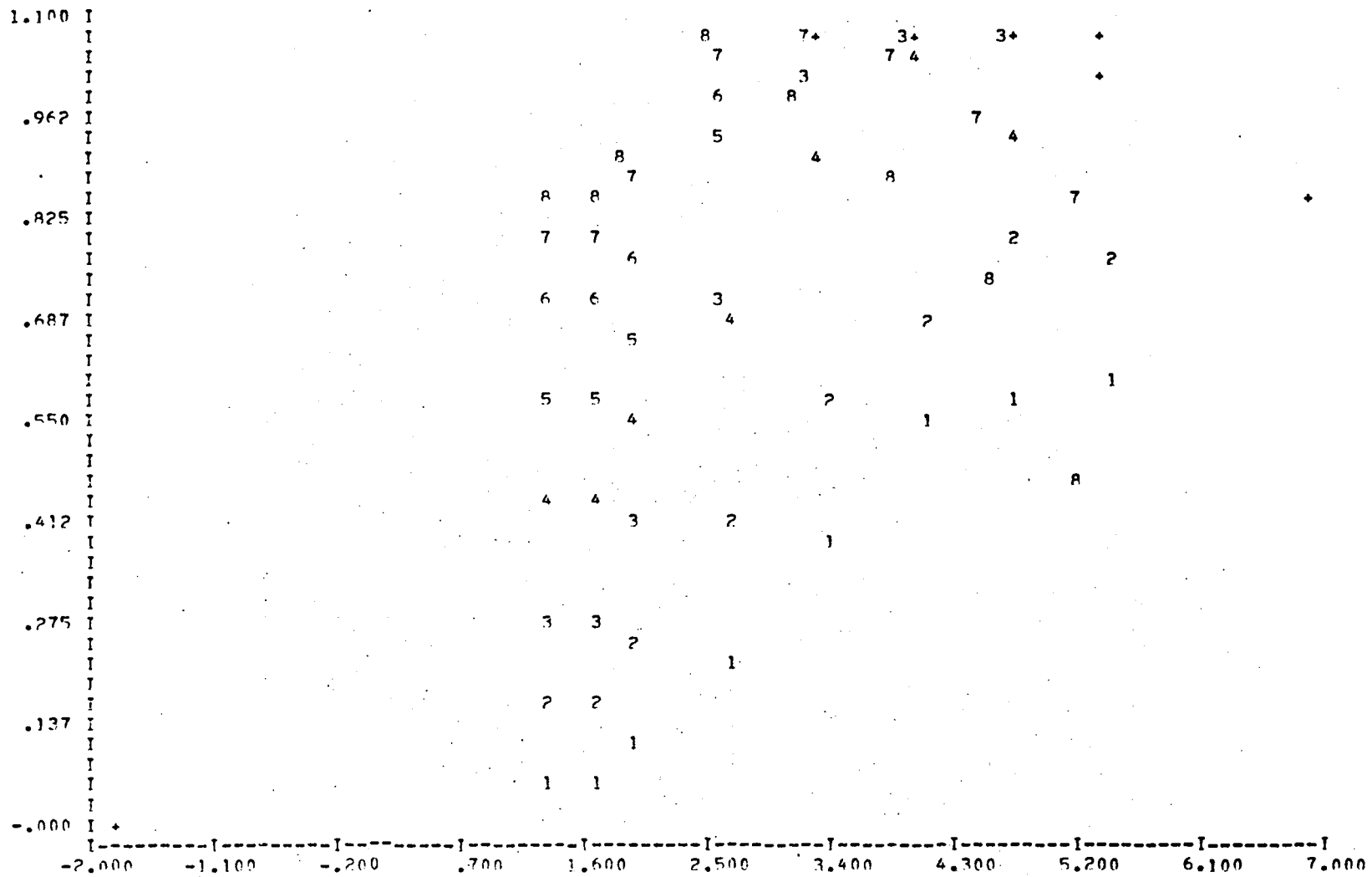
-0.000
.117
.234
.351
.467
.584
.701
.818
.935



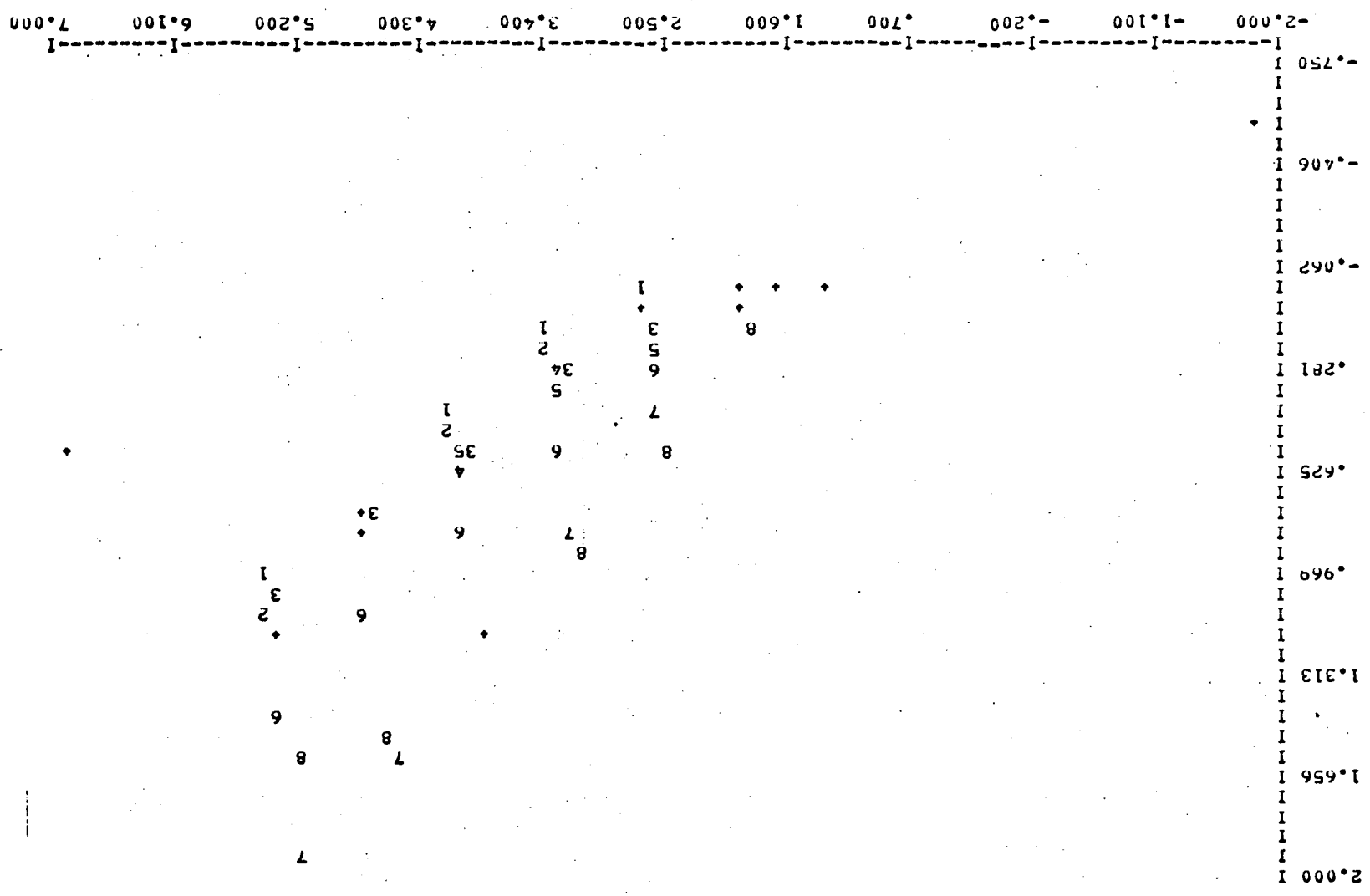


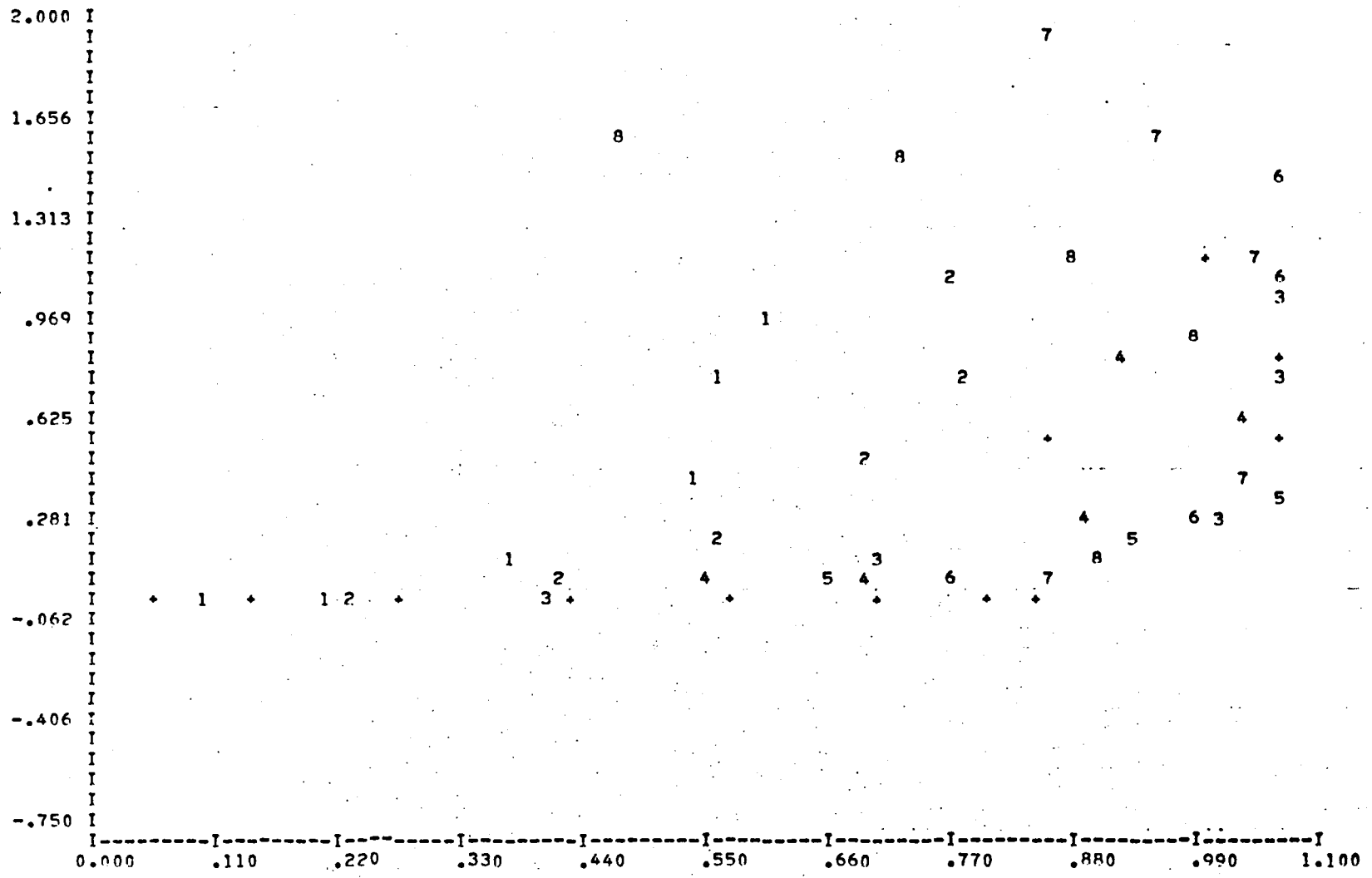
x VS y

	0.000	.093	.187	.281	.374	.467	.561	.654	.748	.841	.935
-0.650											
-0.406											
-0.163											
.081	1	2	3	4	5	6	7				
.325	1	2	3	4	5	6	7				
.569	1	2	3	4	5	6	7				
.812	1	2	3	4	5	6	7				
1.056	1	2	3	4	5	6	7				
1.300	1	2	3	4	5	6	7				



X VS Y





Y VS 7

WING VORTEX STRENGTHS

X/C	ZY/R	GAMAY
***	***	****
.01704	.03015	2.69948
.14645	.03015	.44077
.37059	.03015	.42606
.62941	.03015	.33144
.85355	.03015	.21837
.98296	.03015	.08506
.01704	.11698	1.60319
.14645	.11698	.28572
.37059	.11698	.41397
.62941	.11698	.33436
.85355	.11698	.22344
.98296	.11698	.08351
.01704	.25000	2.06415
.14645	.25000	.32235
.37059	.25000	.29850
.62941	.25000	.29331
.85355	.25000	.21136
.98296	.25000	.07323
.01704	.41318	2.53946
.14645	.41318	.47748
.37059	.41318	.23815
.62941	.41318	.21579
.85355	.41318	.16667
.98296	.41318	.05089
.01704	.58682	3.23341
.14645	.58682	.53154
.37059	.58682	.31264
.62941	.58682	.20575
.85355	.58682	.11987
.98296	.58682	.02939
.01704	.75000	3.92961
.14645	.75000	.54241
.37059	.75000	.45396
.62941	.75000	.28041
.85355	.75000	.13793
.98296	.75000	.03688
.01704	.88302	5.23080
.14645	.88302	.62764
.37059	.88302	.48692
.62941	.88302	.38249
.85355	.88302	.22302
.98296	.88302	.06904

.01704	.96985	8.10640
.14645	.96985	.87192
.37059	.96985	.58965
.62941	.96985	.47335
.85355	.96985	.32222
.98296	.96985	.11631

LEADING-EDGE VORTICES STRENGTHS

ZY/R	CAPGAMA
****	*****
.03015	.41388
.11698	.19614
.25000	.22825
.41318	.22664
.58682	.20691
.75000	.15402
.88302	.09673
.96985	.03885

DELTA-CP DISTRIBUTION

X/C	2Y/R	DELTA-CP
***	****	*****
.01254	.03015	5.37273
.10908	.03015	1.20687
.28306	.03015	.76129
.50000	.03015	.73019
.71694	.03015	.52772
.89092	.03015	.38121
.98746	.03015	.14484
.01254	.11698	7.24640
.10908	.11698	2.50420
.28306	.11698	1.25580
.50000	.11698	.76442
.71694	.11698	.60438
.89092	.11698	.38654
.98746	.11698	.19248
.01254	.25000	2.59038
.10908	.25000	2.72487
.28306	.25000	2.20823
.50000	.25000	1.40225
.71694	.25000	.80584
.89092	.25000	.58850
.98746	.25000	.29099
.01254	.41318	3.49386
.10908	.41318	1.41421
.28306	.41318	1.55573
.50000	.41318	1.69482
.71694	.41318	1.11060
.89092	.41318	.93024
.98746	.41318	.54551
.01254	.58682	3.32251
.10908	.58682	2.27789
.28306	.58682	.80092
.50000	.58682	.91310
.71694	.58682	1.06551
.89092	.58682	.80414
.98746	.58682	.71854
.01254	.75000	3.53866
.10908	.75000	2.80547
.28306	.75000	.71763
.50000	.75000	.46314
.71694	.75000	.40929
.89092	.75000	.32594
.98746	.75000	.18231
.01254	.88302	4.22971

.10908	.88302	3.66379
.28306	.88302	1.15853
.50000	.88302	.51732
.71694	.88302	-.07571
.89092	.88302	-.15354
.98746	.88302	-.52354
.01254	.96985	4.66796
.10908	.96985	4.52855
.28306	.96985	1.53587
.50000	.96985	1.25348
.71694	.96985	.32264
.89092	.96985	.12931
.98746	.96985	-.50031

SECTIONAL PROPERTIES

I	CL	CM	CD	CT
*	**	**	**	**
1	.79297	.29097	.47080	0.00000
2	1.12264	.34315	.61919	0.00000
3	1.29834	.03883	.74537	0.00000
4	1.21109	-.28381	.66595	0.00000
5	.98632	-.37875	.49312	0.00000
6	.71392	-.33113	.27731	0.00000
7	.66261	-.35762	.16599	0.00000
8	.93610	-.60116	.19331	0.00000

TOTAL LIFT COEFFICIENT= 1.05961
 TOTAL PITCHING MOMENT COEFFICIENT= -.03686
 TOTAL DRAG COEFFICIENT= .57220
 TOTAL THRUST COEFFICIENT= 0.00000

SPANWISE PRESSURE AT CONSTANT X=, -.40000
 Y 2Y/R(LOCAL) DELTA-CP
 .02599 .07538 .76345
 .10083 .29244 1.11946
 .21550 .62500 2.51841

SPANWISE PRESSURE AT CONSTANT X=, .41000
 Y 2Y/R(LOCAL) DELTA-CP
 .02599 .04501 .58770
 .10083 .17459 .66697
 .21550 .37313 1.20891
 .35616 .61668 1.74667
 .50584 .87586 1.29153

SPANWISE PRESSURE AT CONSTANT X=, 1.20500
 Y 2Y/R(LOCAL) DELTA-CP
 .02599 .03225 .33228
 .10083 .12511 .31834
 .21550 .26738 .56316
 .35616 .44190 .93004
 .50584 .62762 .97366
 .64650 .80214 .37784
 .76117 .94441 .58189

Similar results for several iterations till " SFAC " value shows an increase (after fifth iteration) from previous value. (See summary sheet on next page)

The best solution is shown after summary sheet.

CONICAL CAMBER WING AT ALPHA 30.7 DEGREES

ALPHA(DEG.)=30.700 MACH NUMBR= 0.000

ITERATION	CL	CM	CD	CT	GMSUM	SFAC
*****	**	**	**	**	*****	****
0	1.0159	-.0307	.5137	0.0000	1.8554	
1	1.1006	-.0546	.5647	0.0000	1.8292	
2	1.1297	-.0925	.5834	0.0000	1.8104	
3	1.0596	-.0369	.5722	0.0000	1.1475	.6443
4	1.2647	-.0083	.6917	0.0000	1.1958	.7056
5	1.3036	-.0050	.7138	0.0000	1.2094	.7195
6	1.3058	-.0051	.7150	0.0000	1.2108	.7159
7	1.3071	-.0054	.7157	0.0000	1.2113	.7181

CONICAL CAMBER WING AT ALPHA 30.7 DEGREES
 ALPHA (DEG.)=30.700 MACH NUMBER= 0.000 ITERATION NUMBER= 6

LEADING EDGE ELEMENTS

**** 1****

1.4000	-1.3639	-1.5624	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.6000	-1.2316	-.6744
-.0517	.6914	1.6433	2.3156	3.0410	3.7669									
.0577	.0577	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0651	.1637
.2739	.4059	.5322	.5307	.5297	.5296									
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0643	.0920
.1657	.2571	.3635	.4090	.4340	.4381									

**** 2****

1.4000	-1.0333	-1.3639	-1.3990	-1.5390	-1.4139	-1.3789	-1.3408	-1.2997	-1.2573	-1.2573	-1.2316	-.6744	-.0517	
.6914	1.6433	2.3156	3.0410	3.7669										
.1540	.1540	.0577	.0577	.0577	.0825	.0848	.0755	.0608	.0448	.0448	.0651	.1637	.2739	
.4059	.5322	.5307	.5297	.5296										
0.0000	0.0000	0.0000	0.0000	0.0000	.0238	.0539	.0801	.0977	.1039	.0727	.0643	.0920	.1657	
.2571	.3635	.4090	.4340	.4381										

**** 3****

1.4000	-.5878	-1.0333	-1.0642	-1.1874	-1.1038	-1.0104	-.9089	-.7993	-.6863	-.6863	-.6744	-.0517	.6914	
1.6433	2.3156	3.0410	3.7669											
.2836	.2836	.1540	.1540	.1540	.2200	.2260	.2013	.1621	.1195	.1195	.1637	.2739	.4059	
.5322	.5307	.5297	.5296											
0.0000	0.0000	0.0000	0.0000	0.0000	.0635	.1437	.2136	.2606	.2771	.1940	.0920	.1657	.2571	
.3635	.4090	.4340	.4381											

**** 4****

1.4000	-.0812	-.5878	-.6130	-.7137	-.6068	-.4932	-.3669	-.2264	-.0804	-.0804	-.0517	.6914	1.6433	
2.3156	3.0410	3.7669												
.4310	.4310	.2836	.2836	.2836	.3470	.3417	.2934	.2264	.1645	.1645	.2739	.4059	.5322	
.5307	.5297	.5296												
0.0000	0.0000	0.0000	0.0000	0.0000	.1048	.2155	.3038	.3562	.3658	.2325	.1657	.2571	.3635	
.4090	.4340	.4381												

**** 5****

1.4000	.4254	-.0812	-.1000	-.1750	-.0385	.1093	.2709	.4517	.6467	.6467	.6914	1.6433	2.3156	
3.0410	3.7669													
.5784	.5784	.4310	.4310	.4310	.4932	.4825	.4079	.3123	.2274	.2274	.4059	.5322	.5307	
.5297	.5296													
0.0000	0.0000	0.0000	0.0000	0.0000	.1522	.3037	.4221	.4827	.4858	.2624	.2571	.3635	.4090	
.4340	.4381													

**** 6****

1.4000	.8709	.4254	.4130	.3637	.5609	.7806	1.0206	1.2932	1.5847	1.5847	1.6433	2.3156	3.0410	
3.7669														
.7080	.7080	.5784	.5784	.5784	.6415	.6142	.4915	.3593	.2548	.2548	.5322	.5307	.5297	
.5296														
0.0000	0.0000	0.0000	0.0000	0.0000	.2191	.4414	.5937	.6597	.6638	.3019	.3635	.4090	.4340	
.4381														

**** 7****

1.4000	1.2016	.8709	.8642	.8374	1.0677	1.3259	1.6041	1.9136	2.2479	2.2479	2.3156	3.0410	3.7669
.8043	.8043	.7080	.7080	.7080	.7650	.7516	.6329	.4875	.3642	.3642	.5307	.5297	.5296
0.0000	0.0000	0.0000	0.0000	0.0000	.2450	.5078	.7135	.8428	.9247	.5088	.4090	.4340	.4381

**** 8****

1.4000	1.3008	1.2016	1.1990	1.1890	1.4857	1.8182	2.1826	2.5752	2.9903	2.9903	3.0410	3.7669
.8620	.8331	.8043	.8043	.8043	.8705	.8542	.7426	.6036	.4822	.4822	.5297	.5296
0.0000	0.0000	0.0000	0.0000	0.0000	.2921	.6175	.8875	1.0986	1.2750	.7231	.4340	.4381

WAKE ELEMENTS

**** 1****

1.4000	1.7000	2.0000	2.7500	3.5000	4.2500	5.0000	5.7500
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 2****

1.4000	1.7000	1.9984	2.7365	3.4298	3.9714	4.6104	5.2510
.0577	.0577	.0871	.2198	.5006	.8507	.9376	1.0114
0.0000	0.0000	.0100	.0224	.0766	.4595	.8425	1.2254

**** 3****

1.4000	1.7000	1.9905	2.6697	3.2258	3.8442	4.4285	5.1233
.1540	.1540	.2280	.5319	.8645	.6816	.3441	.0959
0.0000	0.0000	.0102	.0822	.4651	.8480	1.1754	1.3100

**** 4****

1.4000	1.7000	1.9693	2.4627	3.0583	3.7053	4.3682	5.0568
.2836	.2836	.4142	.8534	.6062	.5002	.3561	.2851
0.0000	0.0000	.0205	.3756	.7585	1.1229	1.4426	1.7311

**** 5****

1.4000	1.7000	1.9467	2.5430	3.1875	3.8371	4.5017	5.1681
.4310	.4310	.5966	.8818	.9037	.7978	.6282	.4016
0.0000	0.0000	.0415	.3958	.7787	1.1384	1.4417	1.7008

**** 6****

1.4000	1.7000	1.9548	2.5881	3.2330	3.8837	4.4696	5.1204
.5784	.5784	.7300	.9768	.9850	.7823	.4663	.1493
0.0000	0.0000	.0456	.3627	.7456	1.0586	1.4042	1.6001

**** 7****

1.4000	1.7000	1.9629	2.5980	3.2512	3.9097	4.5449	5.1788
.7080	.7080	.8397	1.0657	1.0664	.9689	.8200	.6096
0.0000	0.0000	.0596	.3877	.7562	1.1017	1.4716	1.8128

**** 8****

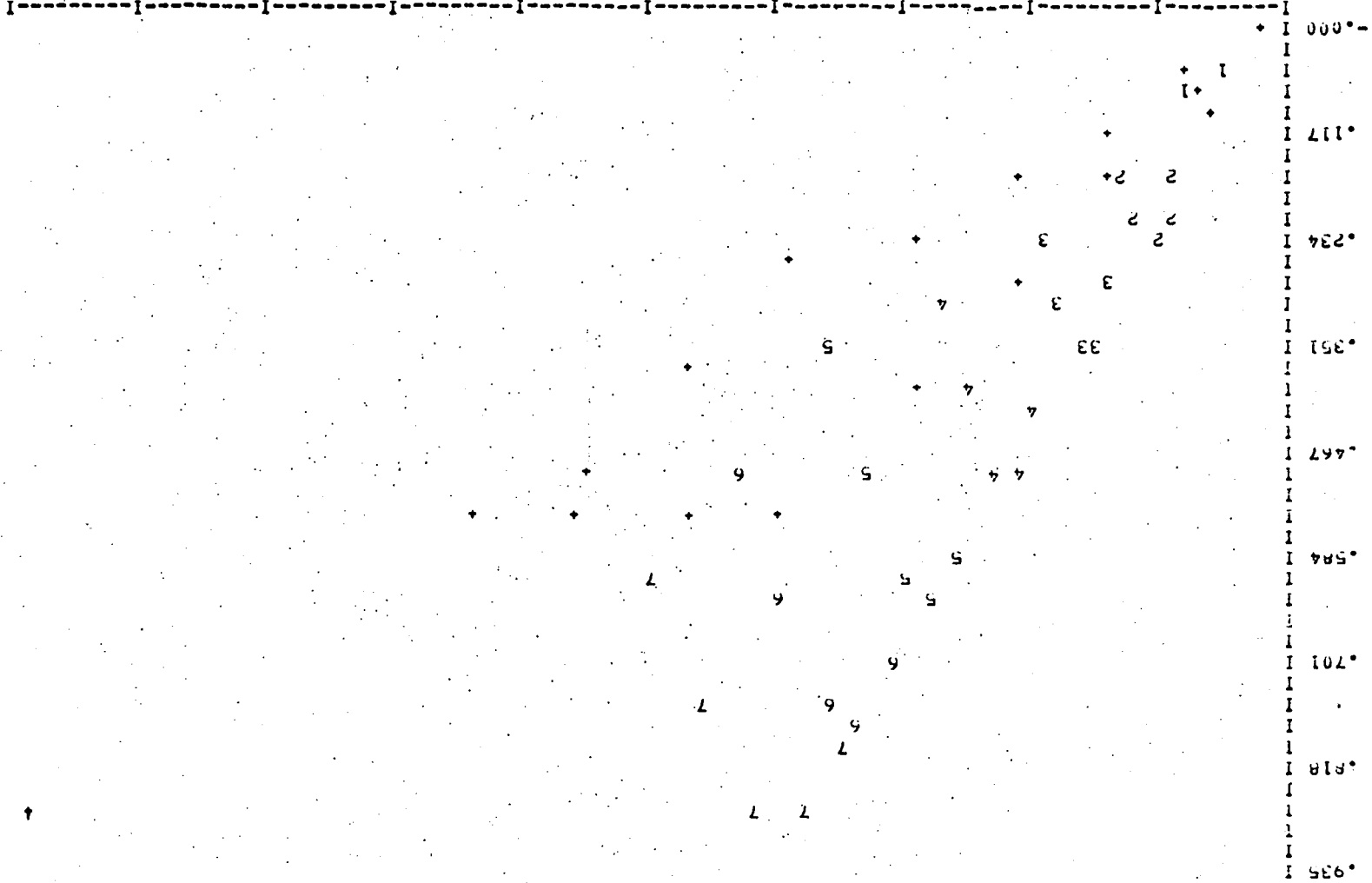
1.4000	1.7000	1.9428	2.5755	3.2199	3.8597	4.5017	5.1481
.8043	.8043	.9469	1.0718	1.0466	.9547	.8228	.6678
0.0000	0.0000	.1035	.4864	.8693	1.2497	1.6142	1.9615

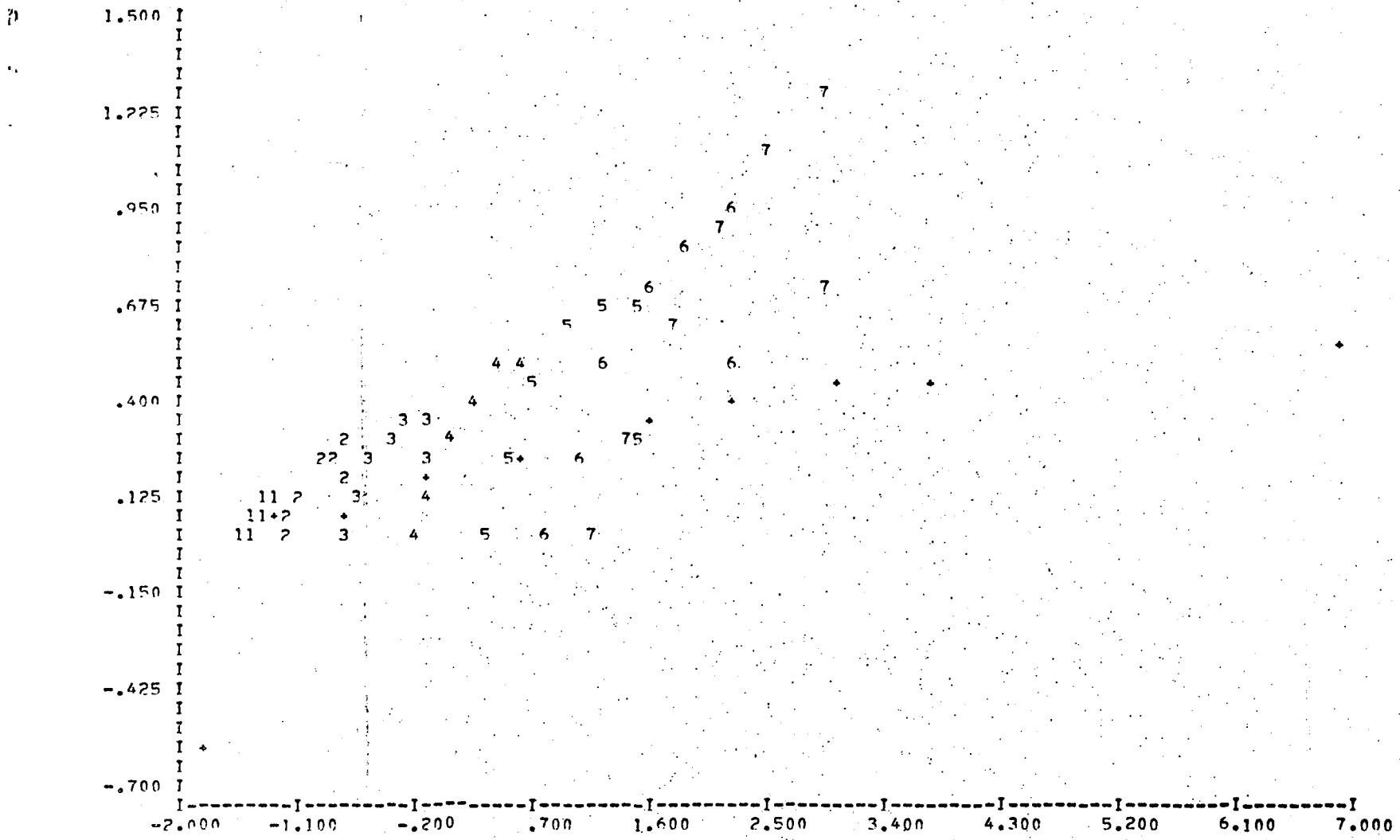
**** 9****

1.4000	1.7000	1.9688	2.6000	3.2497	3.9305	4.6164	5.2689
.8555	.8555	.8721	1.0042	.9498	.8699	.7203	.4018
0.0000	0.0000	.1321	.5150	.8859	1.1901	1.4541	1.6418

X VS Y

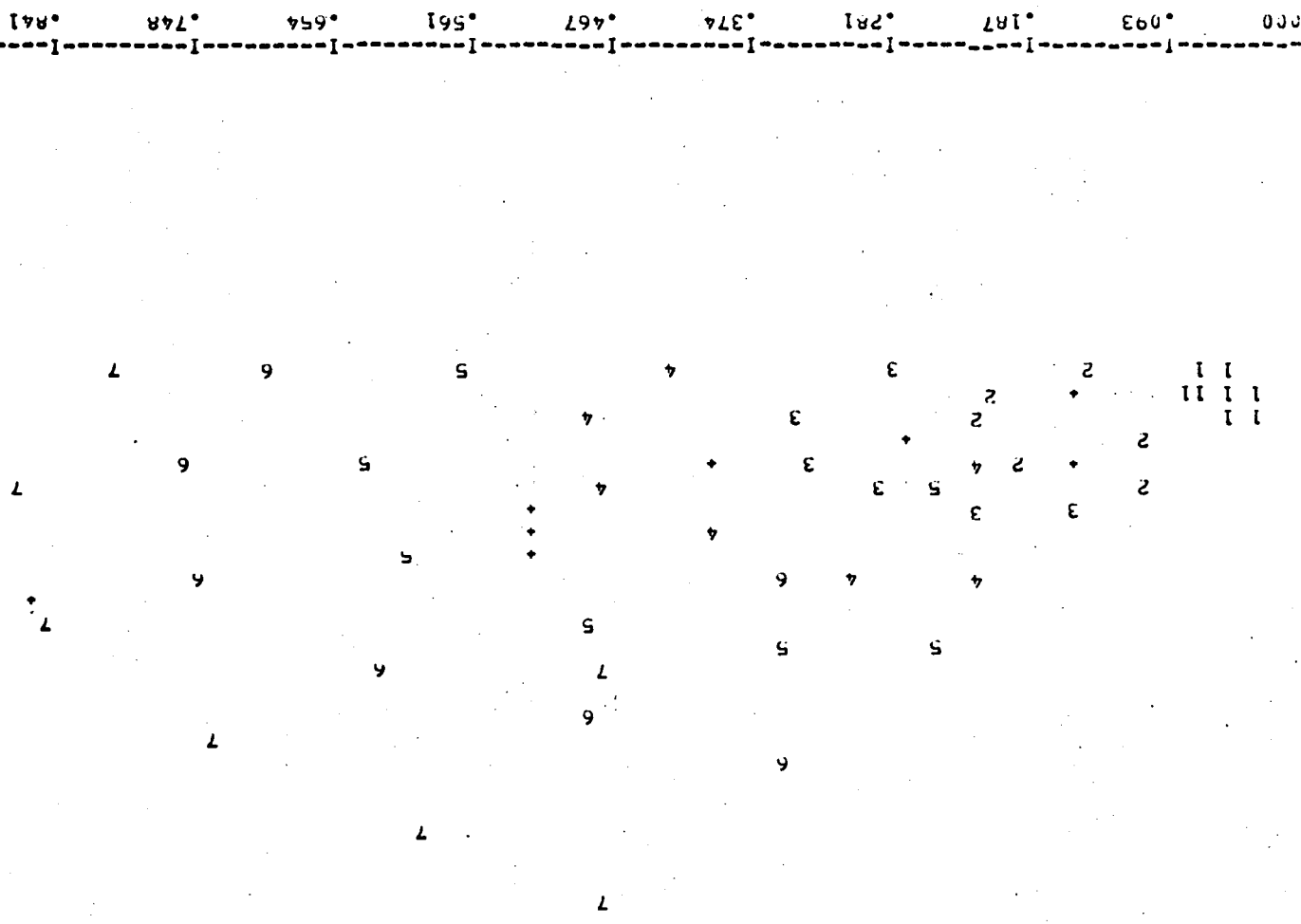
-2.000 -1.100 -.200 .700 1.600 2.500 3.400 4.300 5.200 6.100 7.000



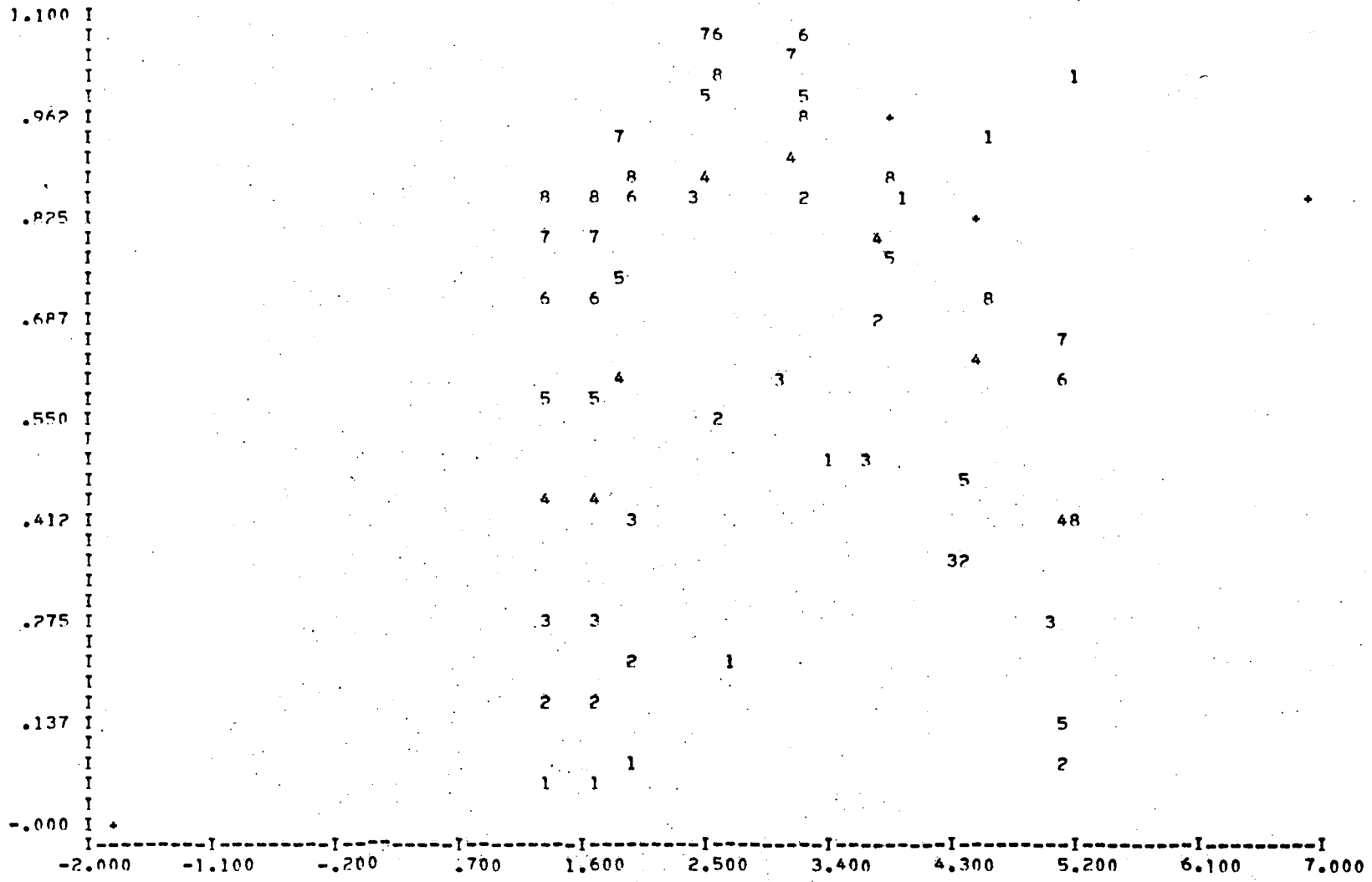


X VS Z

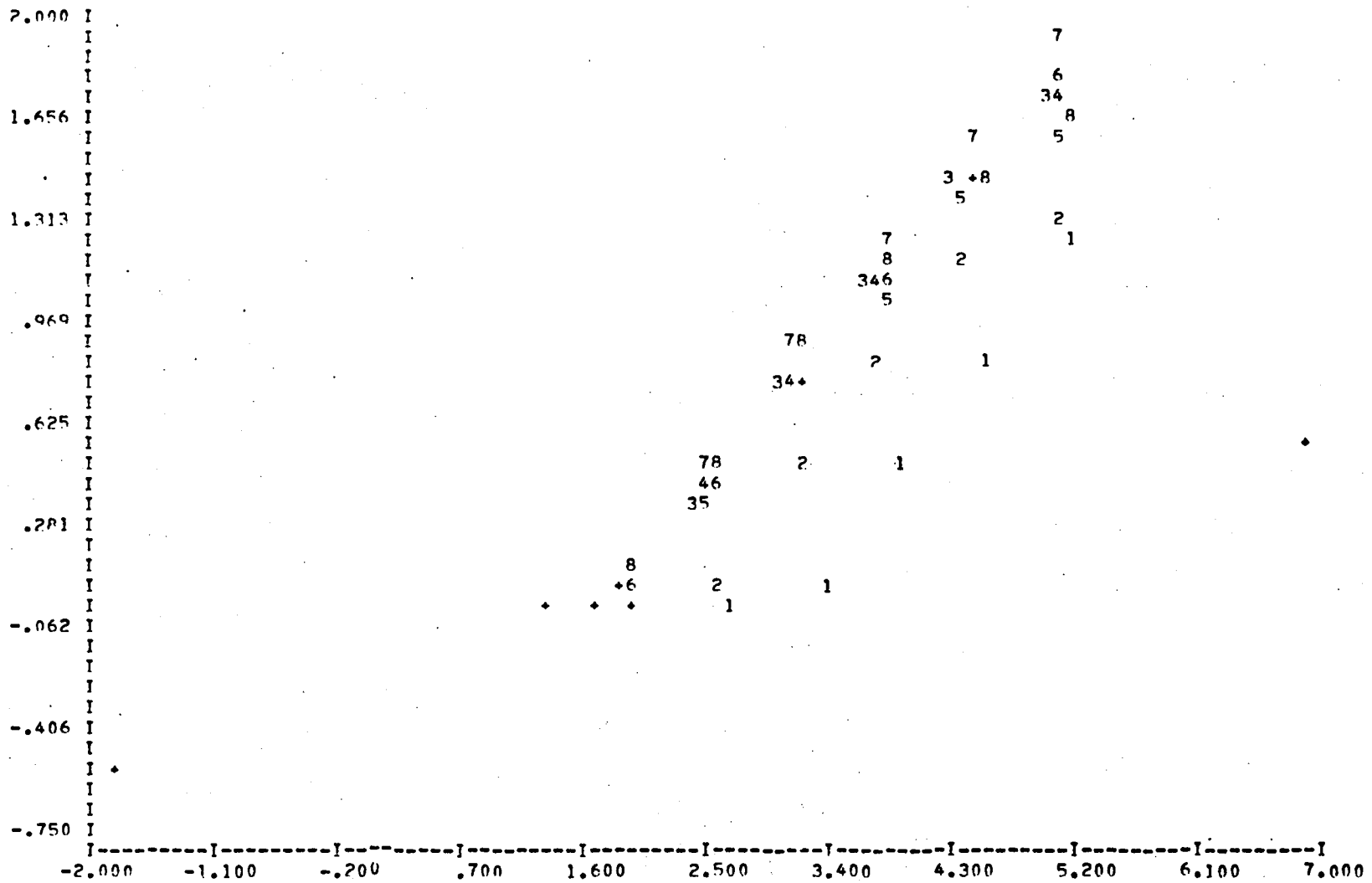
1.500
1.225
1.050
0.675
0.400
0.125
-0.150
-0.425
-0.700



Y VS X

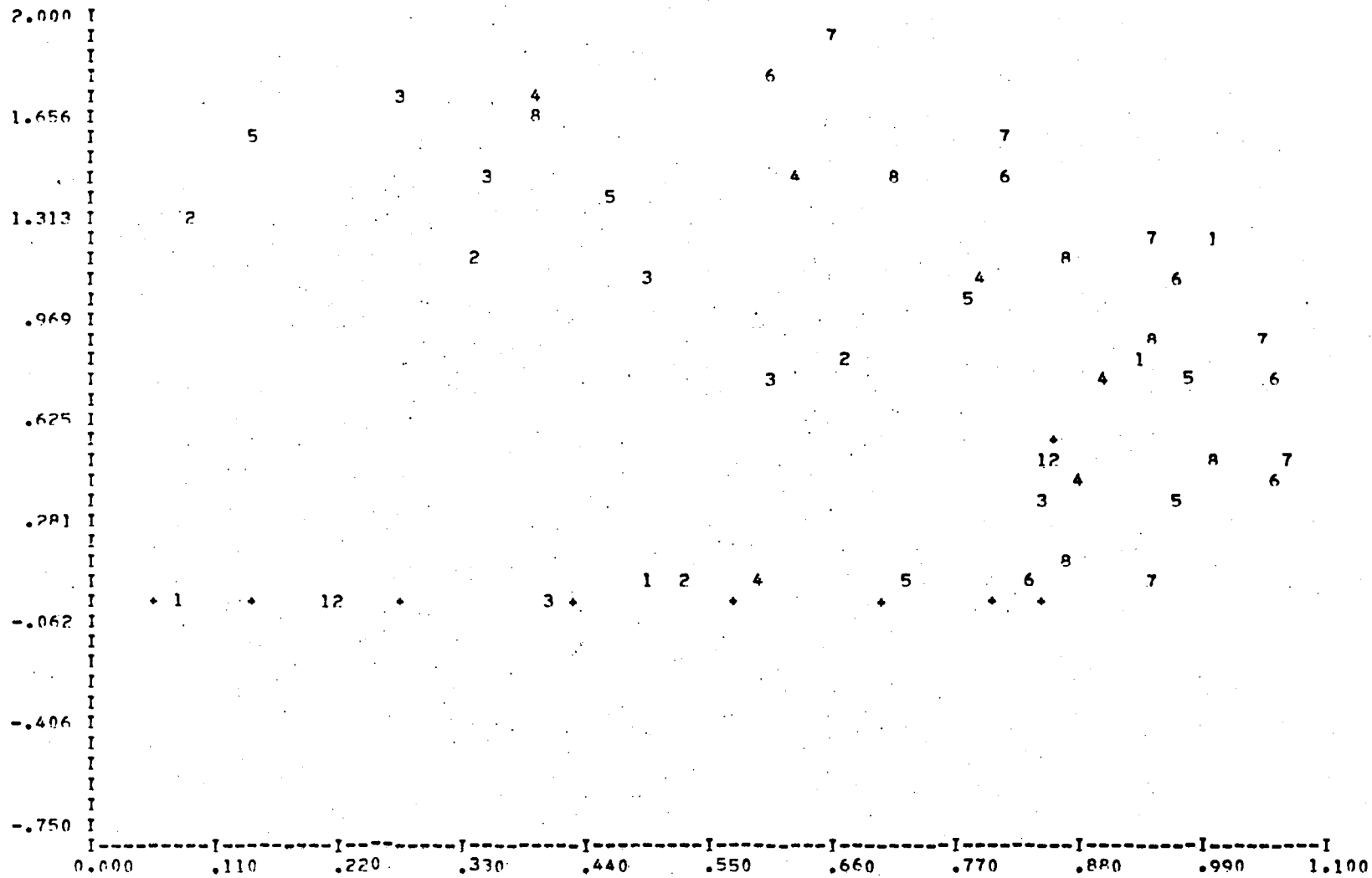


X VS Y



X VS Z

9



Y VS Z

WING VORTEX STRENGTHS

X/C ***	2Y/B ****	GAMAY *****
.01704	.03015	2.42231
.14645	.03015	.46682
.37059	.03015	.43532
.62941	.03015	.33450
.85355	.03015	.21936
.98296	.03015	.09180
.01704	.11698	1.72066
.14645	.11698	.23409
.37059	.11698	.42675
.62941	.11698	.33703
.85355	.11698	.22520
.98296	.11698	.08031
.01704	.25000	2.28950
.14645	.25000	.26095
.37059	.25000	.27138
.62941	.25000	.28508
.85355	.25000	.21341
.98296	.25000	.07034
.01704	.41318	2.66610
.14645	.41318	.45586
.37059	.41318	.19710
.62941	.41318	.18512
.85355	.41318	.15992
.98296	.41318	.04560
.01704	.58682	3.28069
.14645	.58682	.51592
.37059	.58682	.29484
.62941	.58682	.18002
.85355	.58682	.10288
.98296	.58682	.02015
.01704	.75000	3.93349
.14645	.75000	.53743
.37059	.75000	.44080
.62941	.75000	.27561
.85355	.75000	.12935
.98296	.75000	.03276
.01704	.88302	5.22320
.14645	.88302	.62623
.37059	.88302	.48116
.62941	.88302	.37978
.85355	.88302	.22428
.98296	.88302	.06973

.01704	.96985	A.11529
.14645	.96985	.87299
.37059	.96985	.59069
.62941	.96985	.47464
.85355	.96985	.32345
.98296	.96985	.11680

LEADING-EDGE VORTICES STRENGTHS

ZY/R	CAPGAMA
****	*****
.03015	.37658
.11698	.21708
.25000	.25493
.41318	.23887
.58682	.21018
.75000	.15420
.88302	.09659
.96985	.03889

DELTA-CP DISTRIBUTION

```

*****
X/C      2Y/R      DELTA-CP
***      ****      *
.01254   .03015   6.98806
.10908   .03015   1.60492
.28306   .03015   .84178
.50000   .03015   .74088
.71694   .03015   .54086
.89092   .03015   .37889
.98746   .03015   .14148
.01254   .11698   9.54001
.10908   .11698   3.98147
.28306   .11698   1.73228
.50000   .11698   .72563
.71694   .11698   .67064
.89092   .11698   .34810
.98746   .11698   .23262
.01254   .25000   2.54033
.10908   .25000   4.04777
.28306   .25000   3.10560
.50000   .25000   1.67312
.71694   .25000   .91018
.89092   .25000   .63678
.98746   .25000   .34692
.01254   .41318   3.55714
.10908   .41318   1.60558
.28306   .41318   2.01749
.50000   .41318   2.13332
.71694   .41318   1.36905
.89092   .41318   1.15988
.98746   .41318   .71547
.01254   .58682   3.37465
.10908   .58682   2.22913
.28306   .58682   .84266
.50000   .58682   1.08304
.71694   .58682   1.30806
.89092   .58682   1.04583
.98746   .58682   .99100
.01254   .75000   3.62387
.10908   .75000   2.80979
.28306   .75000   .72867
.50000   .75000   .42655
.71694   .75000   .46319
.89092   .75000   .39202
.98746   .75000   .28355
.01254   .88302   4.28095

```

.1090F	.8P302	3.67314
.28306	.88302	1.13856
.50000	.P8302	.46677
.71694	.8P302	-.09444
.89092	.8P302	-.17557
.98746	.8P302	-.53312
.01254	.96985	4.59738
.10908	.96985	4.44246
.28306	.96985	1.51496
.50000	.96985	1.21636
.71694	.96985	.29743
.89092	.96985	.10011
.98746	.96985	-.52598

SECTIONAL PROPERTIES

J	CL	CM	CU	CT
*	**	**	**	**
1	.92808	.38875	.55105	0.00000
2	1.47793	.52553	.81515	0.00000
3	1.69031	.09114	.97860	0.00000
4	1.48083	-.36202	.82349	0.00000
5	1.10559	-.45157	.56406	0.00000
6	.74497	-.35166	.29396	0.00000
7	.64718	-.34701	.15941	0.00000
8	.91155	-.58499	.18766	0.00000

TOTAL LIFT COEFFICIENT= 1.30585
 TOTAL PITCHING MOMENT COEFFICIENT= -.00512
 TOTAL DRAG COEFFICIENT= .71502
 TOTAL THRUST COEFFICIENT= 0.00000

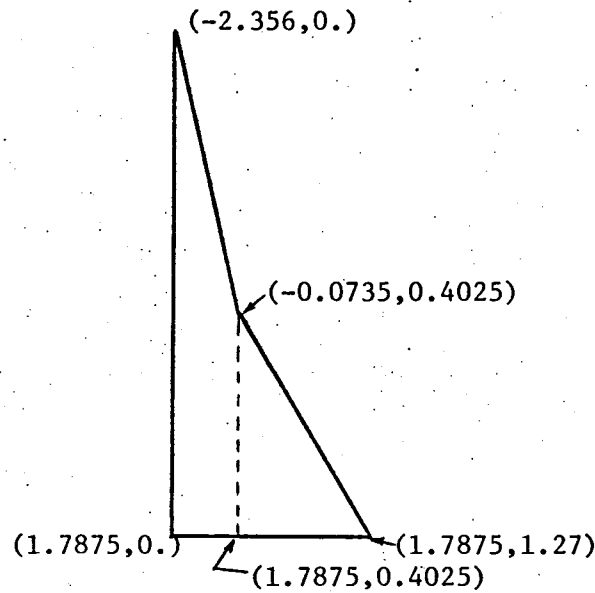
SPANWISE PRESSURE AT CONSTANT X=. - .40000
 Y 2Y/R(LOCAL) DELTA-CP
 .02509 .07538 .79051
 .10083 .29244 1.43394
 .21550 .62500 3.71329

SPANWISE PRESSURE AT CONSTANT Y=. .41000
 Y 2Y/R(LOCAL) DELTA-CP
 .02599 .04501 .60152
 .10083 .17459 .67754
 .21550 .37312 1.39777
 .35616 .61668 2.22570
 .50584 .87586 1.28191

SPANWISE PRESSURE AT CONSTANT X=. 1.20500
 Y 2Y/R(LOCAL) DELTA-CP
 .02599 .03225 .32623
 .10083 .12511 .23926
 .21550 .26738 .60064
 .35616 .44190 1.15861
 .50584 .62762 1.12205
 .64650 .80214 .43487
 .76117 .94441 .53250

2. Input Data of the Second Sample Case

		C O L U M N N U M B E R																				
		1111111111			2222222222			3333333333			4444444444			5555555555			6666666666			7777777777		
CARD NUMBER		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		DOUBLE DELTA WING MODEL ONE (SCALING)																				
1																						
2		6	2	0	0	0	2															
3		2	5	0	0	1	0															
4		0	2																			
5		20.0	0.	0.6	1.2	6.0	2.3835	4.03	0.9													
6		5	5	5	5	5	5	5														
7		0.	1.0																			
8		0.	0.	0.	0.	0.	0.	0.	0.													
9		0.																				
10		-2.356	1.7875	0.	-0.0735	1.7875	0.4025															
11		-0.0735	1.7875	0.4025	1.7875	1.7875	1.27															
12		-2.356	1.7875	0.	-0.0735	1.7875	0.4025															
13		-0.0735	1.7875	0.4025	1.7875	1.7875	1.27															
14		END																				



Output of the Second Sample Case

INPUT DATA CARDS

DOUBLE DELTA WING MODEL ONE (SCALING)

```
  6  2  9  P  0  2
  2  E  6  0  1  0
  0  2
20.00000  0.00000  .60000  1.20000  6.00000  2.39350  4.03000  .90000
  5  5  5  5  5  5  5  5
 0.00000  1.00000
 0.00000  0.00000  0.00000  0.00000  0.00000  0.00000  0.00000  0.00000
 0.00000
SAPWISE SECTION OF NUMBER 1
-2.35600  1.78750  0.00000  -.07350  1.78750  .40250
SAPWISE SECTION OF NUMBER 2
-.07350  1.78750  .40250  1.78750  1.78750  1.27000
```

CAMBER SLOPE AT FINE GRID BOUND ELEMENT

```
DZDXV  DZDYV
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
0.00000  0.00000
```


DZDX DZDY
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
0.00000 0.00000
END OF INPUT DATA

19

DOUBLE DELTA WING MODEL ONE (SCALING)

ALPHA (DEG.)=20.000 MACH NUMBER= 0.000 ITERATION NUMBER= 0

20

LEADING EDGE ELEMENTS

**** 1****

1.7875	-1.8395	-2.3041	-2.3560	-2.5632	-2.1488	-1.5850
.0830	.0830	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560

**** 2****

1.7875	-1.1771	-1.8395	-1.8856	-2.0692	-1.7019	-1.1381	-.5381	.0619	.6619	1.2619	1.8619	2.4619	3.0619
3.6619	4.2619	4.8619	5.4619	6.0619									
.2012	.2012	.0830	.0830	.0830	.0830	.0830	.0830	.0830	.0830	.0830	.0830	.0830	.0830
.0830	.0830	.0830	.0830	.0830									
0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
.3560	.3560	.3560	.3560	.3560									

**** 3****

1.7875	-.5147	-1.1771	-1.2148	-1.3649	-1.0646	-.5008	.0992	.6992	1.2992	1.8992	2.4992	3.0992	3.6992
4.2992	4.8992	5.4992	6.0992										
.3195	.3195	.2012	.2012	.2012	.2012	.2012	.2012	.2012	.2012	.2012	.2012	.2012	.2012
.2012	.2012	.2012	.2012										
0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
.3560	.3560	.3560	.3560										

**** 4****

1.7875	-.0502	-.5147	-.5439	-.6605	-.4274	.1364	.7364	1.3364	1.9364	2.5364	3.1364	3.7364	4.3364
4.9364	5.5364	6.1364											
.4025	.4025	.3195	.3195	.3195	.3195	.3195	.3195	.3195	.3195	.3195	.3195	.3195	.3195
.3195	.3195	.3195											
0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
.3560	.3560	.3560											

**** 5****

1.7875	.2190	-.0502	-.0735	-.1666	.0195	.5834	1.1834	1.7834	2.3834	2.9834	3.5834	4.1834	4.7834
5.3834	5.9834	6.5834											
.5295	.5295	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025
.4025	.4025	.4025											
0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
.3560	.3560	.3560											

**** 6****

1.7875	.6309	.2190	.1990	.1196	.2785	.8423	1.4423	2.0423	2.6423	3.2423	3.8423	4.4423	5.0423
5.6423	6.2423												
.7240	.7240	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295	.5295
.5295	.5295												
0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
.3560	.3560												

**** 7****

1.7875	1.1065	.6309	.6162	.5576	.6747	1.2386	1.8386	2.4386	3.0386	3.6386	4.2386	4.8386	5.4386
6.0386													

	.9485	.9485	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240	.7240
	.7240													
D	0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
	.3560													

	1.7875	1.5184	1.1065	1.0978	1.0633	1.1323	1.6961	2.2961	2.8961	3.4961	4.0961	4.6961	5.2961	5.8961
	6.4961													
	1.1430	1.1430	.9485	.9485	.9485	.9485	.9485	.9485	.9485	.9485	.9485	.9485	.9485	.9485
	.9485													
	0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560
	.3560													

	1.7875	1.6529	1.5184	1.5150	1.5013	1.5286	2.0924	2.6924	3.2924	3.8924	4.4924	5.0924	5.6924	6.2924
	1.2700	1.2065	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430	1.1430
	0.0000	0.0000	0.0000	0.0000	0.0000	.1508	.3560	.3560	.3560	.3560	.3560	.3560	.3560	.3560

WAKE ELEMENTS

**** 1****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 2****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.0830	.0830	.0830	.0830	.0830	.0830
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 3****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.2012	.2012	.2012	.2012	.2012	.2012
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 4****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.3195	.3195	.3195	.3195	.3195	.3195
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 5****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.4025	.4025	.4025	.4025	.4025	.4025
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 6****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.5295	.5295	.5295	.5295	.5295	.5295
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 7****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.7240	.7240	.7240	.7240	.7240	.7240
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 8****

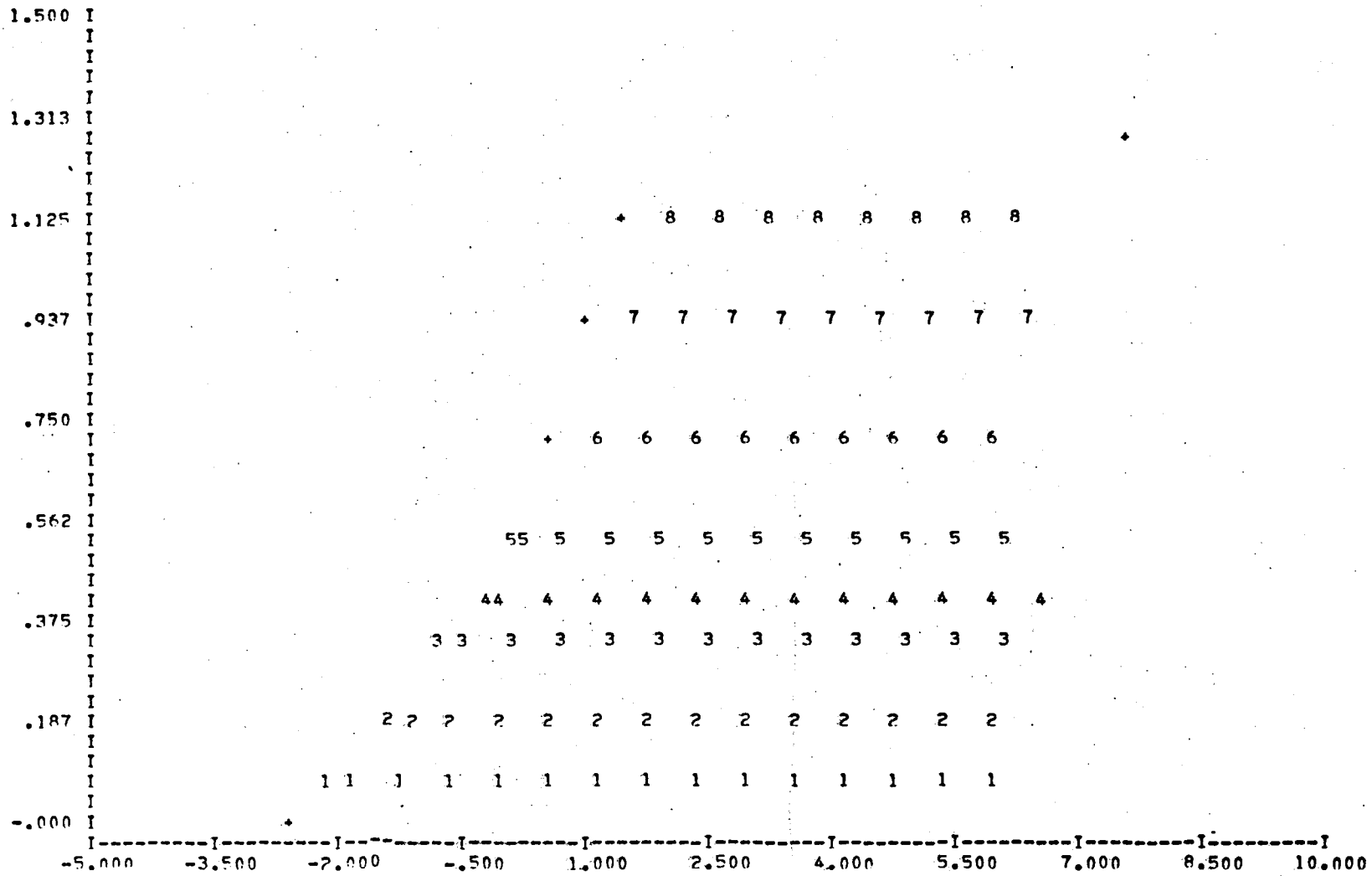
1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
.9485	.9485	.9485	.9485	.9485	.9485
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 9****

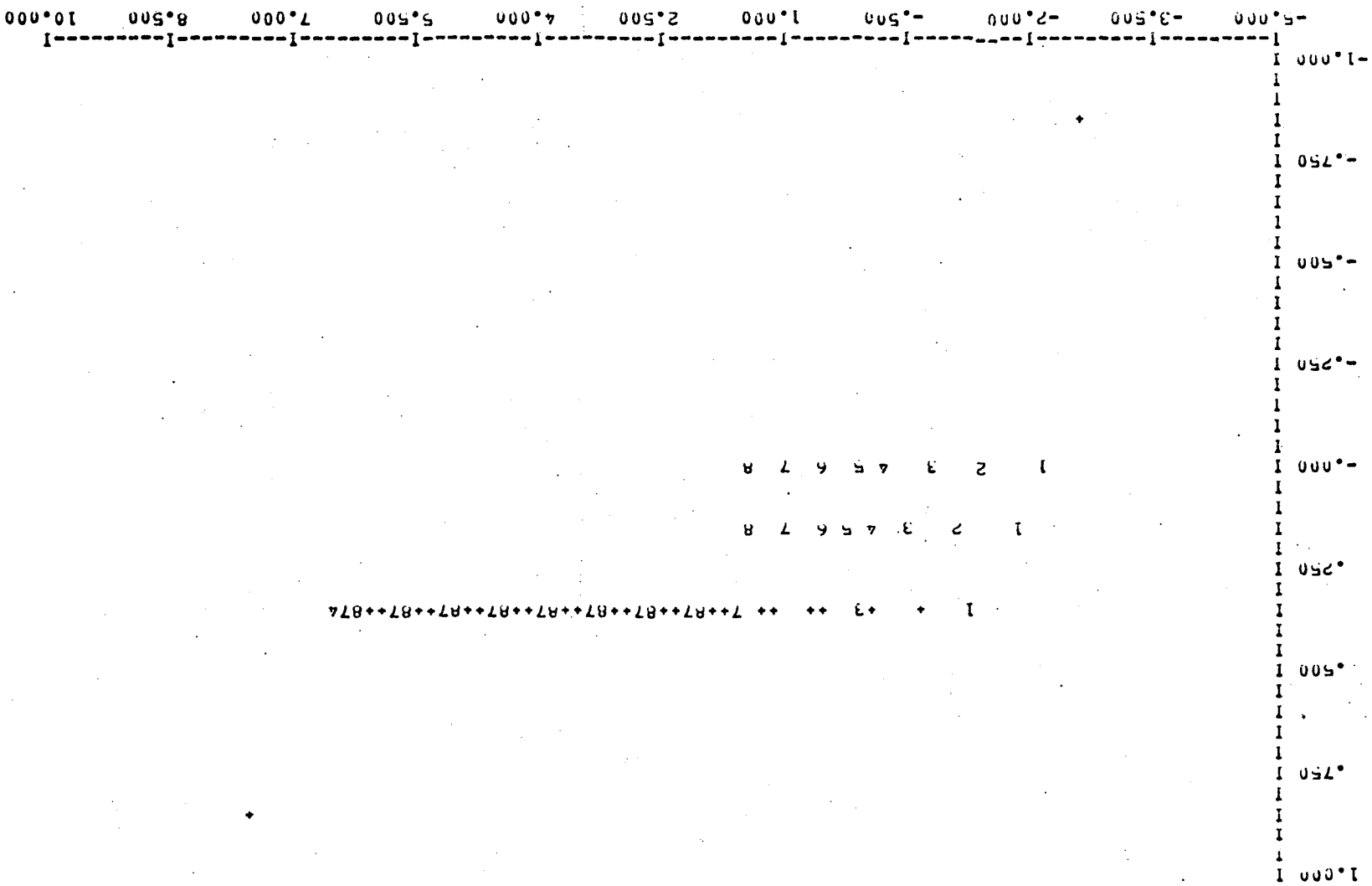
1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
1.1430	1.1430	1.1430	1.1430	1.1430	1.1430
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

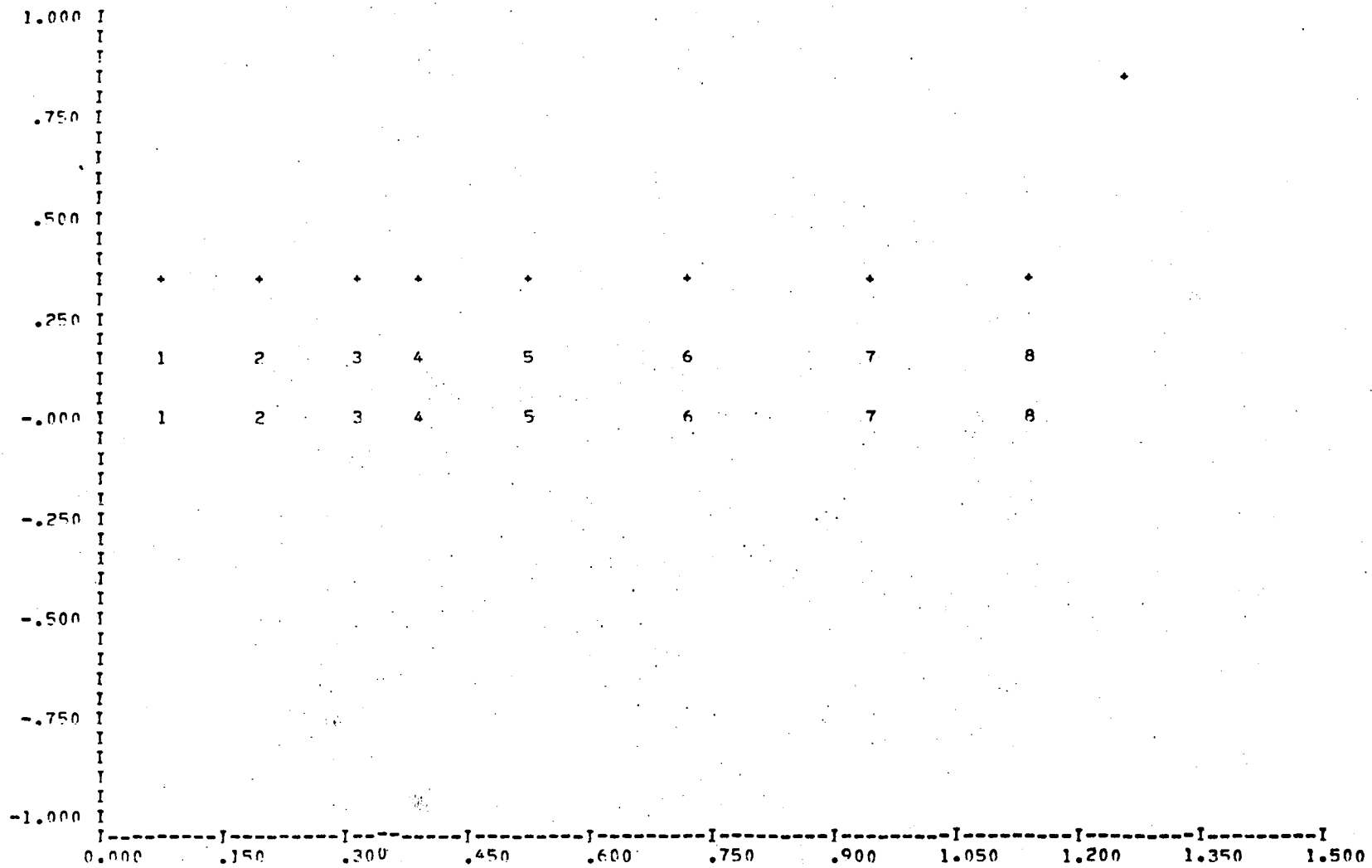
**** 10****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
1.2552	1.2552	1.2552	1.2552	1.2552	1.2552
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

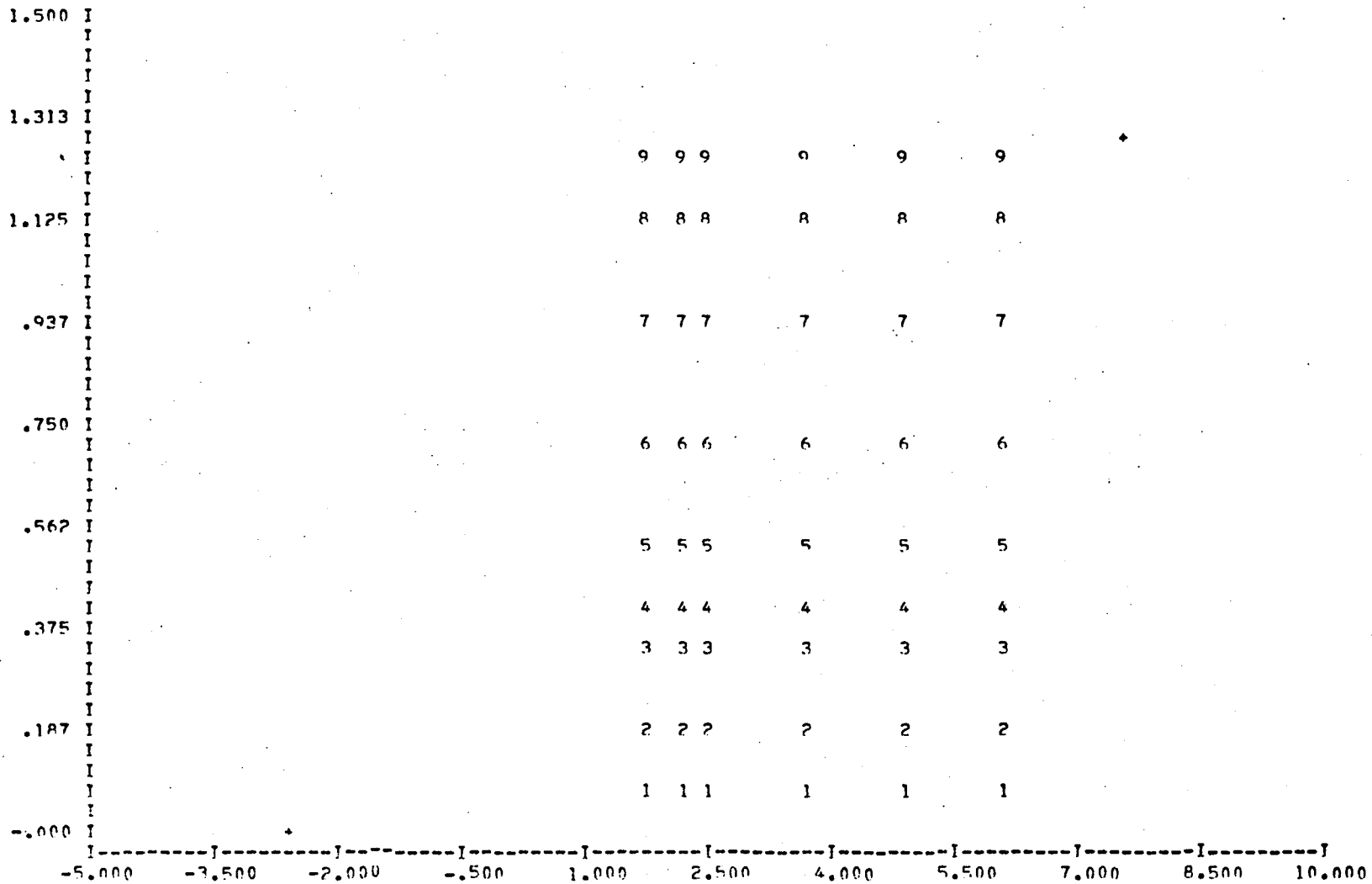


X VS Y

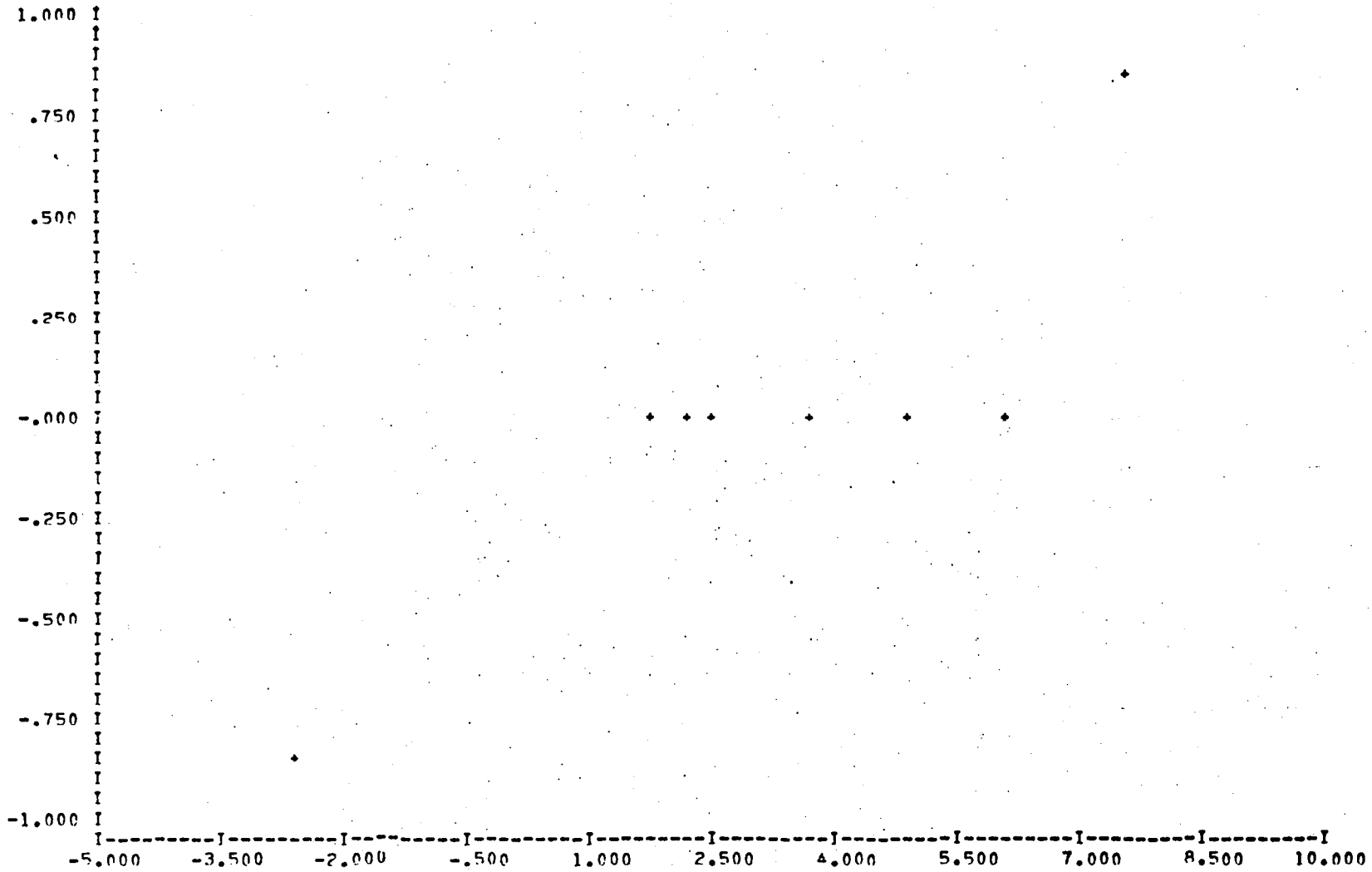




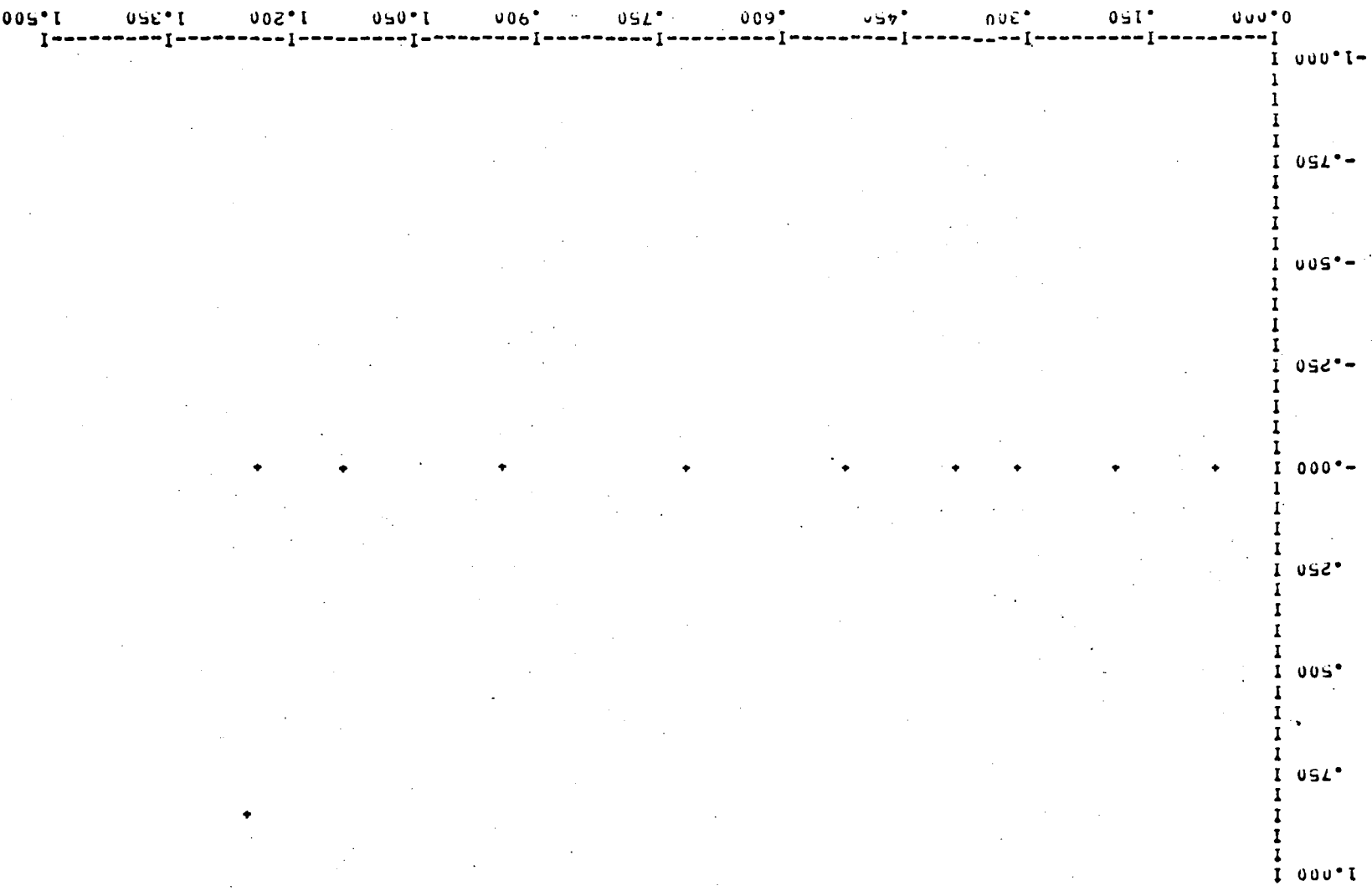
Y VS Z



X VS Y



X VS Z



WING VORTEX STRENGTHS

X/C	2Y/R	GAMAY
***	****	*****
.01704	.03026	2.59407
.14645	.03026	.55458
.37059	.03026	.48124
.62941	.03026	.41650
.85355	.03026	.20818
.98296	.03026	.06456
.01704	.10950	1.84774
.14645	.10950	.51271
.37059	.10950	.50379
.62941	.10950	.43369
.85355	.10950	.21543
.98296	.10950	.06394
.01704	.20743	2.16849
.14645	.20743	.61572
.37059	.20743	.56123
.62941	.20743	.39437
.85355	.20743	.20959
.98296	.20743	.05998
.01704	.28667	2.72216
.14645	.28667	.81409
.37059	.28667	.51791
.62941	.28667	.33941
.85355	.28667	.19500
.98296	.28667	.05518
.01704	.36269	3.36277
.14645	.36269	.70558
.37059	.36269	.44748
.62941	.36269	.30762
.85355	.36269	.18067
.98296	.36269	.05169
.01704	.48770	3.80582
.14645	.48770	.63311
.37059	.48770	.43098
.62941	.48770	.30090
.85355	.48770	.17102
.98296	.48770	.05169
.01704	.65846	5.19767
.14645	.65846	.62487
.37059	.65846	.46970
.62941	.65846	.30604
.85355	.65846	.17329
.98296	.65846	.05345

.01704	.82923	7.17912
.14645	.82923	.75970
.37059	.82923	.51900
.62941	.82923	.34963
.85355	.82923	.18928
.98296	.82923	.05787
.01704	.95424	11.06821
.14645	.95424	1.12482
.37059	.95424	.68775
.62941	.95424	.48266
.85355	.95424	.29289
.98296	.95424	.09640

LEADING-EDGE VORTICES STRENGTHS

ZY/P	CAPGAMA
****	*****
.07026	.49748
.10950	.31003
.20743	.29245
.29667	.28299
.36269	.29368
.48770	.27799
.65846	.25521
.82923	.17709
.95424	.07324

DELTA-CP DISTRIBUTION

X/C	Y/B	DELTA-CP
***	***	*****
.01254	.03026	2.62966
.10908	.03026	1.59500
.28306	.03026	.90802
.50000	.03026	1.02595
.71694	.03026	.70169
.89092	.03026	.38699
.98746	.03026	.16828
.01254	.10950	4.01913
.10908	.10950	.43372
.28306	.10950	.58924
.50000	.10950	1.05212
.71694	.10950	.81478
.89092	.10950	.55881
.98746	.10950	.30239
.01254	.20743	3.98947
.10908	.20743	.18237
.28306	.20743	.86410
.50000	.20743	1.51878
.71694	.20743	1.26026
.89092	.20743	.96383
.98746	.20743	.69370
.01254	.28667	4.93930
.10908	.28667	-.54324
.28306	.28667	.61739
.50000	.28667	1.32812
.71694	.28667	1.03098
.89092	.28667	1.00454
.98746	.28667	.71479
.01254	.36269	4.61817
.10908	.36269	2.05091
.28306	.36269	1.70800
.50000	.36269	1.48027
.71694	.36269	1.16088
.89092	.36269	.95976
.98746	.36269	.74452
.01254	.48770	2.83408
.10908	.48770	1.68652
.28306	.48770	1.21625
.50000	.48770	1.07119
.71694	.48770	1.01238
.89092	.48770	.78103
.98746	.48770	.66521
.01254	.65846	2.32425

.10908	.65846	1.77346
.28306	.65846	.94617
.50000	.65846	.74690
.71694	.65846	.72034
.89092	.65846	.48046
.98746	.65846	.32853
.01254	.82923	2.14580
.10908	.82923	1.85465
.28306	.82923	.88251
.50000	.82923	.57754
.71694	.82923	.33387
.89092	.82923	.18584
.98746	.82923	-.05753
.01254	.95424	1.99767
.10908	.95424	2.01973
.28306	.95424	.90859
.50000	.95424	.84597
.71694	.95424	.47257
.89092	.95424	.30501
.98746	.95424	-.10508

SECTIONAL PROPERTIES

I	CL	CM	CU	CT
*	**	**	**	**
1	.91402	.29392	.33268	0.00000
2	.82187	.06341	.29913	0.00000
3	1.09430	-.20372	.39829	0.00000
4	.92128	-.30765	.33532	0.00000
5	1.50465	-.48795	.54765	0.00000
6	1.13789	-.48842	.41416	0.00000
7	.89491	-.47787	.32572	0.00000
8	.71913	-.46625	.26174	0.00000
9	.83523	-.63475	.30400	0.00000

TOTAL LIFT COEFFICIENT= .97524
 TOTAL PITCHING MOMENT COEFFICIENT= -.19059
 TOTAL DRAG COEFFICIENT= .35496
 TOTAL THRUST COEFFICIENT= 0.00000

SPANWISE PRESSURE AT CONSTANT X=, 0.00000

Y	2Y/R (LOCAL)	DELTA-CP
.03844	.08614	1.01798
.13906	.31166	1.03110
.26344	.59041	1.07920
.36406	.81593	.48499

SPANWISE PRESSURE AT CONSTANT X=, 1.00000

Y	2Y/R (LOCAL)	DELTA-CP
.03844	.04257	.50287
.13906	.15401	.72852
.26344	.29177	1.28738
.36406	.40321	1.17573
.46061	.51014	1.41442
.61937	.68598	1.08199
.83625	.92617	1.52318

Results for iterations 1 and 2 are omitted.

Initial Shape of the Free Sheet and Concentrated Core is shown in Iteration 3.

DOUBLE DELTA WING MODEL ONE (SCALING)
 ALPHA(DFG.)=20.000 MACH NUMBER= 0.000 ITERATION NUMBER= 3

LEADING EDGE ELEMENTS

*** 1***

1.7875	-1.8395	-2.3041	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-1.8619	-.6482
.5654	1.6013	2.6371	3.6730	4.7089										
.0830	.0830	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0810	.1965
.3119	.4327	.5090	.6076	.7062										
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0844	.2047
.3250	.4277	.5304	.6331	.7358										

*** 2***

1.7875	-1.1771	-1.8395	-1.8856	-2.0692	-2.0294	-1.9898	-1.9485	-1.9056	-1.8619	-1.8619	-1.8619	-1.8619	-.6482	.5654
1.6013	2.6371	3.6730	4.7089											
.2012	.2012	.0830	.0830	.0830	.0957	.1093	.1104	.0989	.0810	.0810	.0810	.0810	.1965	.3119
.4105	.5090	.6076	.7062											
0.0000	0.0000	0.0000	0.0000	0.0000	.0291	.0586	.0833	.1032	.1206	.0844	.0844	.0844	.2047	.3250
.4277	.5304	.6331	.7358											

*** 3***

1.7875	-.5147	-1.1771	-1.2148	-1.3649	-1.2274	-1.0903	-.9476	-.7993	-.6482	-.6482	-.6482	-.6482	.5654	1.6013
2.6371	3.6730	4.7089												
.3195	.3195	.2012	.2012	.2012	.2322	.2651	.2679	.2399	.1965	.1965	.1965	.1965	.3119	.4105
.5090	.6076	.7062												
0.0000	0.0000	0.0000	0.0000	0.0000	.0707	.1421	.2021	.2503	.2926	.2047	.2047	.2047	.3250	.4277
.5304	.6331	.7358												

*** 4***

1.7875	-.0502	-.5147	-.5439	-.6605	-.4253	-.1908	.0532	.3069	.5654	.5654	.5654	.5654	1.6013	2.6371
3.6730	4.7089													
.4025	.4025	.3195	.3195	.3195	.3688	.4210	.4254	.3809	.3119	.3119	.3119	.3119	.4105	.5090
.6076	.7062													
0.0000	0.0000	0.0000	0.0000	0.0000	.1123	.2257	.3209	.3974	.4646	.3250	.3250	.3250	.4277	.5304
.6331	.7358													

*** 5***

1.7875	.2190	-.0502	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	.4343	1.5858
2.9156	4.0672	4.5324												
.5295	.5295	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.5227	.7146
.9362	1.1281	1.2057												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.3101	.4239
.5554	.6692	.7152												

*** 6***

1.7875	.6309	.2190	.1990	.1194	.1600	.2226	.2967	.3682	.4343	.4343	.4343	.4343	1.5858	2.9156
4.0672	4.5324													
.7240	.7240	.5295	.5295	.5295	.5795	.5976	.5881	.5600	.5227	.5227	.5227	.5227	.7146	.9362
1.1281	1.2057													
0.0000	0.0000	0.0000	0.0000	0.0000	.1309	.2052	.2468	.2889	.3398	.3101	.3101	.3101	.4239	.5554
.6692	.7152													

**** 7****

1.7875	1.1065	.6309	.6162	.5576	.6896	.8941	1.1365	1.3699	1.5858	1.5858	1.5858	2.9156	4.0672
4.5324													
.9485	.9485	.7240	.7240	.7240	.7923	.8171	.8041	.7657	.7146	.7146	.7146	.9362	1.1281
1.2057													
0.0000	0.0000	0.0000	0.0000	0.0000	.1790	.2806	.3374	.3949	.4646	.4239	.4239	.5554	.6692
.7152													

**** 8****

1.7875	1.5184	1.1065	1.0978	1.0633	1.3010	1.6695	2.1061	2.5267	2.9156	2.9156	2.9156	4.0672	4.5324
1.1430	1.1430	.9485	.9485	.9485	1.0380	1.0705	1.0534	1.0031	.9362	.9362	.9362	1.1281	1.2057
0.0000	0.0000	0.0000	0.0000	0.0000	.2346	.3676	.4420	.5174	.6087	.5554	.5554	.6692	.7152

**** 9****

1.7875	1.6529	1.5184	1.5150	1.5013	1.8306	2.3410	2.9458	3.5284	4.0672	4.0672	4.0672	4.5324	
1.2700	1.2065	1.1430	1.1430	1.1430	1.2508	1.2900	1.2694	1.2088	1.1281	1.1281	1.1281	1.2057	
0.0000	0.0000	0.0000	0.0000	0.0000	.2826	.4429	.5326	.6235	.7335	.6692	.6692	.7152	

WAKE ELEMENTS

**** 1****

1.7875	2.2019	2.6162	3.8162	5.0262	6.2162
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 2****

1.7875	2.2019	2.6141	3.8078	4.9993	6.1897
.0830	.0830	.1235	.2391	.3605	.4650
0.0000	0.0000	.0117	.0502	.1250	.2356

**** 3****

1.7875	2.2019	2.6063	3.7711	4.9219	6.0373
.2012	.2012	.2906	.5646	.7651	1.1722
0.0000	0.0000	.0117	.1015	.3761	.5500

**** 4****

1.7875	2.2019	2.6005	3.7413	4.8315	6.0231
.3195	.3195	.4325	.7225	1.0516	1.1404
0.0000	0.0000	-.0024	.2310	.6093	.7203

**** 5****

1.7875	2.2019	2.6009	3.7761	4.9552	6.1166
.4025	.4025	.5009	.7074	.8537	1.0986
0.0000	0.0000	-.0524	.0756	.2436	.4206

**** 6****

1.7875	2.2019	2.5932	3.7666	4.9363	6.1004
.5295	.5295	.6635	.9087	1.1473	1.3377
0.0000	0.0000	-.0248	.0294	.1514	.3717

**** 7****

1.7875	2.2019	2.5852	3.7010	4.8541	5.9960
.7240	.7240	.8793	.7160	.9615	1.1927
0.0000	0.0000	.0243	.4347	.6583	.9456

**** 8****

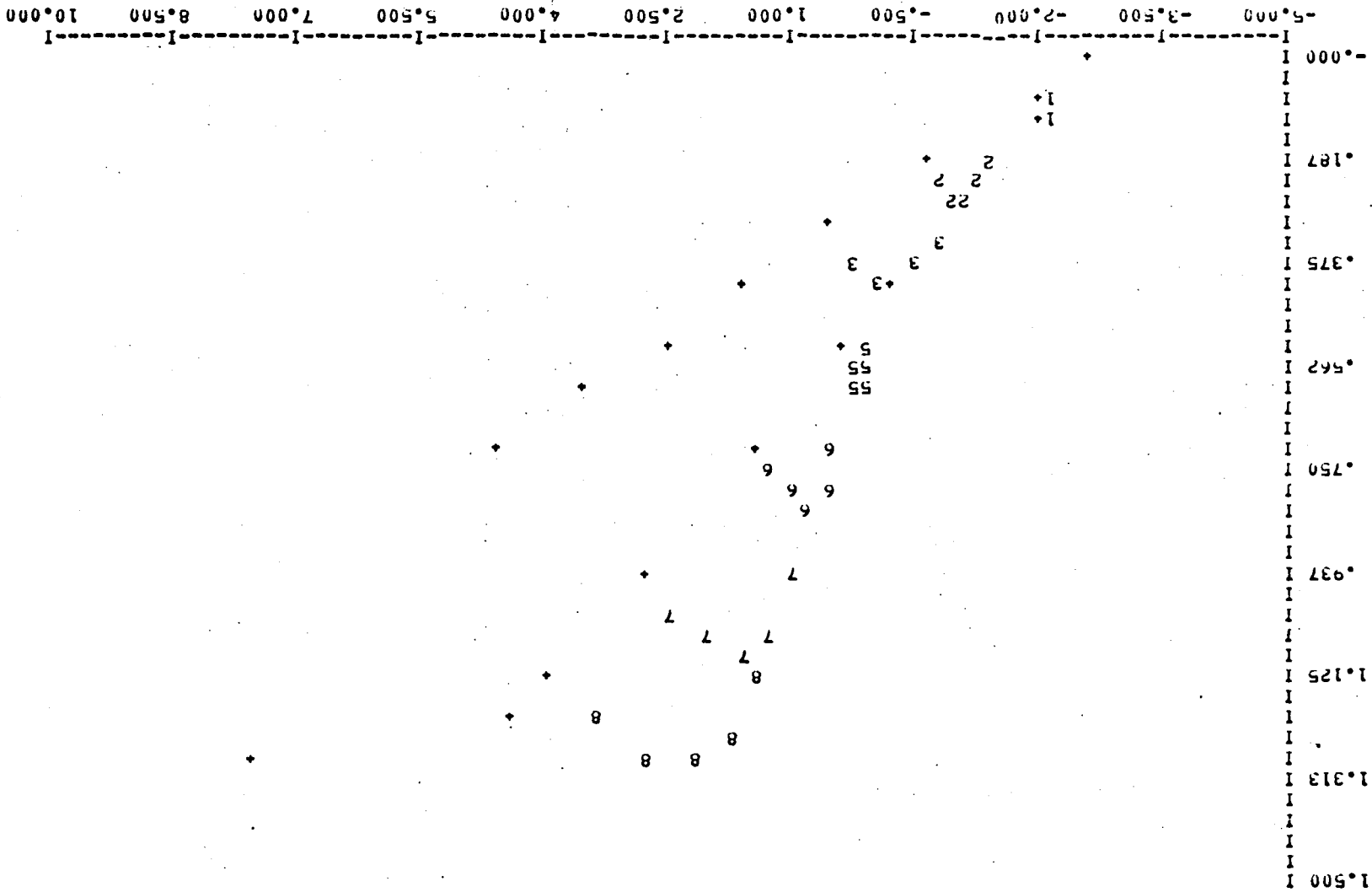
1.7875	2.2019	2.6034	3.7524	4.9057	6.0171
.9405	.9485	.8561	1.1356	1.3969	1.5875
0.0000	0.0000	.0435	.2479	.4518	.6623

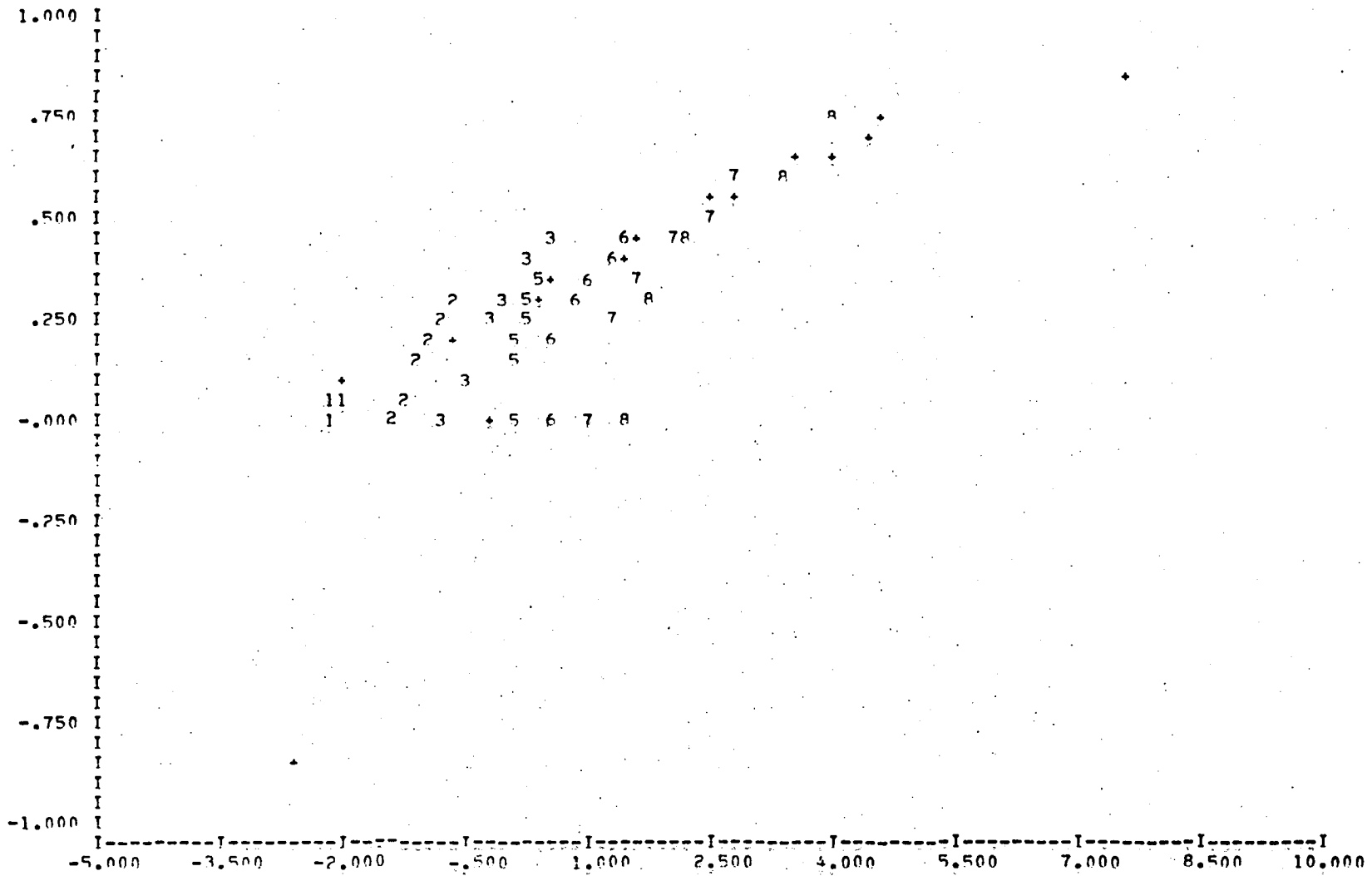
**** 9****

1.7875	2.2019	2.6012	3.7641	4.9312	5.9790
1.1430	1.1430	1.0777	1.2857	1.4333	.9515
0.0000	0.0000	.0889	.2765	.5321	.8637

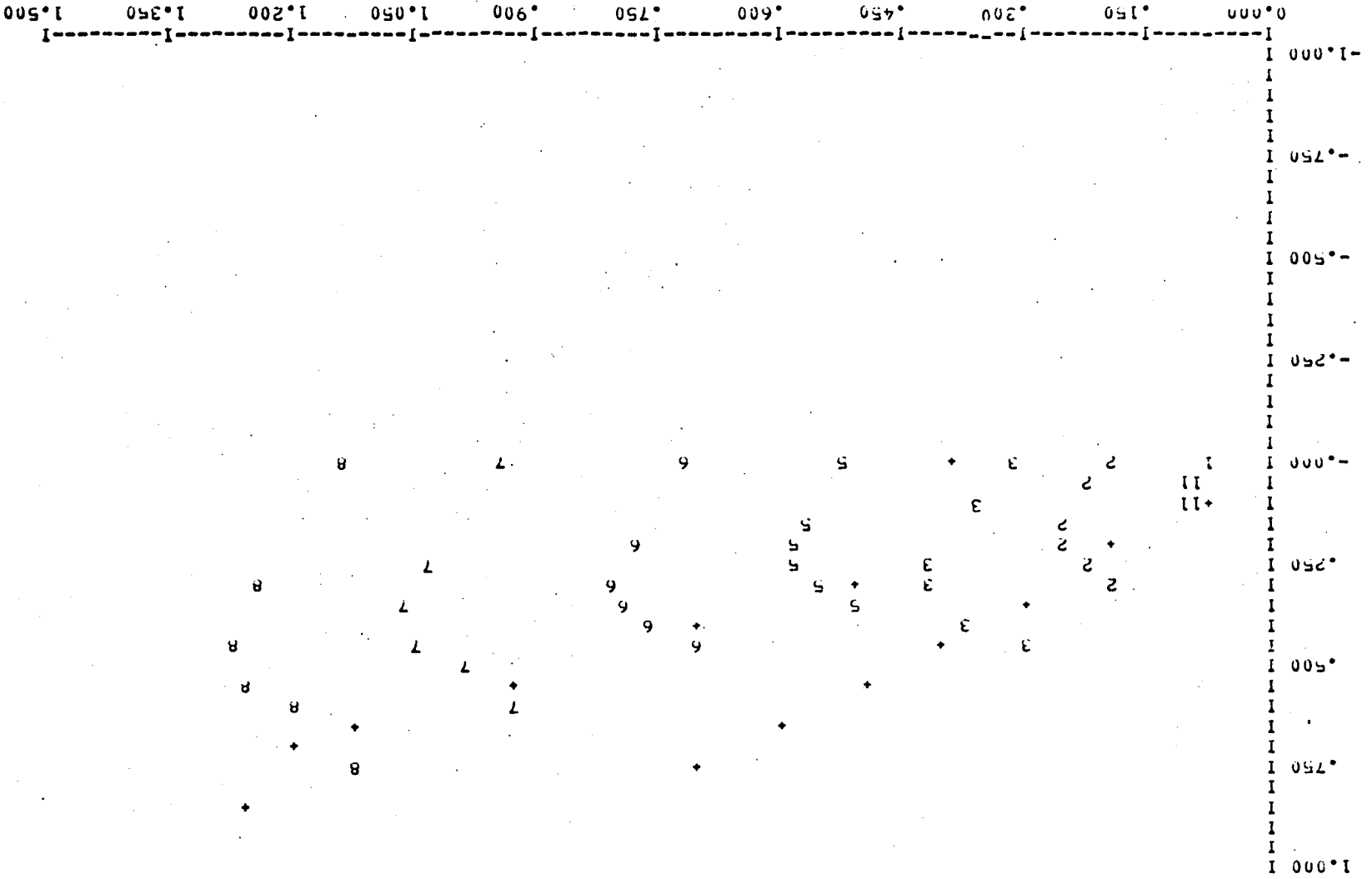
****10****

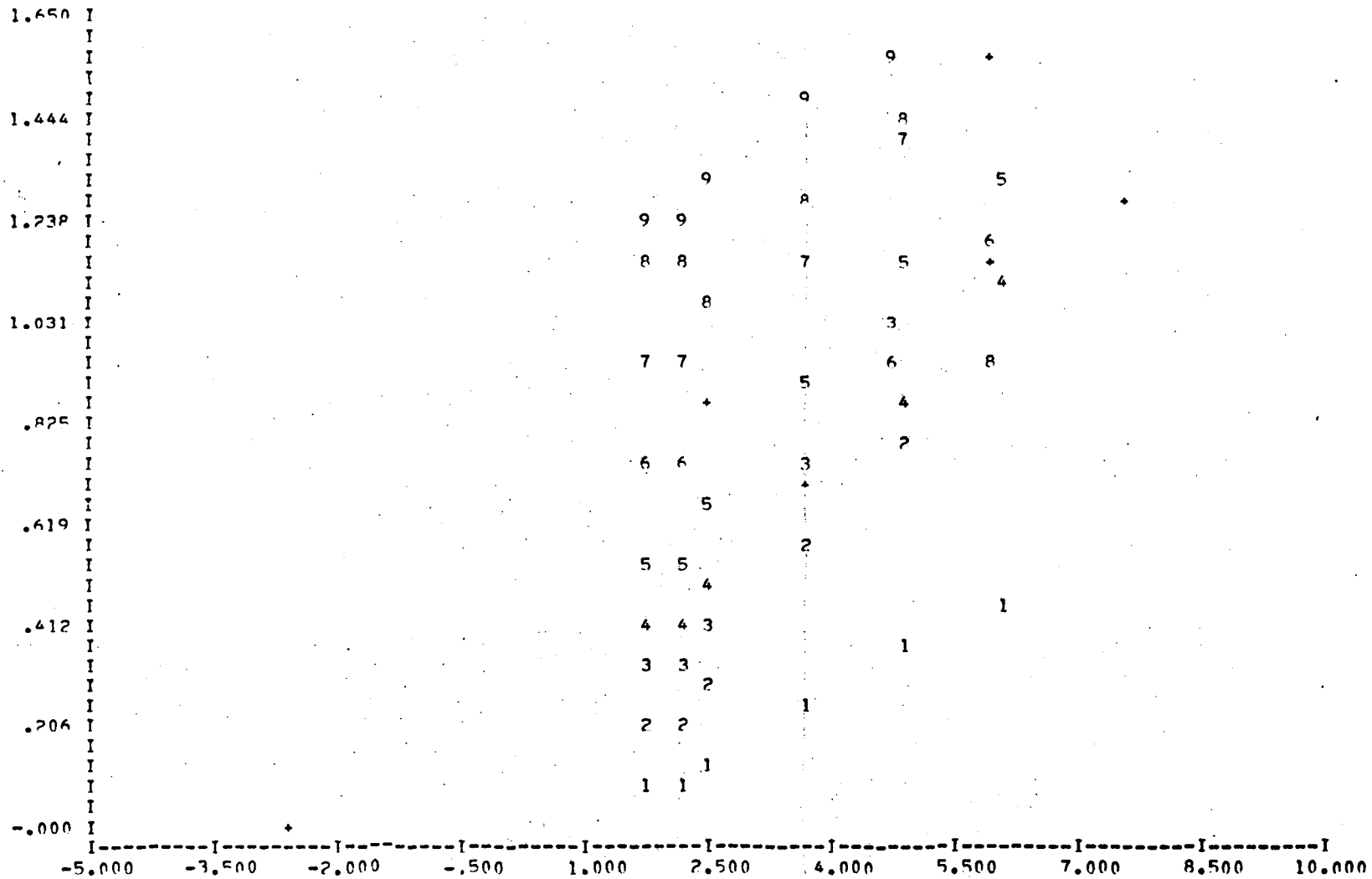
1.7875	2.2019	2.5868	3.7007	4.8251	5.9527
1.2552	1.2552	1.3265	1.5024	1.5875	1.5875
0.0000	0.0000	.1356	.5461	.9565	1.3669



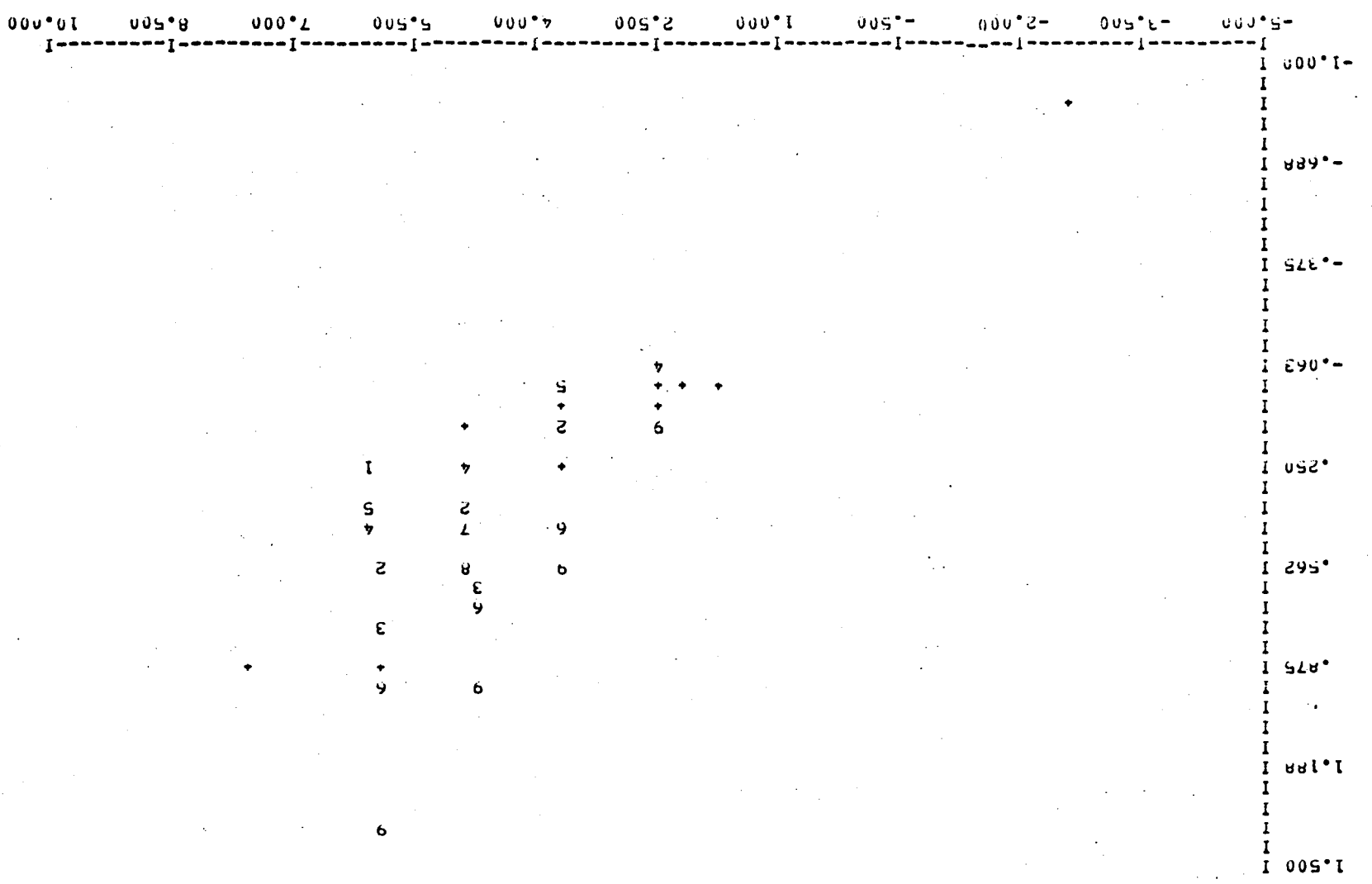


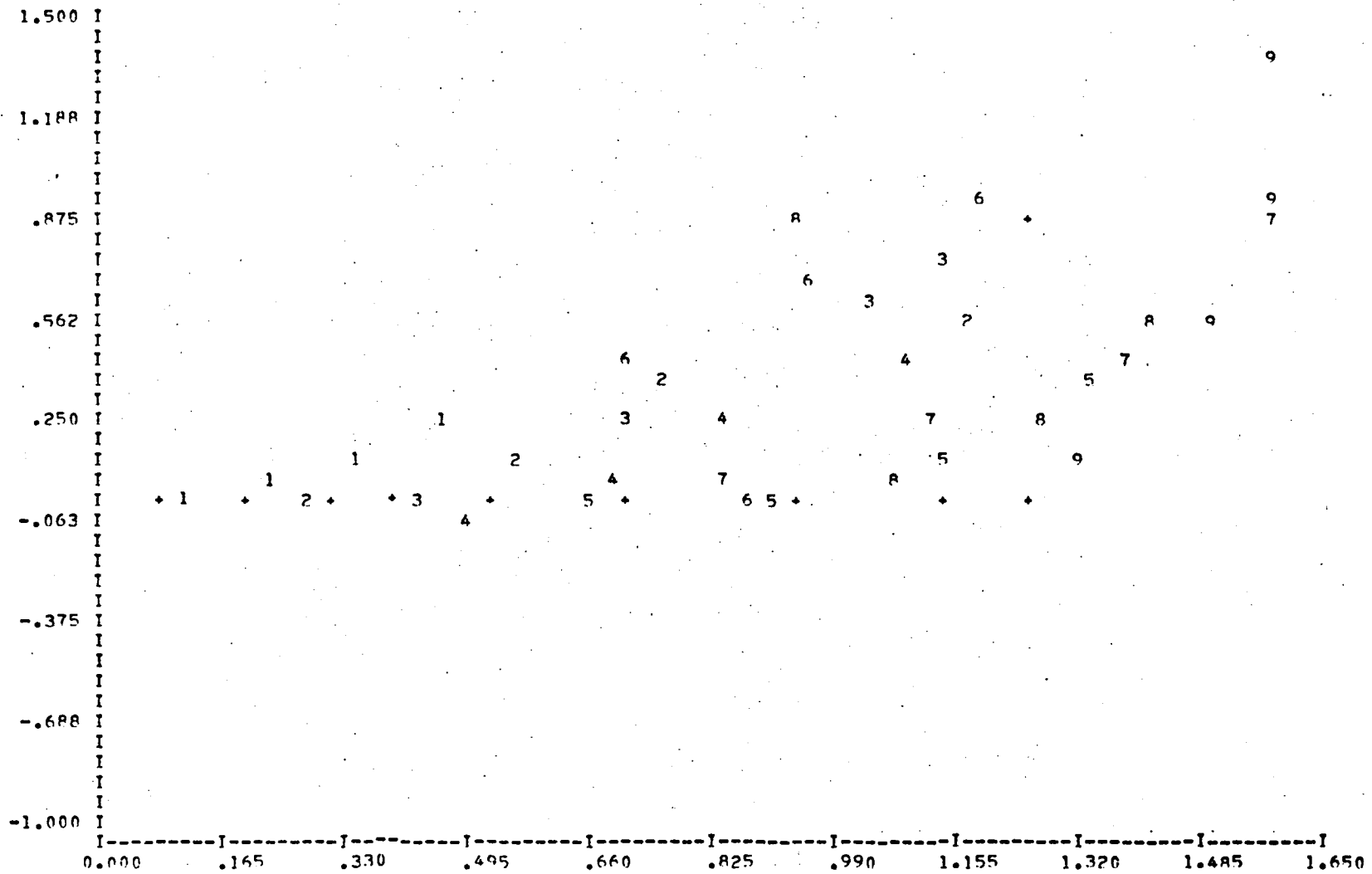
X VS Z





X VS Y





Y VS 7

WING VORTEX STRENGTHS

X/C ***	2Y/R ****	GAMAY *****
.01704	.03026	1.16655
.14645	.03026	.32423
.37059	.03026	.35653
.62941	.03026	.37494
.85355	.03026	.20965
.98296	.03026	.07753
.01704	.10950	1.13868
.14645	.10950	.30904
.37059	.10950	.37315
.62941	.10950	.38205
.85355	.10950	.21182
.98296	.10950	.07365
.01704	.20743	1.53600
.14645	.20743	.39808
.37059	.20743	.45155
.62941	.20743	.31617
.85355	.20743	.18866
.98296	.20743	.05938
.01704	.28667	1.84416
.14645	.28667	.69975
.37059	.28667	.39469
.62941	.28667	.24825
.85355	.28667	.15706
.98296	.28667	.04485
.01704	.36269	3.02992
.14645	.36269	.50711
.37059	.36269	.31690
.62941	.36269	.20740
.85355	.36269	.12733
.98296	.36269	.03317
.01704	.48770	3.11242
.14645	.48770	.48345
.37059	.48770	.29683
.62941	.48770	.19492
.85355	.48770	.10038
.98296	.48770	.02459
.01704	.65846	4.27184
.14645	.65846	.49318
.37059	.65846	.35985
.62941	.65846	.21589
.85355	.65846	.10538
.98296	.65846	.02845

.01704	.82923	6.05306
.14645	.82923	.62411
.37059	.82923	.40234
.62941	.82923	.28362
.85355	.82923	.15541
.98296	.82923	.04680
.01704	.95424	9.67653
.14645	.95424	.97577
.37059	.95424	.59063
.62941	.95424	.41087
.85355	.95424	.24795
.98296	.95424	.08148

LEADING-EDGE VORTICES STRENGTHS

2Y/R	CARGAMA
****	*****
.03026	.21875
.10950	.19305
.20743	.20768
.28667	.19399
.36260	.27156
.48770	.22727
.65846	.21023
.82923	.14945
.95424	.06405

DELTA-CP DISTRIBUTION

X/C	2Y/P	DELTA-CP
***	****	*****
.01254	.03026	.42971
.10908	.03026	1.07984
.28306	.03026	.83555
.50000	.03026	.75921
.71694	.03026	.73044
.89092	.03026	.34812
.98746	.03026	.25502
.01254	.10950	2.82852
.10908	.10950	.79703
.28306	.10950	.89401
.50000	.10950	.97205
.71694	.10950	.69293
.89092	.10950	.41906
.98746	.10950	.15674
.01254	.20743	1.72386
.10908	.20743	-.20992
.28306	.20743	1.03863
.50000	.20743	1.51741
.71694	.20743	1.08278
.89092	.20743	.67433
.98746	.20743	.35061
.01254	.28667	7.84027
.10908	.28667	3.16404
.28306	.28667	1.31392
.50000	.28667	.63009
.71694	.28667	.92996
.89092	.28667	.40483
.98746	.28667	.46578
.01254	.36269	8.45642
.10908	.36269	2.00374
.28306	.36269	1.38517
.50000	.36269	1.28571
.71694	.36269	.84964
.89092	.36269	.74458
.98746	.36269	.46956
.01254	.48770	1.32732
.10908	.48770	1.29937
.28306	.48770	1.08632
.50000	.48770	.95596
.71694	.48770	.88967
.89092	.48770	.70772
.98746	.48770	.60836
.01254	.65846	1.82502

.10908	.65846	1.28225
.28306	.65846	.74076
.50000	.65846	.64379
.71694	.65846	.66539
.89092	.65846	.48549
.98746	.65846	.39853
.01254	.82923	1.98294
.10908	.82923	1.63616
.28306	.82923	.74444
.50000	.82923	.41394
.71694	.82923	.30774
.89092	.82923	.15503
.98746	.82923	-.01195
.01254	.95424	1.37264
.10908	.95424	1.35038
.28306	.95424	.71465
.50000	.95424	.61365
.71694	.95424	.35538
.89092	.95424	.19341
.98746	.95424	-.12076

SECTIONAL PROPERTIES

I	CL	CM	CU	CT
*	**	**	**	**
1	.67747	.13352	.2465A	0.00000
2	.80642	.09343	.29351	0.00000
3	.88140	-.20084	.32080	0.00000
4	1.41811	-.17073	.51615	0.00000
5	1.47580	-.39687	.53715	0.00000
6	.92169	-.41901	.33911	0.00000
7	.74744	-.40669	.27059	0.00000
8	.61804	-.40048	.22528	0.00000
9	.59439	-.45180	.21634	0.00000

TOTAL LIFT COEFFICIENT= .88929
 TOTAL PITCHING MOMENT COEFFICIENT= -.16675
 TOTAL DRAG COEFFICIENT= .32367
 TOTAL THRUST COEFFICIENT= 0.00000

SPANWISE PRESSURE AT CONSTANT X=, 0.00000

Y	2Y/R (LOCAL)	DELTA-CP
.03844	.08614	.77365
.13906	.31166	.98856
.26344	.59041	1.25688
.36406	.81593	2.73492

SPANWISE PRESSURE AT CONSTANT X=, 1.00000

Y	2Y/R (LOCAL)	DELTA-CP
.03844	.04257	.59200
.13906	.15401	.61522
.26344	.29177	1.11678
.36406	.40321	.81418
.46061	.51014	1.20301
.61937	.68598	.97445
.83625	.92617	1.12313

Similar results for several iterations till " SFAC " value shows an increase (after fifth iteration) from previous value. (See summary sheet on next page)

The best solution is shown after summary sheet.

DOUBLE DELTA WING MODEL ONE (SCALING)

ALPHA(DEG.)=20.000 MACH NUMBER= 0.000

ITERATION	CL	CM	CD	CT	GMSUM	SFAC
*****	**	**	**	**	*****	****
0	.9752	-.1906	.3550	0.0000	1.9627	
1	.8762	-.1590	.3189	0.0000	1.8095	
2	.9412	-.2111	.3426	0.0000	1.7998	
3	.8893	-.1667	.3237	0.0000	1.5174	.4826
4	.8734	-.1539	.3179	0.0000	1.5110	.3843
5	.8668	-.1506	.3155	0.0000	1.5034	.3292
6	.8497	-.1439	.3093	0.0000	1.4930	.4383

DOUPLF DELTA WING MODEL ONE (SCALING)

ALPHA(DEG.)=20.000 MACH NUMBER= 0.000 ITERATION NUMBER= 5

LEADING EDGE ELEMENTS

**** 1****

1.7875	-1.8395	-2.3041	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-2.3560	-1.8619	-.6478
.5663	1.6024	2.6384	3.6744	4.7107										
.0830	.0830	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0810	.1948
.3102	.4305	.5066	.6052	.7035										
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0844	.2020
.3177	.4183	.5201	.6212	.7195										

**** 2****

1.7875	-1.1771	-1.8395	-1.8856	-2.0692	-1.8944	-1.8379	-1.7827	-1.7262	-1.6650	-1.6650	-1.8619	-.6478	.5663	
1.6024	2.6384	3.6744	4.7107											
.2012	.2012	.0830	.0830	.0830	.1147	.1270	.1283	.1174	.0810	.0810	.0810	.0810	.1948	.3102
.4305	.5066	.6052	.7035											
0.0000	0.0000	0.0000	0.0000	0.0000	.0201	.0501	.0819	.1129	.1356	.0994	.0844	.2020	.3177	
.4183	.5201	.6212	.7195											

**** 3****

1.7875	-.5147	-1.1771	-1.2148	-1.3649	-1.2363	-1.0991	-.9651	-.8282	-.6796	-.6796	-.6478	.5663	1.6024	
2.6384	3.6744	4.7107												
.3105	.3195	.2012	.2012	.2012	.2784	.3082	.3113	.2848	.1948	.1948	.1948	.1948	.3102	.4305
.5066	.6052	.7035												
0.0000	0.0000	0.0000	0.0000	0.0000	.0487	.1214	.1988	.2740	.3290	.2411	.2020	.3177	.4183	
.5201	.6212	.7195												

**** 4****

1.7875	-.0502	-.5147	-.5439	-.6605	-.4341	-.1953	.0248	.2594	.5138	.5138	.5663	1.6024	2.6384	
3.6744	4.7107													
.4025	.4025	.3195	.3195	.3195	.4049	.4109	.3763	.2697	.1662	.1662	.3102	.4305	.5066	
.6052	.7035													
0.0000	0.0000	0.0000	0.0000	0.0000	.1084	.2250	.3627	.4388	.4132	.2736	.3177	.4183	.5201	
.6212	.7195													

**** 5****

1.7875	.2190	-.0502	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	-.0735	.4343	1.5861
2.9159	4.0677	4.5330												
.5295	.5295	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.4025	.5227	.7134
.9347	1.1263	1.2037												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.3101	.4234
.5547	.6667	.7126												

**** 6****

1.7875	.6309	.2190	.1990	.1196	.2046	.2820	.3499	.4137	.4771	.4771	.4343	1.5861	2.9159	
4.0677	4.5330													
.7240	.7240	.5295	.5295	.5295	.5864	.6083	.6219	.6300	.5227	.5227	.5227	.5227	.7134	.9347
1.1263	1.2037													
0.0000	0.0000	0.0000	0.0000	0.0000	.1040	.1613	.2116	.2710	.3682	.3384	.3101	.4234	.5547	
.6667	.7126													

*** 7***

1.7875	1.1065	.6309	.6162	.5576	.7466	.9478	1.1638	1.3658	1.5624	1.5624	1.5861	2.9159	4.0677
4.5330													
.9485	.9485	.7240	.7240	.7240	.8003	.8434	.8704	.8653	.7134	.7134	.7134	.9347	1.1263
1.2037													
0.0000	0.0000	0.0000	0.0000	0.0000	.1121	.2142	.3357	.4717	.6037	.5630	.4234	.5547	.6667
.7126													

*** 8***

1.7875	1.5184	1.1065	1.0978	1.0633	1.3456	1.6885	2.0748	2.4455	2.8063	2.8063	2.9159	4.0677	4.5330
1.1430	1.1430	.9485	.9485	.9485	1.0346	1.0854	1.0958	1.0306	.9173	.9173	.9347	1.1263	1.2037
0.0000	0.0000	0.0000	0.0000	0.0000	.1801	.3654	.5825	.7909	.9393	.8860	.5547	.6667	.7126

*** 9***

1.7875	1.6529	1.5184	1.5150	1.5013	1.3688	2.3308	2.8611	3.3832	3.8917	3.8917	4.0677	4.5330
1.2700	1.2965	1.1430	1.1430	1.1430	1.2289	1.2893	1.2814	1.1556	1.0328	1.0328	1.1263	1.2037
0.0000	0.0000	0.0000	0.0000	0.0000	.2398	.5055	.8105	1.0615	1.2492	1.1849	.6667	.7126

WAKF ELEMENTS

**** 1****

1.7875	2.2019	2.6162	3.8162	5.0162	6.2162
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

**** 2****

1.7875	2.2019	2.6140	3.8063	4.9954	6.1766
.0830	.0830	.1196	.2455	.3945	.5419
0.0000	0.0000	.0211	.0705	.1347	.2861

**** 3****

1.7875	2.2019	2.6062	3.7531	4.9493	5.8826
.2012	.2012	.2879	.6151	1.0335	1.4850
0.0000	0.0000	.0264	.1586	.4103	.8208

**** 4****

1.7875	2.2019	2.5935	3.6464	4.6577	5.8543
.3195	.3195	.4490	1.0004	1.4991	1.5875
0.0000	0.0000	.0387	.2046	.6150	.5977

**** 5****

1.7875	2.2019	2.6025	3.7230	4.7022	5.8903
.4025	.4025	.5080	.8579	1.3312	1.5875
0.0000	0.0000	-.0038	.2454	.5152	.9256

**** 6****

1.7875	2.2019	2.5878	3.7463	4.8560	5.9486
.5295	.5295	.6792	.9638	1.3088	1.5875
0.0000	0.0000	.0176	.1481	.4472	.8577

**** 7****

1.7875	2.2019	2.5782	3.6990	4.7807	5.9084
.7240	.7240	.8877	1.3054	1.5875	1.5875
0.0000	0.0000	.0572	-.1207	.2897	.7001

**** 8****

1.7875	2.2019	2.5767	3.6345	4.7208	5.8470
.9485	.9485	.7774	1.2294	1.5320	1.5875
0.0000	0.0000	.0436	.3854	.7958	1.2063

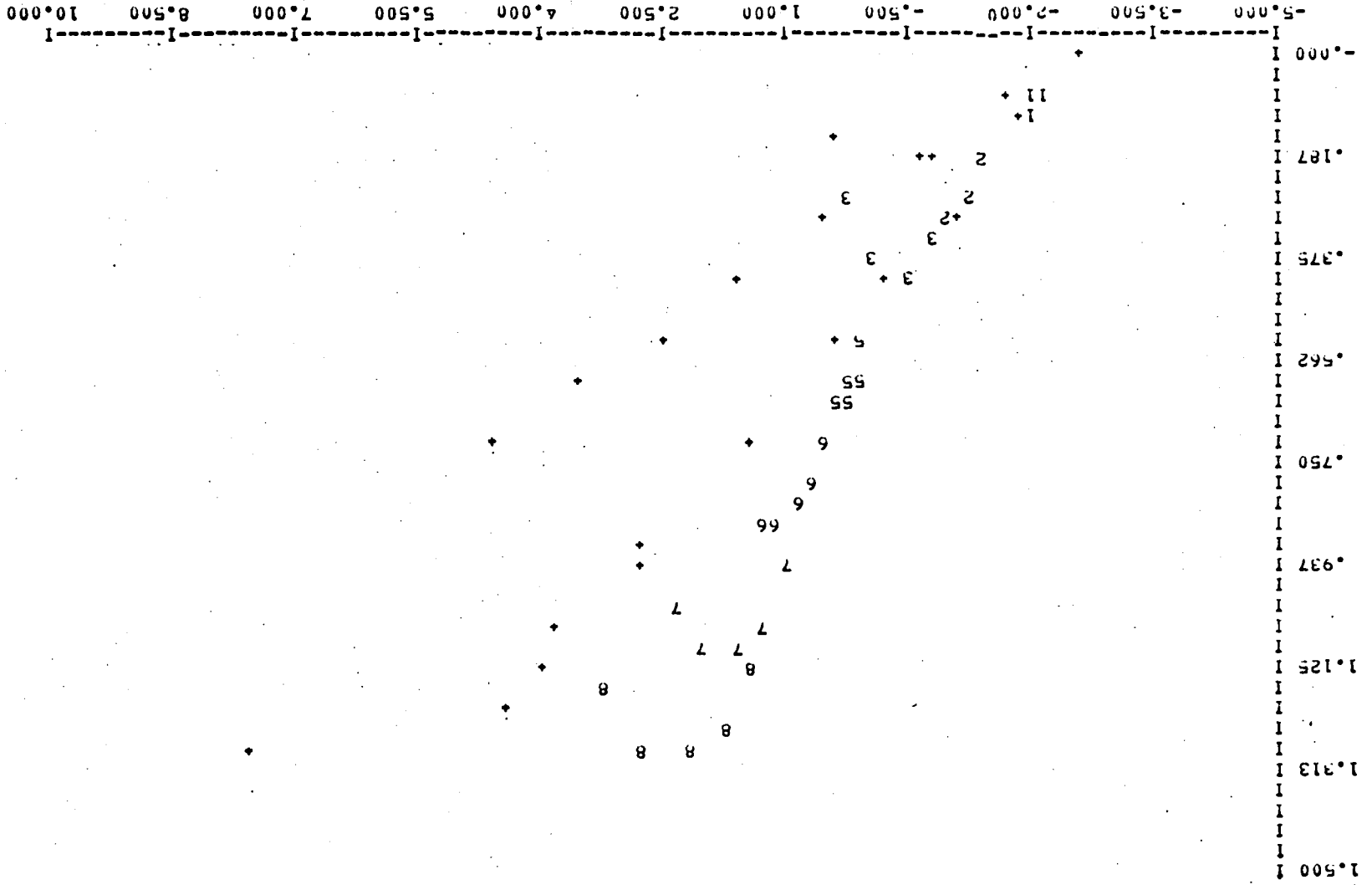
**** 9****

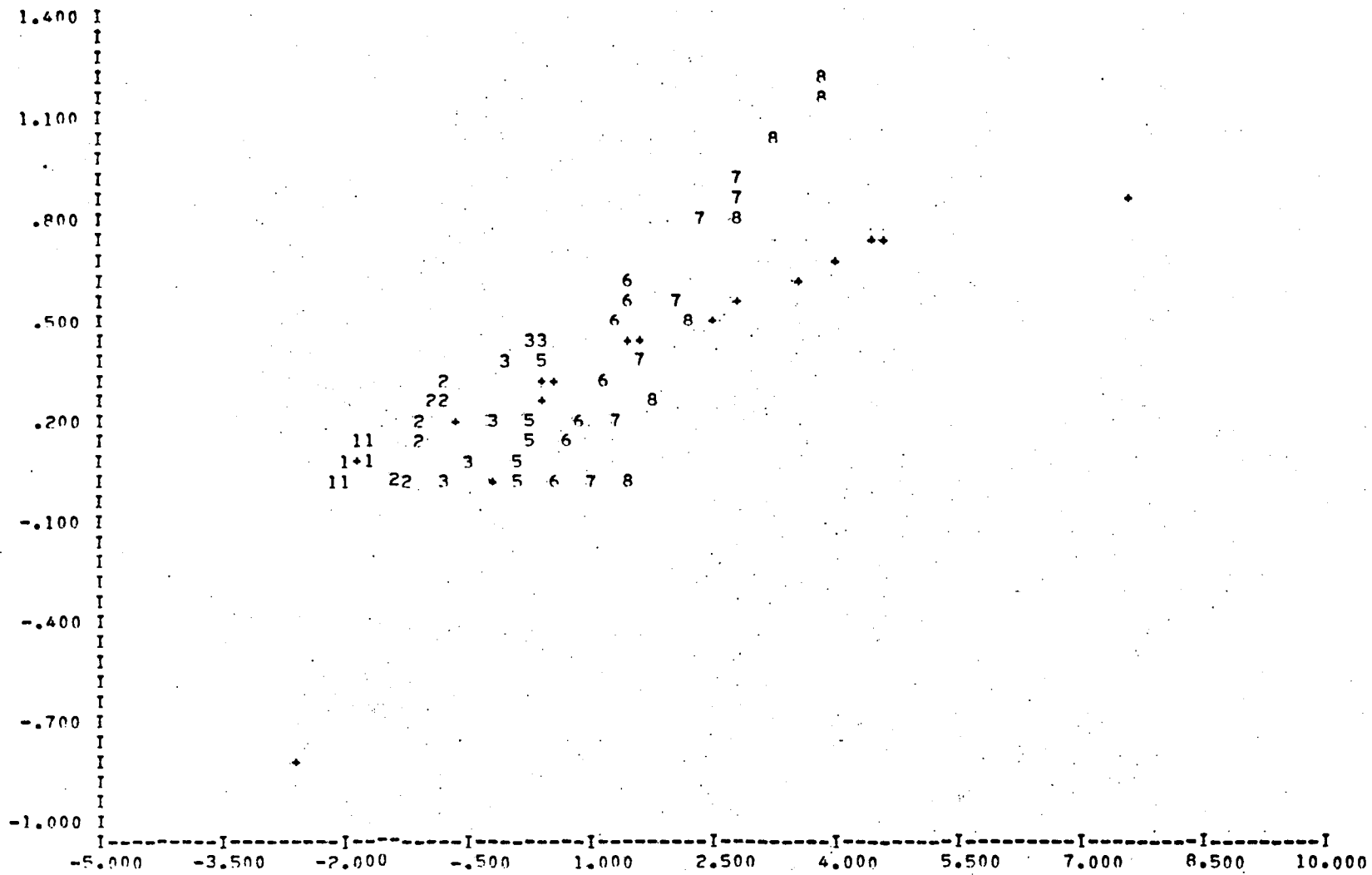
1.7875	2.2019	2.5886	3.7749	4.8287	5.9559
1.1430	1.1430	1.0469	1.1577	1.5591	1.5875
0.0000	0.0000	.1134	.2568	.6672	1.0776

****10****

1.7875	2.2019	2.5813	3.6902	4.8176	5.9450
1.2552	1.2552	1.2426	1.5474	1.5678	1.5469
0.0000	0.0000	.1417	.5521	.9626	1.3730

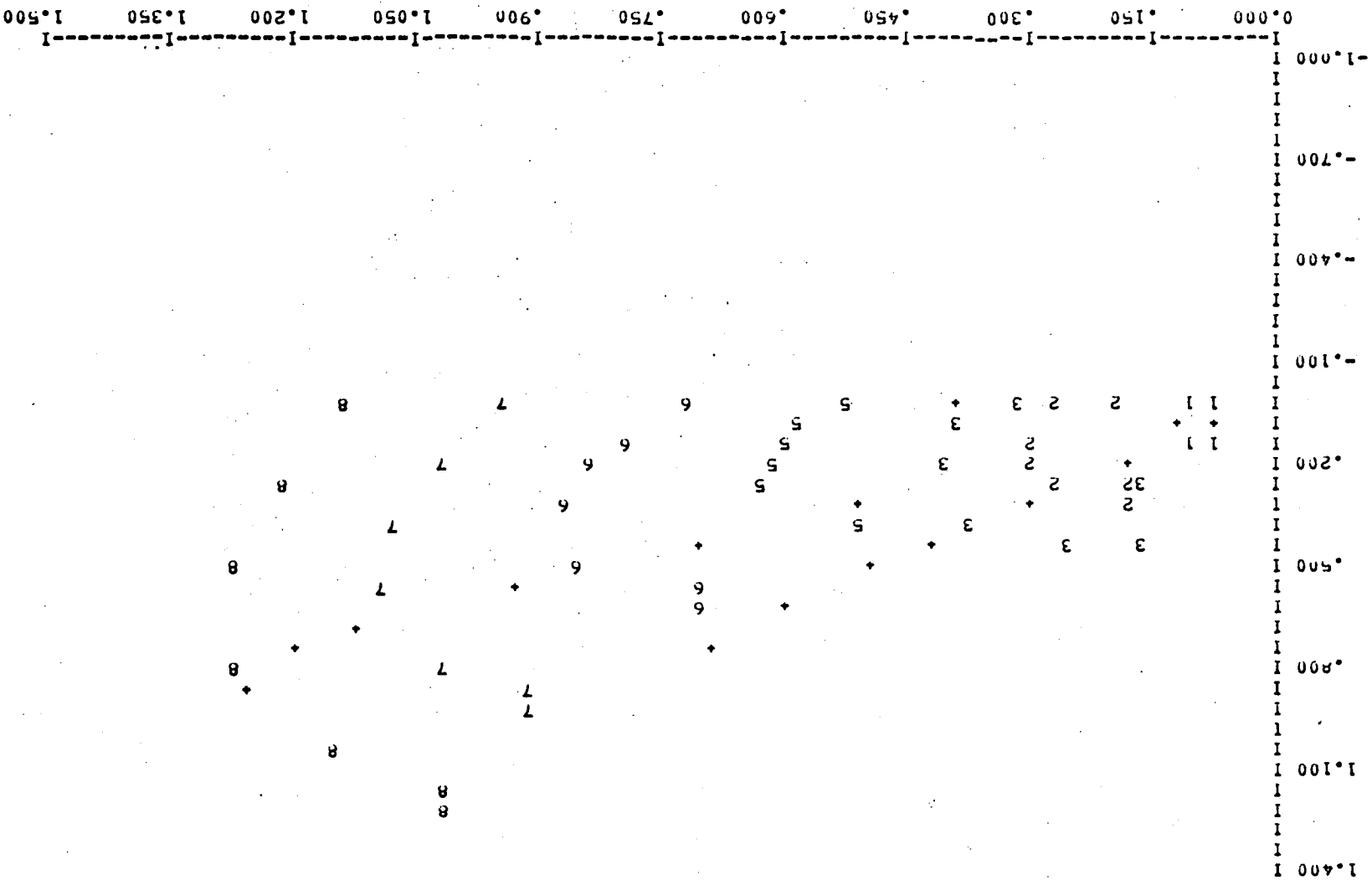
X VS Y

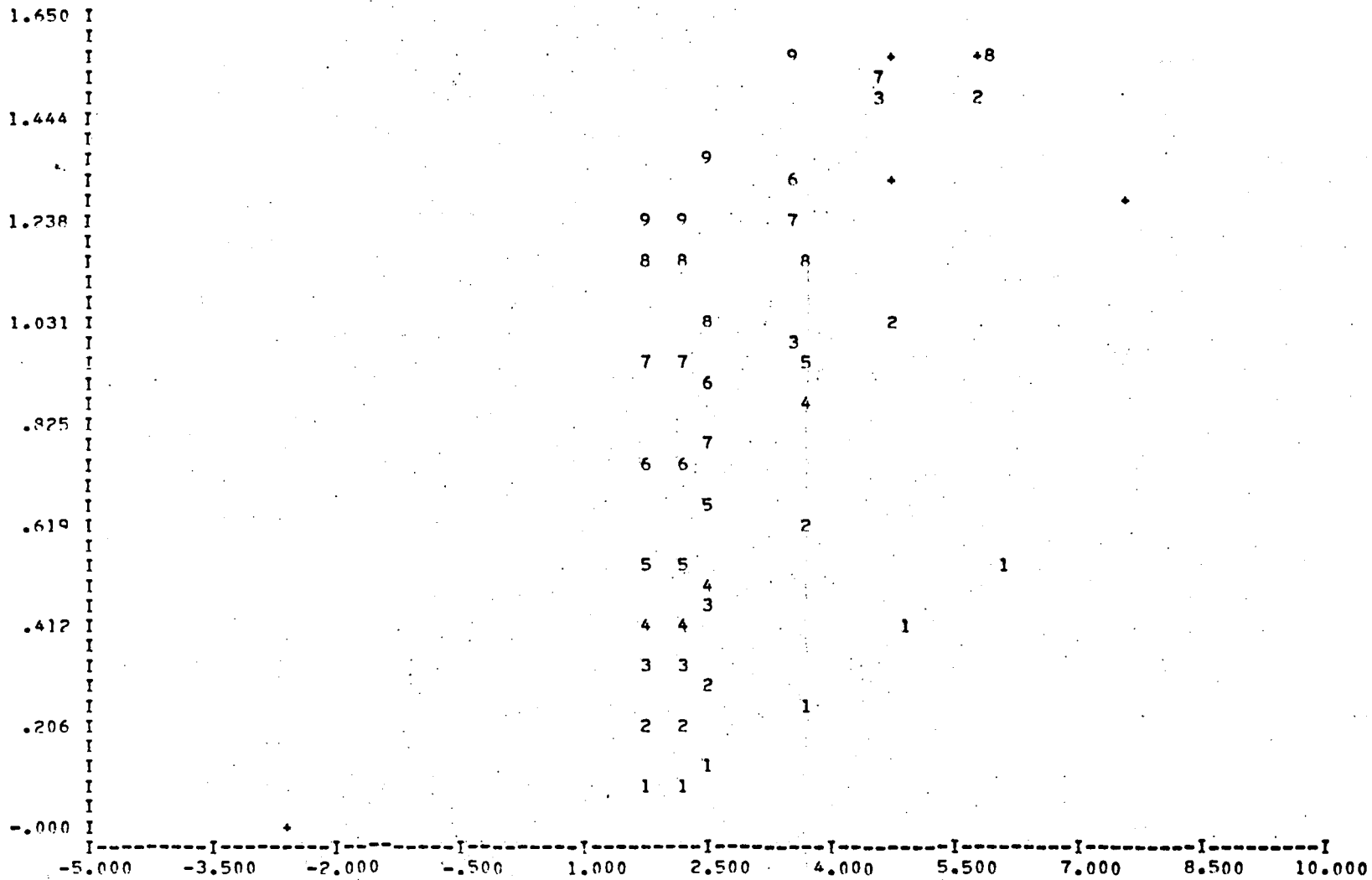




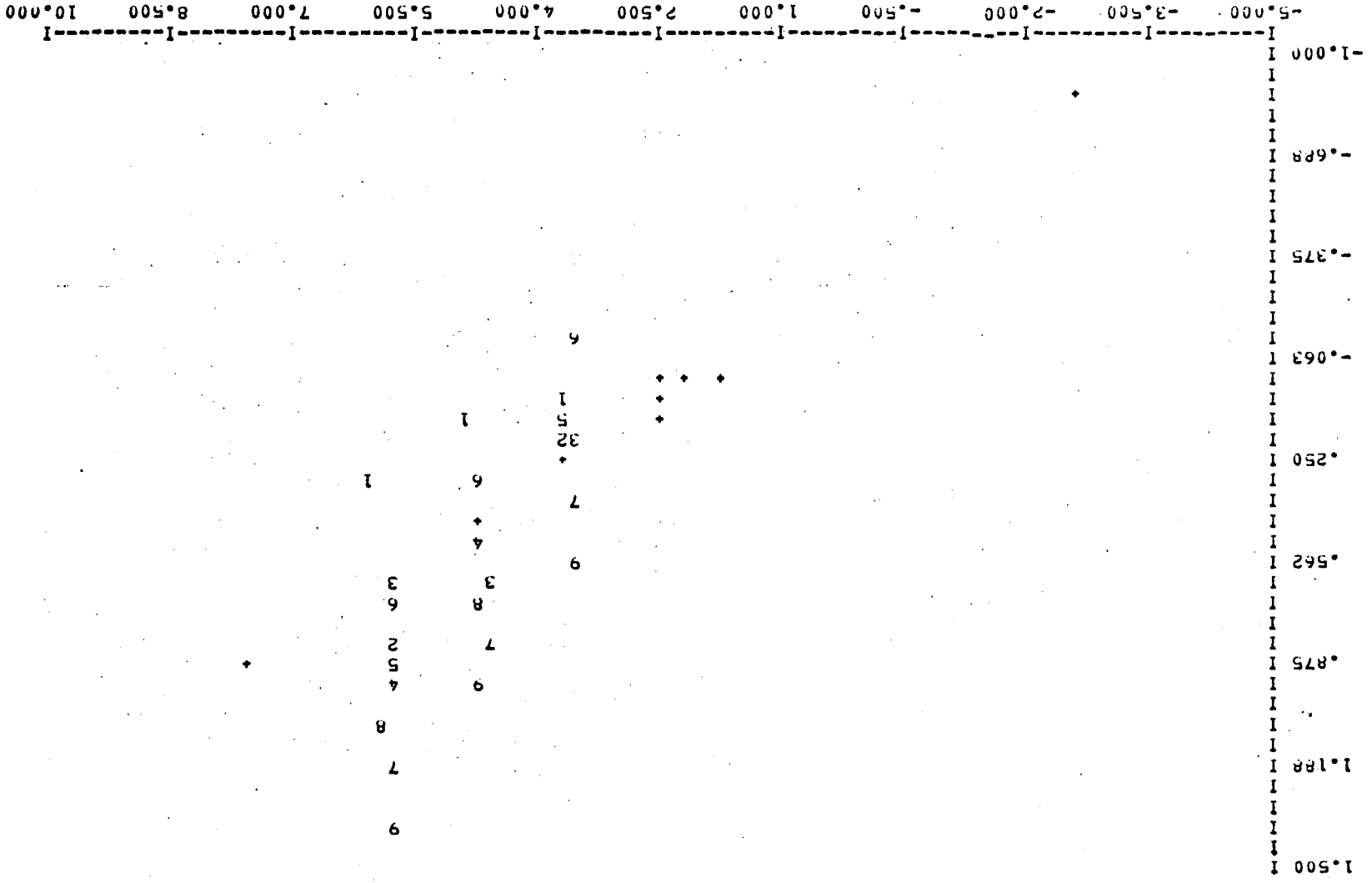
X VS 7

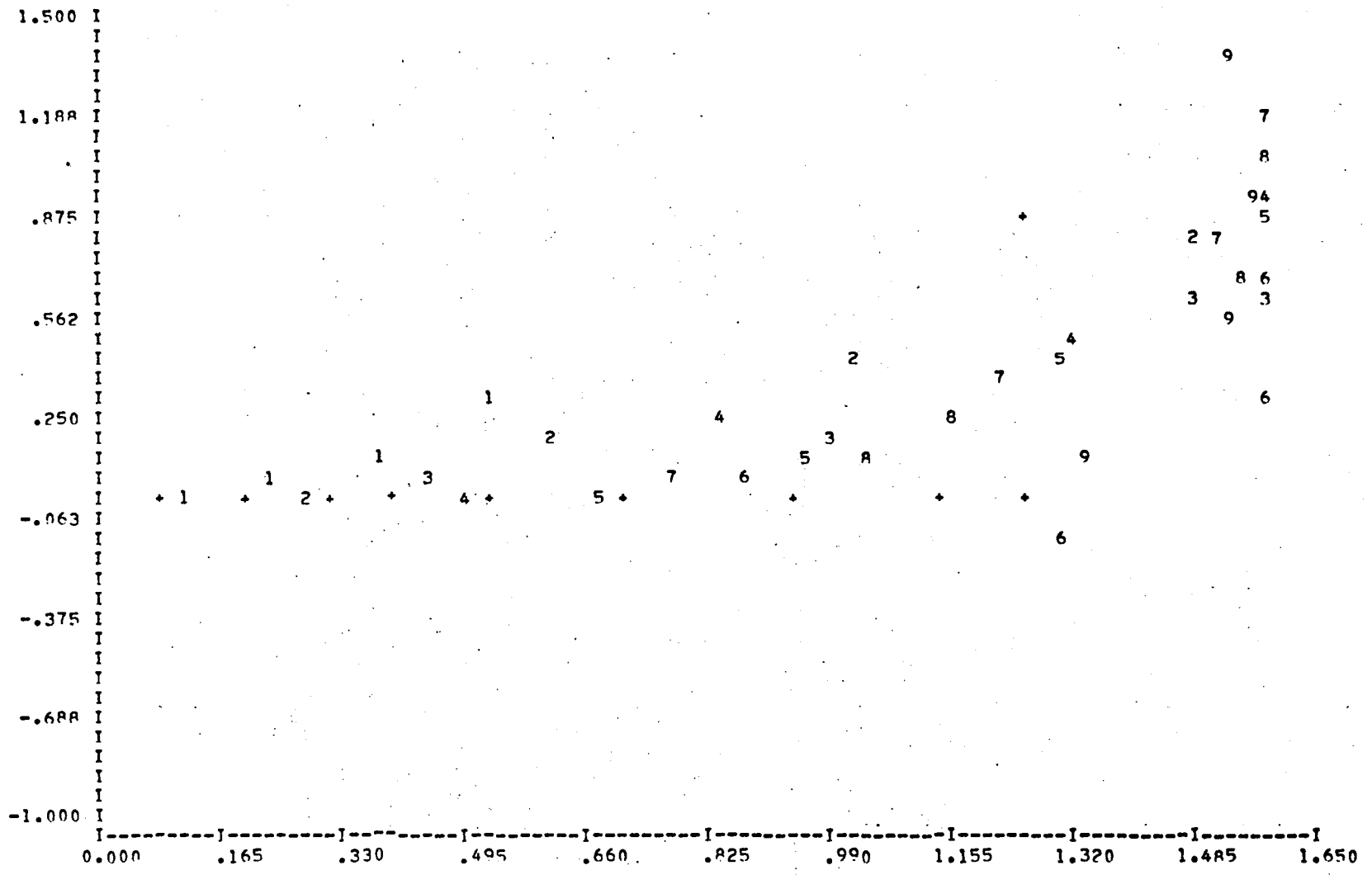
Y VS Z





X VS Y





Y VS Z

WING VORTEX STRENGTHS

X/C ***	ZY/R ****	GAMAY *****
.01704	.03026	.97697
.14645	.03026	.39215
.37059	.03026	.35159
.62941	.03026	.35290
.85355	.03026	.20349
.98296	.03026	.07610
.01704	.10950	1.22977
.14645	.10950	.31044
.37059	.10950	.36876
.62941	.10950	.35601
.85355	.10950	.20574
.98296	.10950	.07252
.01704	.20743	1.57073
.14645	.20743	.39824
.37059	.20743	.43781
.62941	.20743	.29094
.85355	.20743	.18331
.98296	.20743	.05902
.01704	.28667	1.84832
.14645	.28667	.67881
.37059	.28667	.37479
.62941	.28667	.23291
.85355	.28667	.15310
.98296	.28667	.04507
.01704	.36269	2.89782
.14645	.36269	.50371
.37059	.36269	.29915
.62941	.36269	.19963
.85355	.36269	.12529
.98296	.36269	.03399
.01704	.48770	2.98843
.14645	.48770	.44502
.37059	.48770	.29755
.62941	.48770	.19545
.85355	.48770	.10403
.98296	.48770	.02691
.01704	.65846	4.09470
.14645	.65846	.45920
.37059	.65846	.34521
.62941	.65846	.22731
.85355	.65846	.11791
.98296	.65846	.03322

.01704	.82923	5.90207
.14645	.82923	.59899
.37059	.82923	.38384
.62941	.82923	.27781
.85355	.82923	.15767
.98296	.82923	.04829
.01704	.95424	9.58142
.14645	.95424	.96095
.37059	.95424	.57694
.62941	.95424	.39807
.85355	.95424	.23883
.98296	.95424	.07833

LEADING-EDGE VORTICES STRENGTHS

2Y/R	CARGAMA
****	*****
.03026	.18657
.10950	.20608
.20743	.21167
.28667	.19413
.36269	.26172
.48770	.21847
.65846	.29201
.82923	.14585
.95424	.06343

DELTA-CP DISTRIBUTION

X/C	ZY/B	DELTA-CP
***	****	*****
.01254	.03026	.90496
.10908	.03026	1.28204
.28306	.03026	.88498
.50000	.03026	.71102
.71694	.03026	.69318
.89092	.03026	.33870
.98746	.03026	.24983
.01254	.10950	2.68298
.10908	.10950	.92908
.28306	.10950	.96079
.50000	.10950	.92916
.71694	.10950	.64143
.89092	.10950	.41340
.98746	.10950	.14867
.01254	.20743	1.30621
.10908	.20743	-.11517
.28306	.20743	1.03939
.50000	.20743	1.42176
.71694	.20743	1.01387
.89092	.20743	.65418
.98746	.20743	.33857
.01254	.28667	7.24285
.10908	.28667	2.92956
.28306	.28667	1.19925
.50000	.28667	.57214
.71694	.28667	.88029
.89092	.28667	.40340
.98746	.28667	.45483
.01254	.36269	7.96349
.10908	.36269	1.84363
.28306	.36269	1.25312
.50000	.36269	1.19310
.71694	.36269	.81762
.89092	.36269	.72404
.98746	.36269	.46685
.01254	.48770	1.45271
.10908	.48770	1.28982
.28306	.48770	1.03077
.50000	.48770	.88973
.71694	.48770	.55536
.89092	.48770	.68398
.98746	.48770	.58195
.01254	.65846	1.89426

.10908	.65846	1.23161
.28306	.65846	.75092
.50000	.65846	.61742
.71694	.65846	.67132
.89092	.65846	.47015
.98746	.65846	.38511
.01254	.82923	2.09114
.10908	.82923	1.68458
.28306	.82923	.80615
.50000	.82923	.40484
.71694	.82923	.32938
.89092	.82923	.16281
.98746	.82923	.00285
.01254	.95424	1.33408
.10908	.95424	1.29537
.28306	.95424	.68820
.50000	.95424	.58164
.71694	.95424	.33570
.89092	.95424	.17859
.98746	.95424	-.12067

SECTIONAL PROPERTIES

I	CL	CM	CU	CT
*	**	**	**	**
1	.71690	.18123	.26096	0.00000
2	.80969	.10646	.29470	0.00000
3	.93793	-.19245	.30498	0.00000
4	1.31511	-.16239	.47866	0.00000
5	1.37916	-.37423	.50161	0.00000
6	.90139	-.40234	.32808	0.00000
7	.73109	-.39064	.26609	0.00000
8	.64241	-.41574	.23382	0.00000
9	.56791	-.43157	.20670	0.00000

TOTAL LIFT COEFFICIENT= .86679
 TOTAL PITCHING MOMENT COEFFICIENT= -.15059
 TOTAL DRAG COEFFICIENT= .31549
 TOTAL THRUST COEFFICIENT= 0.00000

SPANWISE PRESSURE AT CONSTANT X=. 0.00000

Y	2Y/R(LOCAL)	DELTA-CP
.03844	.08614	.72062
.13906	.31166	.95651
.26344	.59041	1.22761
.36406	.81593	2.52929

SPANWISE PRESSURE AT CONSTANT X=. 1.00000

Y	2Y/R(LOCAL)	DELTA-CP
.03844	.04257	.57018
.13906	.15401	.57436
.26344	.29177	1.04410
.36406	.40321	.75933
.46061	.51014	1.12420
.61937	.68598	.90551
.83625	.92617	1.08864

FORTRAN PROGRAM LISTING

This program was written in FORTRAN IV language and is operational on CDC Cyber 175 Computer system at Langley Research Center. The run stream (control cards) is listed at the end of the program. The following table is an index to the program listing.

<u>Program or subroutine</u>	<u>Main Purpose</u>	<u>Page</u>
LEVSP	executive routine, prints out free elements in the leading-edge and wake vortex system, and to check convergence	114
TAN	trigonometric function	118
SKIPR	skips records	118
ARCOS	inverse trigonometric function cosine	119
DOTPRD	dot product of two vectors	119
CRSPRD	cross product of two vectors	119
VDTWNG	calculates induced velocity due to wing elements	119
VDTFRE	calculates induced velocity due to free elements	124
NORMAL	computes unit normal vector	128
SWAHC	sidewash correction	128
ABVLE	absolute value of a vector	130
INOUT	check control points by vector analysis	131
ORDER	sets up the order of two parallel vortex segments on the leading-edge free elements	131
F	computes the magnitude of $[(x_1 - x_2)^2 + \beta(y_1 - y_2)^2 + \beta(z_1 - z_2)^2]^{1/2}$	132
CAMBER	calculates camber slopes at wing bound elements and control points	133

		111
ZCDX	defines analytical camber slopes	134
ZCR	determines camber slopes numerically	135
PNLEF	determines control point locations within or without a flat leading-edge flap	136
ZCAM	cubic spline interpolation of camber slopes	137
FUNA	computes induced velocity due to a vortex element in the far field	138
INFL2	computes induced velocity due to a vortex segment in the near field	139
NEWVEL	computes total velocity at a point	140
VMSEQN	vector method for solving simultaneous equations	143
GEOM	defines the wing and free element geometry	144
PNLWNG	generates the grids of bound and trailing vortex elements	154
SHAPLE	defines the shape of leading-edge	156
SHAPTE	defines the shape of trailing-edge	157
FRELM	finds the initial coordinates of free vortex elements	157
SPLINE	cubic spline subroutine	163
APLOT	sets up dimensions for plotting leading- edge and wake elements	164
PLOTT	manipulates leading-edge and wake elements coordinates in a form suitable for plotting	165
LNPLOT	generates plots on line printer	167
SOLN	sets up dimensions for solving the strengths of wing and leading-edge vortex system	170
AERODN	solves strengths of wing and leading-edge vortex system	171

THRST	calculates sectional leading-edge thrust coefficients	174
LOADS	sets up dimensions for evaluating aerodynamic characteristics	175
COEFS	computes aerodynamic characteristics	177
SURFSET	sets up program for surface spline	190
SURFORD	surface spline interpolation	193
MATINV	matrix inversion with accompanying solution of linear equations	193
NEWSHAP	sets up dimensions for computing new locations of leading-edge and trailing-edge vortices by making them force free	196
NEWELM	computes new locations of leading-edge and trailing-edge vortices by making them force free	197
CORE	finds the centroid of the diffused leading-edge vortex element system	214
CFAEC	computes the force on each vortex segment of core	216
SEGMNT	computes the force gradient of each vortex segment of core	217
NEWBC	returns to the previous location	218
NEWDA	saves newly computed locations of leading-edge vortex elements system	219
MODEL	generates the vortex segments along each free element on the free vortex sheet	220
CHOPS	determines the intersection between the centroid of leading-edge vortex system and	222

		113
	the leading-edge vortex filament	
LIRITN	establishes the free sheet and concentrated core	223
AZCORE	adjusts z-coordinates of initial core	228
APEXC	rearranges vortex segments of core	228
AYCORE	adjusts y-coordinates of initial core	229
LEADLM	generates the equal-length vortex segments on each free element	231
CFSET	determines z-coordinates of vortex segments along each free element	232
MINMAX	determines the maximum and minimum of two numbers	232
CENTRD	computes y- and z-coordinates at some stations chosen by the program	233
COORD	coordinates computation	233
CSIPAR	cubic spline fitting	234

	OVERLAY (LEVSP,0,0)	LEV 10
	PROGRAM LEVSP(INPUT,OUTPUT,TAPE1,TAPE2,TAPE3,TAPE5=INPUT,TAPE6=OUT	LEV 20
	IPUT,PUNCH,TAPE4,TAPE7,TAPF8,TAPE9,TAPE10)	LEV 30
C		LEV 40
C	AERODYNAMICS OF LOW ASPECT-RATIO WINGS WITH PARTIAL LEADING-EDGE	LEV 50
C	SEPARATION (LEADING-EDGE VORTEX SEPARATION PROGRAM)	LEV 60
C	BY - JENN LOUH PAO , SUDHIR C. MEHROTRA AND C. EDWARD LAN	LEV 70
C	UNIVERSITY OF KANSAS	LEV 80
C		LEV 90
C	THIS PROGRAM IS APPLICABLE TO NONPLANAR WINGS (LIMITED TO TWO	LEV 100
C	SPANWISE SECTIONS)	LEV 110
C		LEV 120
C	PROGRAM IS DIVIDED INTO FIVE OVERLAYS.	LEV 130
C	OVERLAY (1,0) READ ALL THE DATA CARDS AND SETS UP INITIAL	LEV 140
C	GEOMETRY OF THE WING AND THE FREE ELEMENTS	LEV 150
C	OVERLAY (2,0) PLOTS FREE ELEMENTS OVER THE WING AND IN THE WAKE ON	LEV 160
C	THE LINE PRINTER OUTPUT	LEV 170
C	OVERLAY (3,0) SOLVES FOR THE STRENGTHS OF WING AND LEADING-EDGE	LEV 180
C	VORTEX SYSTEM	LEV 190
C	OVERLAY (4,0) COMPUTE THE AERODYNAMICS CHARACTERISTICS , THE	LEV 200
C	SUM OF FREE SHEET AND CORE FORCES	LEV 210
C	OVERLAY (5,0) COMPUTES THE NEW LOCATIONS OF THE LEADING-EDGE AND	LEV 220
C	TRAILING-EDGE VOPTICES	LEV 230
C	AS THE PROBLEM IS NONLINEAR, IT IS SOLVED BY ITERATION. ITERATION	LEV 240
C	IS PERFORMED OVER OVERLAYS (2,0) THRU (4,0) TO OBTAIN THE FINAL	LEV 250
C	CONVERGED SOLUTION.	LEV 260
C		LEV 270
C	COMMON DUMMY1(3000)	LEV 280
	COMMON /COEFF/ CL,FZMINS(10),FHS(2,10),RATIOS(2,10),	LEV 290
	ICFCORE(2,10),RATIOC(2,10)	LEV 300
	COMMON /NCTT/ NCT,NCON,NBT,NCOR(15),KUI,NFSH(15),KUC,FLG(10)	LEV 310
	COMMON /AERO/ NAFRO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	LEV 320
	COMMON /TAPE/ ITEST,IGOOD,SFAC(10),KU3,NSTOP	LEV 330
	COMMON /SHPT/ NTE,YST(15),AGT(14),BGT(14),CQT(14),DQT(14)	LEV 340
	COMMON /SHPL/ NLE,YSL(15),AQL(14),BQL(14),CQL(14),DQL(14)	LEV 350
	COMMON /LANDA/ FGMA1,FBDA1,FGMA,CLS	LEV 360
	COMMON /LOCSP/ FTANTY(10,15),FTANTZ(10,15),CTANTY(40,2),CTANTZ(40,	LEV 370
	12)	LEV 380
	COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4),	LEV 390
	1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZBDY(200)	LEV 400
	2,CURV(10),CHND(10),S7BDYV(200)	LEV 410

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COMMON /INFAV/ FYT(20),F7T(20),FYI(40),FZI(40),VXI(40),VYI(40),V7ILEV 420
1(40),FXT(20),TFORCE(20) LEV 430
COMMON /MDFAV/ FYP(40,2,2),FZP(40,2,2) LEV 440
COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5),ICL LEV 450
COMMON /ALLI/ NSW,NSW1,NCW,NWNG,NCPTTL,MITER,IPUNCH LEV 460
COMMON /ALLRA/ TTL(16),ALPHA,SINA,COSA,SWPLE,BETA,BETA2,TANPH1,B2PLEV 470
1H1,RSQD4P,D4,CON,PI,D4SQ2,CBAR,HALFB,AREA LEV 480
COMMON /ALLRB/ AX(210),ZMIN,NELM(11),NNELM(12),IST LEV 490
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40),XXE(11,20),YYE(11,20), LEV 500
1ZZE(11,20),NMAX,NNMAX,NCONTS LEV 510
COMMON /OABC/ DYE(10,40),DYE(10,40),DZE(10,40) LEV 520
COMMON /XPLOT/ XMN,VMN,ZMN,XXM,VMX,ZMX LEV 530
COMMON /GM/ ITER,L1,L2,L3,L4,L5,L6,L7,L8 LEV 540
COMMON /XSTN/ XRRR(25),NRRR LEV 550
COMMON /TIPVX/ XTIP(15,30),YTIP(15,30),ZTIP(15,30),NTLM(15),NTMAX LEV 560
COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2), LEV 570
1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC LEV 580
COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),RBM(10,20), LEV 590
1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),ZBDXV(200) LEV 600
10 CALL OVERLAY (5HLEVSP,1,0) LEV 610
ITEST=9 LEV 620
IGOOD= 10 LEV 630
KU3=KU1+3 LEV 640
NSTOP=0 LEV 650
NSW1=NTS LEV 660
NSW=NTS+1 LEV 670
ITER=ITERS LEV 680
20 CONTINUE LEV 690
ALP=ALPHA*180./PI LEV 700
AMACH=SQRT(1.-BETA2) LEV 710
C WRITE FREE ELEMENTS LOCATIONS LEV 720
WRITE (6,140) TTL,ALP,AMACH,ITER LEV 730
IF (ITER.GE.KU3) WRITE (ITEST,140) TTL,ALP,AMACH,ITER LEV 740
DO 30 I=1,MAXL LEV 750
K=NELM(I) LEV 760
WRITE (6,180) I LEV 770
WRITE (6,170) (XE(I,J),J=1,K) LEV 780
WRITE (6,170) (YE(I,J),J=1,K) LEV 790
30 WRITE (6,170) (ZE(I,J),J=1,K) LEV 800
WRITE (6,210) LEV 810
DO 40 I=1,MAXW LEV 820

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K=NNELM(I)
WRITE (6,180) I
WRITE (6,170) (XXE(I,J),J=1,K)
WRITE (6,170) (YYE(I,J),J=1,K)
40 WRITE (6,170) (ZZE(I,J),J=1,K)
IF (ITER.LT.KU3) GO TO 70
M=ITEST
DO 50 I=1,MAXL
K=NELM(I)
WRITE (M,180) I
WRITE (M,170) (XE(I,J),J=1,K)
WRITE (M,170) (YE(I,J),J=1,K)
50 WRITE (M,170) (ZE(I,J),J=1,K)
CONTINUE
WRITE (M,210)
DO 60 I=1,MAXW
K=NNELM(I)
WRITE (M,180) I
WRITE (M,170) (XXE(I,J),J=1,K)
WRITE (M,170) (YYE(I,J),J=1,K)
60 WRITE (M,170) (ZZE(I,J),J=1,K)
CONTINUE
70 CONTINUE
CALL OVERLAY (5HLEVSP,2,0)
NAERO=0
NSW=NTS+1
CALL OVERLAY (5HLEVSP,3,0)
NAERO=1
NSW1=NTS
NSW=NTS+1
CALL OVERLAY (5HLEVSP,4,0)
IF (NSTOP.NE.1) GO TO 75
REWIND ITEST
ENDFILE ITEST
ENDFILE ITEST
GO TO 90
75 RATIOC(1,ITEP)=1.
RATIOC(2,ITER)=1.
RATIOS(1,ITEP)=1.
RATIOS(2,ITER)=1.
NSW1=NTS

```

```

LEV 830
LEV 840
LEV 850
LEV 860
LEV 870
LEV 880
LEV 890
LEV 900
LEV 910
LEV 920
LEV 930
LEV 940
LEV 950
LEV 960
LEV 970
LEV 980
LEV 990
LEV1000
LEV1010
LEV1020
LEV1030
LEV1040
LEV1050
LEV1060
LEV1070
LEV1080
LEV1090
LEV1100
LEV1110
LEV1120
LEV1130
LEV1135
LEV1140
LEV1145
LEV1150
LEV1155
LEV1160
LEV1170
LEV1180
LEV1190
LEV1200

```

	NSW=NTS+1	LEV1210
	IF (ITER.LT.KU3) GO TO 80	LEV1220
	RATIOS(1,ITER)=ABS((FHS(1,ITER)-FHS(1,ITER-1))/FHS(1,ITER-1))	LEV1230
	RATIOC(1,ITER)=ABS((CFCORE(1,ITER)-CFCORE(1,ITER-1))/CFCORE(1,ITER-1))	LEV1240
	1))	LEV1250
	IF (ITRAKE.NE.1) RATIOC(2,ITER)=ABS((CFCORE(2,ITER)-CFCORE(2,ITER-1))	LEV1260
	1)))/CFCORE(2,ITER-1))	LEV1270
	IF (ITRAKE.NE.1) RATIOS(2,ITER)=ABS((FHS(2,ITER)-FHS(2,ITER-1))/FH	LEV1280
	1S(2,ITER-1))	LEV1290
80	CONTINUE	LEV1300
	IF (ITER.EQ.MITER) GO TO 90	LEV1310
	CALL OVERLAY (5HLEVSP,5,0)	LEV1320
	ITER=ITER+1	LEV1330
	IF (ITER.LE.MITER) GO TO 20	LEV1340
90	CONTINUE	LEV1350
	IF (IPUNCH.EQ.0) GO TO 120	LEV1360
C	PUNCH-OUT FREE ELEMENTS LOCATIONS AFTER LAST ITERATION	LEV1370
	REWIND 4	LEV1380
	PUNCH 200, (NELM(I),I=1,NSW1)	LEV1390
	DO 100 I=1,NSW1	LEV1400
	K=NELM(I)	LEV1410
	PUNCH 190, (XE(I,J),J=1,K)	LEV1420
	PUNCH 190, (YF(I,J),J=1,K)	LEV1430
100	PUNCH 190, (ZE(I,J),J=1,K)	LEV1440
	PUNCH 200, (NNELM(I),I=1,NSW)	LEV1450
	DO 110 I=1,NSW	LEV1460
	K=NNELM(I)	LEV1470
	PUNCH 190, (XXF(I,J),J=1,K)	LEV1480
	PUNCH 190, (YYF(I,J),J=1,K)	LEV1490
110	PUNCH 190, (ZZF(I,J),J=1,K)	LEV1500
C	FORMULATION OF SUMMARY SHEET	LEV1510
120	REWIND 7	LEV1520
	WRITE (6,150) TTL,ALP,AMACH	LEV1530
	MIT=MITER+1	LEV1540
	IF (ITERS.EQ.0) KSS=1	LEV1550
	IF (ITERS.EQ.3) KSS=4	LEV1560
	DO 130 I=KSS,MIT	LEV1570
	J=I-1	LEV1580
C	*****	LEV1590
	READ (7) GMSUM	LEV1600
	READ (7) CL,CM,CD,CTT	LEV1610

```

C *****LEVI620
  IF (ITER.LE.KUI) WRITE (6,160) J,CL,CM,CD,CTT,GMSUM          LEVI630
  IF (ITER.GT.KUI) WRITE (6,160) J,CL,CM,CD,CTT,GMSUM,SFAC(J)  LEVI640
130 CONTINUE                                                    LEVI650
    GO TO 10                                                    LEVI660
C                                                                 LEVI680
140  FORMAT (1H1,/,16A5,/,1X,12HALPHA(DEG.)=,F6.3,14H MACH NUMBER=,F6
      1.3,19H ITERATION NUMBER=,I2,/,1X,21HLEADING EDGE ELEMENTS,/,1X,2
      21H*****))
150  FORMAT (1H1,/,1X,16A5,/,2X,12HALPHA(DEG.)=,F6.3,14H MACH NUMBER
      1=,F6.3,/,66H ITERATION CL CM CD CT GMSUM          LEVI730
      2 SFAC ,/,58H ***** ** ** ** ** LEVI740
      3*** ***)
160  FORMAT (I7,4X,6F8.4)                                       LEVI760
170  FORMAT (1H ,14F9.4)                                       LEVI770
180  FORMAT (1H ,5H ****.I2,4H****)                             LEVI780
190  FORMAT (8F10.4)                                           LEVI790
200  FORMAT (10I2)                                             LEVI800
210  FORMAT (1H1,/,14H WAKE ELEMENTS,/,14H *****))
      END
      LEVI820-

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FUNCTION TAN(X)
TAN=SIN(X)/COS(X)
RETURN
END
TAN 10
TAN 20
TAN 30
TAN 40-

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SUBROUTINE SKIPP (NT,NR)
C SKIPS NR-RECORDS OF TAPE NT
DO 10 I=1,NR
10 READ (NT)
RETURN
END
SKP 10
SKP 20
SKP 30
SKP 40
SKP 50
SKP 60-

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C FUNCTION ARCOS (X)
CALCULATES ARC-COSINE OF X
ARC 10
ARC 20

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	ARCOS=0.	ARC	30
	IF (X.FQ.1.) RETURN	ARC	40
	IF (X.EQ.(-1.)) GO TO 10	ARC	50
	XX=X/(SQRT(1.-X*X))	ARC	60
	ARCOS=1.5707963-ATAN(XX)	ARC	70
	RETURN	ARC	80
10	ARCOS=3.1415926	ARC	90
	RETURN	ARC	100
	END	ARC	110-

	SUBROUTINE DOTPRD (A,B,SUM)	DOT	10
C	CALCULATES DOT-PRODUCT OF TWO VECTORS	DOT	20
	DIMENSION A(3), B(3)	DOT	30
	SUM=0.	DOT	40
	DO 10 I=1,3	DOT	50
10	SUM=SUM+A(I)*P(I)	DOT	60
	RETURN	DOT	70
	END	DOT	80-

	SUBROUTINE CRSPRD (A,B,C)	CRS	10
C	CALCULATES CROSS-PRODUCT OF TWO VECTORS	CRS	20
	DIMENSION A(3), B(3), C(3)	CRS	30
	C(1)=A(2)*B(3)-A(3)*B(2)	CRS	40
	C(2)=A(3)*B(1)-A(1)*B(3)	CRS	50
	C(3)=A(1)*B(2)-A(2)*B(1)	CRS	60
	RETURN	CRS	70
	END	CRS	80-

	SUBROUTINE VDTWNG (C,THETP,XX,YY,ZZ,XN,YN,XTE,YTE,CONS,CONI1,CONI3WNG	10	
	1,CONJ1,CONJ2,CONJ3,CONK1,CONK2,CONK3,CONI,CONJ,CONK,SI,NSW1,NCW,NWWNG	20	
	2NG)	WNG	30
C	EVALUATES INFLUENCE COEFFICIENTS FOR CALCULATION OF INDUCED	WNG	40
C	VELOCITY DUE TO WING ELEMENTS	WNG	50
	COMMON /ALLI/ NSW	WNG	60
	COMMON /ALLRB/ XXE(30),YYE(30),ZZE(30)	WNG	70

	1,AX(120),ZMIN,NFLM(11),NNFLM(12)	WNG 80
	COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40),PXXE(11,20),	WNG 90
	1PYE(11,20),PZZE(11,20),NMAX,NNMAX,NCONTS	WNG 100
	COMMON /NCTT/ NCT,NCON,NRT,NCOR(15),KU1,NFSH(15),KUC	WNG 110
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	WNG 120
	1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC	WNG 130
	COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)	WNG 140
	COMMON /AERO/ NAFRO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	WNG 150
	COMMON /TIPVX/ XTIP(15,30),YTIP(15,30),ZTIP(15,30),NTLM(15)	WNG 160
	COMMON /XIYIZI/ XI,YI,ZI	WNG 170
	DIMENSION THETP(1), C(1), CONS(1), XTE(1), YTE(1), SI(1), CONI1(1)	WNG 180
	1, CONI3(1), CONJ1(1), CONJ2(1), CONJ3(1), CONK1(1), CONK2(1), CONKW	WNG 190
	23(1), CONI(1), CONJ(1), CONK(1), XN(NWNG,2), YN(NWNG,2), B(3), D(3)	WNG 200
	3)	WNG 210
C	DIMENSIONS OF FJ1,FJ2,FJ3-(2*NSW) ** SEE GEOM **	WNG 220
C	DIMENSIONS OF FI2,FI3-(2*NCPTTL) ** SEE GEOM **	WNG 230
	DIMENSION FJ1(40), FJ2(40), FJ3(40), FI2(418), FI3(418)	WNG 240
	XI=XX	WNG 250
	YI=YY	WNG 260
	ZI=ZZ	WNG 270
	NC1=NWNG+NCW	WNG 280
	NC2=NWNG-NCW	WNG 290
C	VELOCITY DUE TO ROUND ELEMENTS	WNG 300
	NSW1=NTS	WNG 310
	DO 10 I=1,NSW1	WNG 320
	DO 10 J=1,NCW	WNG 330
	NP=(I-1)*NCW+J	WNG 340
	CALL INFL2 (XN(NP,1),YN(NP,1),0.,XN(NP,2),YN(NP,2),0.,R)	WNG 350
	A1=-YN(NP,1)	WNG 360
	A2=-YN(NP,2)	WNG 370
	CALL INFL2 (XN(NP,1),A1,0.,XN(NP,2),A2,0.,D)	WNG 380
	CONI(NP)=CONS(I)*(R(1)-D(1))	WNG 390
	CONJ(NP)=CONS(I)*(R(2)-D(2))	WNG 400
10	CONK(NP)=CONS(I)*(R(3)-D(3))	WNG 410
C	VELOCITY DUE TO TRAILING ELEMENTS ON THE WING SURFACE	WNG 420
	DO 20 I=1,NSW1	WNG 430
	DO 20 J=1,NCW	WNG 440
	NP=(I-1)*NCW+J	WNG 450
	CALL INFL2 (XN(NP,1),YN(NP,1),0.,XTE(I),YN(NP,1),0.,R)	WNG 460
	FI2(NP)=B(2)	WNG 470
	FI3(NP)=B(3)	WNG 480

	AYN=-YN(NP,1)	WNG 490
	NQ=NC1+NP	WNG 500
	CALL INFL2 (XN(NP,1),AYN,0.,XTE(I),AYN,0.,R)	WNG 510
	FI2(NQ)=B(2)	WNG 520
	FI3(NQ)=B(3)	WNG 530
20	CONTINUE	WNG 540
	IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) GO TO 40	WNG 550
	DO 30 I=1,NCW	WNG 560
	NP1=NWNG+I	WNG 570
	NP2=NC1+NP1	WNG 580
	FI2(NP1)=0.	WNG 590
	FI2(NP2)=0.	WNG 600
	FI3(NP1)=0.	WNG 610
	FI3(NP2)=0.	WNG 620
	NN=NTLM(I)-1	WNG 630
	DO 30 J=1,NN	WNG 640
	CALL INFL2 (XTIP(I,J),YTIP(I,J),ZTIP(I,J),XTIP(I,J+1),YTIP(I,J+1),	WNG 650
	1ZTIP(I,J+1),R)	WNG 660
	FI2(NP1)=B(2)+FI2(NP1)	WNG 670
	FI3(NP1)=B(3)+FI3(NP1)	WNG 680
	AY1=-YTIP(I,J)	WNG 690
	AY2=-YTIP(I,J+1)	WNG 700
	CALL INFL2 (XTIP(I,J),AY1,ZTIP(I,J),XTIP(I,J+1),AY2,ZTIP(I,J+1),B)	WNG 710
	FI2(NP2)=B(2)+FI2(NP2)	WNG 720
	FI3(NP2)=B(3)+FI3(NP2)	WNG 730
30	CONTINUE	WNG 740
	GO TO 60	WNG 750
40	CONTINUE	WNG 760
	DO 50 J=1,NCW	WNG 770
	NP1=NWNG+J	WNG 780
	NP2=NC1+NP1	WNG 790
	NP=NC2+J	WNG 800
	CALL INFL2 (XN(NP,2),YN(NP,2),0.,XTE(NSW),YN(NP,2),0.,R)	WNG 810
	FI2(NP1)=B(2)	WNG 820
	FI3(NP1)=B(3)	WNG 830
	AYN=-YN(NP,2)	WNG 840
	CALL INFL2 (XN(NP,2),AYN,0.,XTE(NSW),AYN,0.,R)	WNG 850
	FI2(NP2)=B(2)	WNG 860
	FI3(NP2)=B(3)	WNG 870
50	CONTINUE	WNG 880
60	CONTINUE	WNG 890

	DO 70 I=1,NSW1	WNG 900
	DO 70 J=1,NCW	WNG 910
	NP=(I-1)*NCW+J	WNG 920
	I1=NP+NC1	WNG 930
	I2=NP+NCW	WNG 940
	I3=I1+NCW	WNG 950
	CONJ2(NP)=CONS(I)*(FI2(I1)-FI2(NP)+FI2(I2)-FI2(I3))	WNG 960
70	CONK2(NP)=CONS(I)*(FI3(I1)-FI3(NP)+FI3(I2)-FI3(I3))	WNG 970
C	VFLOCITY DUE TO TRAILING ELFMENTS BEYOND TRAILING EDGE	WNG 980
	NSW1=MAXL	WNG 990
	IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) GO TO 90	WNG1000
	DO 80 I=1,NSW	WNG1010
	FJ1(I)=0.	WNG1020
	FJ2(I)=0.	WNG1030
	FJ3(I)=0.	WNG1040
	FJ1(I+NSW)=0.	WNG1050
	FJ2(I+NSW)=0.	WNG1060
	FJ3(I+NSW)=0.	WNG1070
80	CONTINUE	WNG1080
	NT=NSW1	WNG1090
	GO TO 100	WNG1100
90	NT=NSW	WNG1110
100	CONTINUE	WNG1120
	DO 150 I=2,NT	WNG1130
	KK=NNELM(I)	WNG1140
	DO 110 J=1,KK	WNG1150
	XXE(J)=PYXE(I,J)	WNG1160
	YYE(J)=PYYE(I,J)	WNG1170
	ZZE(J)=PZZE(I,J)	WNG1180
110	CONTINUE	WNG1190
	FJ1(I)=0.	WNG1200
	FJ2(I)=0.	WNG1210
	FJ3(I)=0.	WNG1220
	IF (I.EQ.NCT) GO TO 130	WNG1230
	DO 120 J=2,KK	WNG1240
	CALL INFL2 (XXE(J-1),YYE(J-1),ZZE(J-1),XXE(J),YYE(J),ZZE(J),R)	WNG1250
	FJ1(I)=FJ1(I)+R(1)	WNG1260
	FJ2(I)=FJ2(I)+R(2)	WNG1270
	FJ3(I)=FJ3(I)+R(3)	WNG1280
120	CONTINUE	WNG1290
	CALL FUNA (XXE(KK),YYE(KK),ZZE(KK),R(1),R(2),R(3))	WNG1300

	FJ1(I)=FJ1(I)+R(1)	WNG1310
	FJ2(I)=FJ2(I)+R(2)	WNG1320
	FJ3(I)=FJ3(I)+R(3)	WNG1330
130	CONTINUE	WNG1340
	IN=I+NSW	WNG1350
	FJ1(IN)=0.	WNG1360
	FJ2(IN)=0.	WNG1370
	FJ3(IN)=0.	WNG1380
	DO 140 J=2, KK	WNG1390
	AYT1=-YYE(J-1)	WNG1400
	AYT2=-YYE(J)	WNG1410
	CALL INFL2 (XXE(J-1), AYT1, ZZE(J-1), XXE(J), AYT2, ZZE(J), R)	WNG1420
	FJ1(IN)=FJ1(IN)+R(1)	WNG1430
	FJ2(IN)=FJ2(IN)+R(2)	WNG1440
	FJ3(IN)=FJ3(IN)+R(3)	WNG1450
140	CONTINUE	WNG1460
	AYT2=-YYE(KK)	WNG1470
	CALL FIINA (XXE(KK), AYT2, ZZE(KK), B(1), B(2), R(3))	WNG1480
	FJ1(IN)=FJ1(IN)+R(1)	WNG1490
	FJ2(IN)=FJ2(IN)+R(2)	WNG1500
	FJ3(IN)=FJ3(IN)+R(3)	WNG1510
150	CONTINUE	WNG1520
	FJ1(1)=0.	WNG1530
	FJ2(1)=0.	WNG1540
	FJ3(1)=0.	WNG1550
	FJ1(NSW+1)=0.	WNG1560
	FJ2(NSW+1)=0.	WNG1570
	FJ3(NSW+1)=0.	WNG1580
	DO 160 I=1, NSW1	WNG1590
	I1=I+1	WNG1600
	I2=I+NSW	WNG1610
	I3=I2+1	WNG1620
	EFJ1=CONS(I)*(FJ1(I2)-FJ1(I)+FJ1(I1)-FJ1(I3))	WNG1630
	EFJ2=CONS(I)*(FJ2(I2)-FJ2(I)+FJ2(I1)-FJ2(I3))	WNG1640
	EFJ3=CONS(I)*(FJ3(I2)-FJ3(I)+FJ3(I1)-FJ3(I3))	WNG1650
	DO 160 J=1, NCW	WNG1660
	NP=(I-1)*NCW+J	WNG1670
	CONI3(NP)=EFJ1	WNG1680
	CONJ3(NP)=EFJ2	WNG1690
160	CONK3(NP)=EFJ3	WNG1700
C	TOTAL INDUCED VELOCITY	WNG1710

	I=1	WNG1720
	DO 170 J=1,NWNG	WNG1730
	CONT(J)=(CONT(J)+CONI3(J))*SI(I)	WNG1740
	CONJ(J)=(CONJ(J)+CONJ2(J)+CONJ3(J))*SI(I)	WNG1750
	CONK(J)=(CONK(J)+CONK2(J)+CONK3(J))*SI(I)	WNG1760
	I=I+1	WNG1770
	IF (I.GT.NCW) I=1	WNG1780
170	CONTINUE	WNG1790
	RETURN	WNG1800
	END	WNG1810-
	SUBROUTINE VDTFRE (X,Y,Z,CI,CJ,CK,NSW1,BSQD4P,XLE,YLE)	FRE 10
C	EVALUATES INFLUENCE COEFFICIENTS FOR CALCULATION OF INDUCED	FRE 20
C	VELOCITY DUE TO FREE ELEMENTS	FRE 30
	COMMON /ALLRB/ XE(40),YE(40),ZE(40),XXE(30),YYE(30),Z7E(30)	FRE 40
	1,ZMIN,NELM(11),NNELM(12)	FRE 50
	COMMON /ABC/ PXE(10,40),PYF(10,40),PZE(10,40),PXXF(11,20),	FRE 60
	1PYFE(11,20),PZZE(11,20),NMAX,NNMAX,NCONTS	FRE 70
	COMMON /NCTT/ NCT,NCON,NRT,NCOR(15),KUI,NFSH(15),KUC,FLG(10)	FRE 80
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	FRE 90
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	FRE 100
	1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC	FRE 110
	COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)	FRE 120
	DIMENSION P(5),Q(5),R(5)	FRE 130
	COMMON /GM/ ITER	FRE 140
	COMMON /XIYIZI/ XI,YI,ZI	FRE 150
	DIMENSION CI(1),CJ(1),CK(1),XLE(1),YLE(1),V(3),VVV(3)	FRE 160
C	DIMENSION OF VTDL-(NSW1,3) ** SEE GEOM **	FRE 170
	DIMENSION VTDL(19,3)	FRE 180
	XI=X	FRE 190
	YI=Y	FRE 200
	ZI=Z	FRE 210
	NCT1=0	FRE 220
10	CONTINUE	FRE 230
	IF (ISPAN.EQ.0) NSW1=NTS	FRE 240
	IF (ISPAN.EQ.1) NSW1=MAXL	FRE 250
	DO 90 I=1,NSW1	FRE 260
	NCP=NCOR(I)	FRE 270
	V(1)=0.	FRE 280

	V(2)=0.	FRE 290
	V(3)=0.	FRE 300
	FJ1=0.	FRE 310
	FJ2=0.	FRE 320
	FJ3=0.	FRE 330
	KK=NELM(I)	FRE 340
	DO 20 J=1, KK	FRE 350
	XE(J)=PXF(1, J)	FRE 360
	YE(J)=PYE(1, J)	FRE 370
	ZE(J)=PZE(1, J)	FRE 380
20	CONTINUE	FRE 390
	K=KK-1	FRE 400
C	VELOCITY DUE TO FREE ELEMENTS AHEAD OF TRAILING-EDGE AND THOSE	FRE 410
C	OVER THE WING	FRE 420
	DO 40 J=1, K	FRE 430
	IF (ITER.GT.KU1.AND.I.EQ.1.AND.J.GE.3.AND.J.LT.NCR) GO TO 40	FRE 440
	IF (ITER.GT.KU1.AND.I.EQ.M1(1).AND.J.GE.3.AND.J.LT.NCR.AND.ITRAKE.	FRE 450
	INE.1) GO TO 40	FRE 460
	IF (ABS(XE(J+1)-XI).LE.1.E-5) GO TO 40	FRE 470
	IF (I.EQ.NCON.AND.J.GT.4.AND.YI.GT.0.AND.ITER.LE.KU1) GO TO 40	FRE 480
	IF (I.FQ.NCON.AND.NRT.EQ.0.AND.J.GT.4.AND.J.LT.NCR.AND.YI.GT.0.AND	FRE 490
	1.ITER.GT.KU1) GO TO 40	FRE 500
	IF (ITER.GT.KU1.AND.J.GE.NCR.AND.YI.GT.0.AND.NRT.EQ.1) GO TO 40	FRE 510
	CALL INFL2 (XE(J), YE(J), ZF(J), XE(J+1), YE(J+1), ZE(J+1), VVV)	FRE 520
	IF (ITER.LE.KU1) GO TO 30	FRE 530
	IF (J.LT.NCR) GO TO 30	FRE 540
	IF (NAFPO.EQ.0) GO TO 30	FRE 550
	IF (NCT1.GT.0.AND.J.LT.NCR) GO TO 30	FRE 560
C	INDUCED VELOCITIES MODIFIED BY VISCOUS CORE EFFECT	FRE 570
	P(1)=XE(J)-XE(J+1)	FRE 580
	P(2)=YE(J)-YE(J+1)	FRE 590
	P(3)=ZF(J)-ZF(J+1)	FRE 600
	CALL ABVLE (P, SUM)	FRE 610
	IF (SUM.LE.1.E-5) GO TO 30	FRE 620
	P(1)=P(1)/SUM	FRE 630
	P(2)=P(2)/SUM	FRE 640
	P(3)=P(3)/SUM	FRE 650
	Q(1)=XI-XE(J+1)	FRE 660
	Q(2)=YI-YE(J+1)	FRE 670
	Q(3)=ZI-ZE(J+1)	FRE 680
	CALL CRSPRD (P, Q, R)	FRE 690

	CALL ARVLE (P,D1)	FRE 700
	L1=1	FRE 710
	L3=M1(1)-1	FRE 720
	IF (ITRAKE.NE.1.AND.I.GE.M1(1)) L1=M1(1)	FRE 730
	IF (ITRAKE.NE.1.AND.I.GE.M1(1)) L3=M1(2)	FRE 740
	P(1)=PXE(L3,4)-PXE(L1,4)	FRE 750
	P(2)=PYF(L3,4)-PYE(L1,4)	FRE 760
	P(3)=PZE(L3,4)-PZE(L1,4)	FRE 770
	CALL ARVLE (P.SUM)	FRE 780
	P(1)=P(1)/SUM	FRE 790
	P(2)=P(2)/SUM	FRE 800
	P(3)=P(3)/SUM	FRE 810
	Q(1)=XE(J+1)-PXE(L1,4)	FRE 820
	Q(2)=YE(J+1)-PYF(L1,4)	FRE 830
	Q(3)=ZE(J+1)-PZE(L1,4)	FRE 840
	CALL CRSPRD (P,Q,R)	FRE 850
	CALL ARVLE (P,D2)	FRE 860
	D2=0.75*D2	FRE 870
	RATIO=D1/D2	FRE 880
	IF (RATIO.GT.1.) GO TO 30	FRE 890
	VVV(2)=VVV(2)*(RATIO**2)	FRE 900
	VVV(3)=VVV(3)*(RATIO**2)	FRE 910
30	CONTINUE	FRE 920
	V(1)=V(1)+VVV(1)	FRE 930
	V(2)=V(2)+VVV(2)	FRE 940
	V(3)=V(3)+VVV(3)	FRE 950
	IF (ITEP.LE.KU1) GO TO 40	FRE 960
	CORR=0.	FRE 970
	IF (NAFRO.EQ.0) GO TO 40	FRE 980
	IF (NRT.EQ.0) GO TO 40	FRE 990
	IF (I.EQ.NSW1) GO TO 40	FRE1000
	IF (ITRAKE.NE.1.AND.I.EQ.M1(1)-1) GO TO 40	FRE1010
	IF (J.LE.4.OP.J.GE.NCP-1) GO TO 40	FRE1020
C	SIDEWASH CORRECTION FACTOR	FRE1030
	CALL ORDER (I,J,P,Q,R)	FRE1040
	CALL SWAHC (I,P,Q,R,XI,YI,ZI,CORR)	FRE1050
	V(2)=V(2)+CORR	FRE1060
40	CONTINUE	FRE1070
	IF (ITER.LE.KU1.AND.I.EQ.NCON.AND.YI.GT.0.) GO TO 50	FRE1080
	IF (ITEP.GT.KU1.AND.NRT.EQ.1.AND.YI.GT.0.) GO TO 50	FRE1090
	CALL FUNA (XE(K+1),YE(K+1),ZE(K+1),FJ1,FJ2,FJ3)	FRE1100

50	VTDL(I,1)=V(1)+FJ1	FRE1110
	VTDL(I,2)=V(2)+FJ2	FRE1120
	VTDL(I,3)=V(3)+FJ3	FRE1130
	FJ1=0.	FRE1140
	FJ2=0.	FRE1150
	FJ3=0.	FRE1160
	IF ((PXT(NC+1)-PXL(NC+1)).NF.0..AND.I.EQ.NSW1) GO TO 80	FRE1170
	I1=I+1	FRE1180
	II=NNELM(I1)	FRE1190
	DO 60 J=1,I1	FRE1200
	XXE(J)=PXXE(I1,J)	FRE1210
	YYE(J)=PYYE(I1,J)	FRE1220
	ZZE(J)=PZZE(I1,J)	FRE1230
60	CONTINUE	FRE1240
	IF (I1.EQ.NCT.AND.YI.GT.0.) GO TO 80	FRE1250
C	VELOCITY DUE TO WAKE ELEMENTS	FRE1260
	DO 70 J=2,I1	FRE1270
	CALL INFL2 (XXF(J-1),YYE(J-1),ZZE(J-1),XXE(J),YYE(J),ZZE(J),V)	FRE1280
	FJ1=FJ1+V(1)	FRE1290
	FJ2=FJ2+V(2)	FRE1300
	FJ3=FJ3+V(3)	FRE1310
70	CONTINUE	FRE1320
	CALL FUNA (XXE(II),YYE(II),ZZE(II),V(1),V(2),V(3))	FRE1330
	FJ1=FJ1+V(1)	FRE1340
	FJ2=FJ2+V(2)	FRE1350
	FJ3=FJ3+V(3)	FRE1360
80	CONTINUE	FRE1370
	VTDL(I,1)=VTDL(I,1)-FJ1	FRE1380
	VTDL(I,2)=VTDL(I,2)-FJ2	FRE1390
	VTDL(I,3)=VTDL(I,3)-FJ3	FRE1400
90	CONTINUE	FRE1410
	YI=-YI	FRE1420
	NCT1=NCT1+1	FRE1430
	IF (NCT1.GT.1) GO TO 110	FRE1440
	DO 100 I=1,NSW1	FRE1450
	CI(I)=VTDL(I,1)	FRE1460
	CJ(I)=VTDL(I,2)	FRE1470
	CK(I)=VTDL(I,3)	FRE1480
100	CONTINUE	FRE1490
	GO TO 10	FRE1500
C	TOTAL INDUCED VELOCITY	FRE1510


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110 DO 120 I=1,NSW1
    CI(I)=RSQD4P*(CI(I)+VTDL(I,1))
    CJ(I)=RSQD4P*(CJ(I)-VTDL(I,2))
120 CK(I)=RSQD4P*(CK(I)+VTDL(I,3))
    RETURN
    END

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FRE1520
FRE1530
FRE1540
FRE1550
FRE1560
FRE1570-

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SUBROUTINE NORMAL (X,Y,Z,UN)
DIMENSION X(5),Y(5),Z(5),A(3),B(3),C(3),UN(3)
A(1)=X(3)-X(1)
A(2)=Y(3)-Y(1)
A(3)=Z(3)-Z(1)
B(1)=X(4)-X(2)
B(2)=Y(4)-Y(2)
B(3)=Z(4)-Z(2)
CALL CRSPRD (R,A,C)
CALL ARVLE (C,ARSN)
IF (ARSN.LE.1.E-5) GO TO 10
UN(1)=C(1)/ARSN
UN(2)=C(2)/ARSN
UN(3)=C(3)/ARSN
RETURN
10 UN(1)=0.
    UN(2)=0.
    UN(3)=0.
    RETURN
    END.

```

```

NOR 10
NOR 20
NOR 30
NOR 40
NOR 50
NOR 60
NOR 70
NOR 80
NOR 90
NOR 100
NOR 110
NOR 120
NOR 130
NOR 140
NOR 150
NOR 160
NOR 170
NOR 180
NOR 190
NOR 200-

```

```

SUBROUTINE SWAHC (I,X,Y,Z,XI,YI,ZI,CORR)
DIMENSION X(5),Y(5),Z(5),A(3),B(3),C(3),UN(3),FLPC(4)
COMMON /NCTT/ NCT,NCON,NPT,NCOR(15),KU1,NFSH(15),KUC,FLG(10)
C FIND THE FOUR CORNER POINTS AFTER PLANE TRANSFORMATION
CALL NORMAL (X,Y,Z,UN)
XBAR=0.25*(X(1)+X(2)+X(3)+X(4))
YBAR=0.25*(Y(1)+Y(2)+Y(3)+Y(4))
ZBAR=0.25*(Z(1)+Z(2)+Z(3)+Z(4))
DSD=ARS(UN(1)*(XBAR-X(1))+UN(2)*(YBAR-Y(1))+UN(3)*(ZBAR-Z(1)))

```

```

SWH 10
SWH 20
SWH 30
SWH 40
SWH 50
SWH 60
SWH 70
SWH 80
SWH 90

```

	IF (DSD.EQ.0.) GO TO 30	SWH 100
C	NEW PLANAR CORNER POINTS	SWH 110
	DO 10 K=1,4	SWH 120
	X(K)=X(K)+(-1)**(K+1)*UN(1)*DSD	SWH 130
	Y(K)=Y(K)+(-1)**(K+1)*UN(2)*DSD	SWH 140
	Z(K)=Z(K)+(-1)**(K+1)*UN(3)*DSD	SWH 150
10	CONTINUE	SWH 160
	CALL NORMAL (X,Y,Z,UN)	SWH 170
	IF (UN(1).EQ.0..AND.UN(2).EQ.0..AND.UN(3).EQ.0.) GO TO 30	SWH 180
	X(5)=X(1)	SWH 190
	Y(5)=Y(1)	SWH 200
	Z(5)=Z(1)	SWH 210
C	FIND THE SHORTEST DISTANCE FROM THE CONTROL POINT TO THE PLANE	SWH 220
	A(1)=X(1)-XI	SWH 230
	A(2)=Y(1)-YI	SWH 240
	A(3)=Z(1)-ZI	SWH 250
	CALL DOTPRD (A,UN,VDS)	SWH 260
	X0=XI+VDS*UN(1)	SWH 270
	Y0=YI+VDS*UN(2)	SWH 280
	Z0=ZI+VDS*UN(3)	SWH 290
	CALL INOUT (X,Y,X0,Y0,NSIDE)	SWH 300
	IF (NSIDE.NE.1) GO TO 30	SWH 310
C	FIND THE DISTANCE BETWEEN THE INTERSECTION POINT TO ALL EDGES OF	SWH 320
C	PANEL	SWH 330
	DO 20 K=1,4	SWH 340
	B(1)=X0-X(K)	SWH 350
	B(2)=Y0-Y(K)	SWH 360
	B(3)=Z0-Z(K)	SWH 370
	A(1)=X(K+1)-X(K)	SWH 380
	A(2)=Y(K+1)-Y(K)	SWH 390
	A(3)=Z(K+1)-Z(K)	SWH 400
	CALL ARVLE (A,DPD)	SWH 410
	A(1)=A(1)/DPD	SWH 420
	A(2)=A(2)/DPD	SWH 430
	A(3)=A(3)/DPD	SWH 440
	CALL CRSPRD (B,A,C)	SWH 450
	CALL ARVLE (C,DP)	SWH 460
	FLPC(K)=DP	SWH 470
20	CONTINUE	SWH 480
	FLPC(1)=-ABS(FLPC(1))	SWH 490
	FY=FLPC(4)/F(FLPC(4),0.,0.,0.,VDS)+FLPC(2)/F(FLPC(2),0.,0.,0.,VDS)	SWH 500

	CY1=FLPC(1)	SWH 510
	CY2=FLPC(3)	SWH 520
	CZ1=VDS	SWH 530
	CZ2=VDS	SWH 540
	IF (ARS(CZ1).LE.1.E-5.OR.ARS(CZ2).LE.1.E-5) GO TO 30	SWH 550
	G2=CY1**2+CZ1**2	SWH 560
	G3=CY2**2+CZ2**2	SWH 570
	G4=CZ2/G3+CZ1/G2	SWH 580
	AVGG=(FLG(I)+FLG(I+1))/2.	SWH 590
	G5=-0.5*FY*G4*AVGG*1.1	SWH 600
	G6=CZ2/ARS(CZ2)*ATAN(CY2/ARS(CZ2))	SWH 610
	G7=CZ1/ARS(CZ1)*ATAN(CY1/ARS(CZ1))	SWH 620
	G8=FY*(G6-G7)*AVGG/(FLPC(3)-FLPC(1))	SWH 630
	CORR=(G5+G8)/AVGG	SWH 640
C	FIND THE SIDE WASH CORRECTION FACTOR IN THE LOCAL PANEL Y	SWH 650
	A(1)=X(3)-X(2)	SWH 660
	A(2)=Y(3)-Y(2)	SWH 670
	A(3)=Z(3)-Z(2)	SWH 680
	CALL ABVLE (A,TOL)	SWH 690
	A(1)=A(1)/TOL	SWH 700
	A(2)=A(2)/TOL	SWH 710
	A(3)=A(3)/TOL	SWH 720
	B(1)=X(4)-X(1)	SWH 730
	B(2)=Y(4)-Y(1)	SWH 740
	B(3)=Z(4)-Z(1)	SWH 750
	CALL ABVLE (B,TOL)	SWH 760
	P(1)=R(1)/TOL	SWH 770
	B(2)=R(2)/TOL	SWH 780
	R(3)=R(3)/TOL	SWH 790
	CC=(A(2)+B(2))/2.	SWH 800
	CORR=CORR*CC	SWH 810
	GO TO 40	SWH 820
30	CORR=0.	SWH 830
40	CONTINUE	SWH 840
	RETURN	SWH 850
	END	SWH 860-

SUBROUTINE ABVLE (A,ARSUM)
 DIMENSION A(3)

ABV 10
 ABV 20

```

ABSUM=SQRT(A(1)**2+A(2)**2+A(3)**2)
RETURN
END

```

```

ARV 30
ARV 40
ARV 50-

```

```

C SUBROUTINE INOUT (X,Y,XO,YO,NSIDE)
  TO CHECK THE CONTROL PT BY VECTOR ANALYSIS
  DIMENSION X(5),Y(5)
  X(5)=X(1)
  Y(5)=Y(1)
  NSIDE=1
  DO 10 I=1,4
  VECT=(XO-X(I))*(Y(I+1)-Y(I))-(X(I+1)-X(I))*(YO-Y(I))
  IF (VECT.LT.0.) NSIDE=0
10 CONTINUE
  RETURN
  END

```

```

INO 10
INO 20
INO 30
INO 40
INO 50
INO 60
INO 70
INO 80
INO 90
INO 100
INO 110
INO 120-

```

```

SUBROUTINE ORDER (I,J,X,Y,Z)
  DIMENSION X(5),Y(5),Z(5)
  COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40)
  X(1)=PXE(I,J+1)
  Y(1)=PYE(I,J+1)
  Z(1)=PZE(I,J+1)
  X(5)=X(1)
  Y(5)=Y(1)
  Z(5)=Z(1)
  X(2)=PXE(I,J)
  Y(2)=PYE(I,J)
  Z(2)=PZE(I,J)
  X(3)=PXE(I+1,J)
  Y(3)=PYE(I+1,J)
  Z(3)=PZE(I+1,J)
  X(4)=PXE(I+1,J+1)
  Y(4)=PYE(I+1,J+1)
  Z(4)=PZE(I+1,J+1)
  RETURN
  END

```

```

ODR 10
ODR 20
ODR 30
ODR 40
ODR 50
ODR 60
ODR 70
ODR 80
ODR 90
ODR 100
ODR 110
ODR 120
ODR 130
ODR 140
ODR 150
ODR 160
ODR 170
ODR 180
ODR 190
ODR 200-

```

FUNCTION F (X1,X,Y1,Y,Z1,Z)	FUN	10
COMMON /ALLRA/ TTL(16),ALPHA,SINA,COSA,SWPLF,RETA,BETA2	FUN	20
XX=X1-X	FUN	30
YY=Y1-Y	FUN	40
ZZ=Z1-Z	FUN	50
F=SQRT(XX**2+RETA2*YY**2+RETA2*ZZ**2)	FUN	60
RETURN	FUN	70
END	FUN	80-
SURROUTINE CAMBER (NPRCY,C,XCP,YCP,XN,YN,XLM,YLM,XAVWNG,YAVWNG)	CBR	10
DIMENSION XN(190,2),YN(190,2),C(19),XLM(19),YLM(19)	CBR	20
DIMENSION XCP(209),YCP(209),XAVWNG(190),YAVWNG(190)	CBR	30
COMMON /ALLRB/ AX(210),ZMIN,NELM(11),NNELM(12),IST	CBR	40
COMMON /ALLI/ NSW,NSW1,NCW,NWNG	CBR	50
COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4),	CBR	60
1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZRDY(200)	CBR	70
2,CURV(10),CHND(10),SZRDYV(200)	CBR	80
COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),BBM(10,20),	CBR	90
1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),ZRDYV(200)	CBR	100
C NPRCY = 0 , FINE GRIDS	CBR	110
C NPRCY = 1 , 2 . COARSE GRIDS.	CBR	120
IF (NPRCY.EQ.2) GO TO 90	CBR	130
IF (NPRCY.EQ.1) GO TO 10	CBR	140
IF (NPRCY.EQ.0) GO TO 60	CBR	150
10 CONTINUE	CBR	160
C FIND THE CAMBER SLOPE AT CONTROL POINTS	CBR	170
DO 30 I=1,NSW1	CBR	180
DO 30 J=1,NCW	CBR	190
IJ=(I-1)*NCW+J	CBR	200
XC=(XCP(IJ)-XLM(J))/C(I)	CBR	210
IF (ICAM.EQ.3) XC=XCP(IJ)	CBR	220
IF (ICAM.EQ.2) GO TO 20	CBR	230
YK1=(YCP(IJ)-YN(IJ,1))/(YN(IJ,2)-YN(IJ,1))	CBR	240
XK1=XN(IJ,1)+(XN(IJ,2)-XN(IJ,1))*YK1	CBR	250
X1=(XK1-XLM(I))/C(I)	CBR	260
CALL ZCR (XC,YCP(IJ),DZDX,ICAM,X1,1,C,DZDY)	CBR	270

	ZRDX(IJ)=DZDX	CBR 280
	ZBDY(IJ)=DZDY	CBR 290
	GO TO 30	CBR 300
20	YC=YLM(I)	CBR 310
	XC=XCP(IJ)	CBR 320
	CALL ZCDX (XC,YC,DZDX,DZDY)	CBR 330
	ZRDX(IJ)=DZDX	CBR 340
	ZBDY(IJ)=DZDY	CBR 350
30	CONTINUE	CBR 360
C	FIND THE CAMPER SLOPE AT LEADING-EDGE CONTROL POINTS	CBR 370
	DO 50 I=1,NSW1	CBR 380
	IJ=NWNG+I	CBR 390
	XC=0.	CBR 400
	IF (ICAM.EQ.2) GO TO 40	CBR 410
	IF (ICAM.EQ.3) XC=XLM(I)	CBR 420
	Z1=XC	CBR 430
	CALL ZCR (XC,YLM(I),DZDX,ICAM,Z1,1,C,DZDY)	CBR 440
	ZBDX(IJ)=DZDX	CBR 450
	ZBDY(IJ)=DZDY	CBR 460
	GO TO 50	CBR 470
40	XC=XLM(I)	CBR 480
	YC=YLM(I)	CBR 490
	CALL ZCDX (XC,YC,DZDX,DZDY)	CBR 500
	ZBDX(IJ)=DZDX	CBR 510
	ZBDY(IJ)=DZDY	CBR 520
50	CONTINUE	CBR 530
	RETURN	CBR 540
60	CONTINUE	CBR 550
C	FIND CAMPER SLOPE AT BOUND ELEMENTS	CBR 560
	DO 80 I=1,NSW1	CBR 570
	DO 80 J=1,NCW	CBR 580
	IJ=(I-1)*NCW+J	CBR 590
	XC=(XAVWNG(IJ)-XLM(I))/C(I)	CBR 600
	IF (ICAM.EQ.3) XC=XAVWNG(IJ)	CBR 610
	IF (ICAM.EQ.2) GO TO 70	CBR 620
	Z1=XC	CBR 630
	CALL ZCR (XC,YAVWNG(IJ),DZDX,ICAM,Z1,1,C,DZDY)	CBR 640
	ZBDXV(IJ)=DZDX	CBR 650
	ZBDYV(IJ)=DZDY	CBR 660
	GO TO 80	CBR 670
70	YC=YLM(I)	CBR 680

	XC=XAVWNG(IJ)	CBR 690
	CALL 7CDX (XC, YC, DZDX, DZDY)	CBR 700
	ZBDXV(IJ)=DZDX	CBR 710
	ZBDYV(IJ)=DZDY	CBR 720
80	CONTINUE	CBR 730
	RETURN	CBR 740
90	CONTINUE	CBR 750
C	FIND CAMBER SLOPE AT ROUND ELEMENTS	CBR 760
	DO 110 I=1, NSW1	CBR 770
	DO 110 J=1, NCW	CBR 780
	IJ=(I-1)*NCW+J	CBR 790
	XC=(XAVWNG(IJ)-XLM(I))/C(I)	CBR 800
	IF (ICAM.EQ.3) XC=XAVWNG(IJ)	CBR 810
	IF (ICAM.EQ.2) GO TO 100	CBR 820
	Z1=XC	CBR 830
	CALL 7CP (XC, YAVWNG(IJ), DZDX, ICAM, Z1, 1, C, DZDY)	CBR 840
	SZBDYV(IJ)=DZDY	CBR 850
	GO TO 110	CBR 860
100	YC=YLM(I)	CBR 870
	XC=XAVWNG(IJ)	CBR 880
	CALL 7CDX (XC, YC, DZDX, DZDY)	CBR 890
	SZBDYV(IJ)=DZDY	CBR 900
110	CONTINUE	CBR 910
	RETURN	CBR 920
	END	CBR 930-

	SUBROUTINE 7CDX (X, Y, ZCX, DZDY)	ZCD 10
C	DEFINE THE CAMBER SLOPE, DZDX, AT ANY X, Y LOCATION IN CLOSE FORM,	ZCD 20
C	WHERE X AND DIMENSIONAL COORDINATES REFERED TO C.G.	ZCD 30
C	CONICAL CAMBER FOR A CONFIGURATION IN NASA CR-2002	ZCD 40
C		ZCD 50
	YB=0.231303*(1.6+X)	ZCD 60
	ZCX=0.	ZCD 70
	DZDY=0.	ZCD 80
	IF (Y.LT.YB) Y=0.	ZCD 90
	IF (Y.LT.YB) RETURN	ZCD 100
	XX=X	ZCD 110
	R=0.06821207*(1.6+XX)	ZCD 120
	ZC=-R+SQRT(R*R-(Y-YB)**2)	ZCD 130

ZCX=(0.231303*(Y-YP)-0.068212*ZC)/(7C+R)	ZCD 140
DZDY=-(Y-YB)/(7C+R)	ZCD 150
Y=ZC	ZCD 160
C Y IS RETURNED AS THE Z COORDINATE.	ZCD 170
RETURN	ZCD 180
END	ZCD 190-

SUBROUTINE ZCP (X,Y,DZDX,ICAM,X1,KP,CHORD,DZDY)	ZCR 10
COMMON /ALLRB/ AX(210),ZMIN,NELM(11),NNELM(12),IST	ZCR 20
COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4),	ZCR 30
1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZBDY(200)	ZCR 40
2,CURV(10),CHND(10)	ZCR 50
XE=X1	ZCR 60
KK=DZDX	ZCR 70
RR=DZDY	ZCR 80
DZDX=0.	ZCR 90
DZDY=0.	ZCR 100
IF (ICAM.EQ.1) GO TO 50	ZCR 110
IF (ICAM.NE.3) GO TO 60	ZCR 120
X1=0.	ZCR 130
I=1	ZCR 140
10 IF (Y.GE.YLEF(I,1).AND.Y.LE.YLEF(I,2)) GO TO 20	ZCR 150
I=I+1	ZCR 160
IF (I.GE.IST) GO TO 60	ZCR 170
IF (I.EQ.11) GO TO 60	ZCR 180
GO TO 10	ZCR 190
20 YB=YLF(I,1)+SLP1(I)*(X-XLF(I,1))	ZCR 200
KCON=0	ZCR 210
IF (KK.NE.100) GO TO 30	ZCR 220
XB=XLF(I,1)	ZCR 230
IF (SLP1(I).GT.1.E-18) XR=XLF(I,1)+(Y-YLF(I,1))/SLP1(I)	ZCR 240
DX=RR/(XR-XE)	ZCR 250
IF (ABS(1.-DX).LE.0.1) KCON=1	ZCR 260
IF (KCON.EQ.1) GO TO 40	ZCR 270
30 CONTINUE	ZCR 280
IF (Y.LE.YB) RETURN	ZCR 290
40 CONTINUE	ZCR 300
TEST1=PNLEF(X,Y,XLF,YLF,I,1,2)	ZCR 310
IF (ABS(TEST1).LT.1.E-8.AND.Y.GE.YLF(I,1)) TEST1=1.E-8	ZCR 320

	IF (TFST1.LT.0.) RETURN	ZCR 330
	TEST2=PNLEF(X,Y,XLF,YLF,I,4,3)	ZCR 340
	IF (ARS(TEST2).LT.1.E-8.AND.Y.LE.YLF(I,3)) TEST2=1.E-8	ZCR 350
	IF (TEST2.GT.0.) RETURN	ZCR 360
	DZDX=-XNF(I)/ZNF(I)	ZCR 370
	DZDY=-YNF(I)/ZNF(I)	ZCR 380
	D=-XNF(I)*XLF(I,1)-YNF(I)*YLF(I,1)	ZCR 390
	X1=-(D+XNF(I)*X+YNF(I)*Y)/ZNF(I)	ZCR 400
	IF (KCON.EQ.0) GO TO 60	ZCR 410
	DZDX=0.5*DZDX	ZCR 420
	DZDY=0.5*DZDY	ZCR 430
	X1=0.	ZCR 440
	GO TO 60	ZCR 450
50	CALL ZCAM (X,Y,ZR,X1,KP,CHORD)	ZCR 460
60	RETURN	ZCR 470
	END	ZCR 480-

	FUNCTION PNLEF(X,Y,XLF,YLF,I,J,K)	PNL 10
	DIMENSION XLF(10,4),YLF(10,4)	PNL 20
	PNLEF=(X-XLF(I,J))*(YLF(I,K)-YLF(I,J))-(XLF(I,K)-XLF(I,J))*(Y-YLF(I,J))	PNL 30
	1 I,J)	PNL 40
	RETURN	PNL 50
	END	PNL 60-

	SUBROUTINE ZCAM (X,Y,ZR,X1,KP,CHORD)	ZCM 10
	DIMENSION ZZ(2),ZQ(2),C(15)	ZCM 20
	COMMON /ALLRB/ AX(210),ZMIN,BX(23),IST	ZCM 30
	COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),RBM(10,20),	ZCM 40
	ICCM(10,20),DDM(10,20),YT(10),ZRDY(200),ZBDYV(200)	ZCM 50
	COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4),	ZCM 60
	1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZBDY(200)	ZCM 70
	2,CURV(10),CHND(10)	ZCM 80
	I=KP	ZCM 90
	ZR=0.	ZCM 100
10	IF (Y.GT.YT(I).AND.Y.LT.YT(I+1)) GO TO 30	ZCM 110
	I=I+1	ZCM 120
	IF (I.GT.IST) GO TO 20	ZCM 130

	GO TO 10	ZCM 140
20	IF (Y.LT.YT(1)) I=1	ZCM 150
	IF (Y.GT.YT(IST)) I=IST-1	ZCM 160
30	IK=1	ZCM 170
	XF=0.	ZCM 180
	ICV=CHRV(I)	ZCM 190
	IF (ICV.EQ.1) GO TO 40	ZCM 200
	XF1=XT(I,2)*CHND(I)	ZCM 210
	IF (ABS(DDM(I,1)).LE.0.0001) XF1=XT(I,1)*CHND(I)	ZCM 220
	XF2=XT(I+1,2)*CHND(I+1)	ZCM 230
	YF=(Y-YT(I))/(YT(I+1)-YT(I))	ZCM 240
	XF=(XF1+(XF2-XF1)*YF)/CHORD	ZCM 250
	IF (X1.GT.XF) GO TO 40	ZCM 260
	FAC=CHND(I+1)	ZCM 270
	IF (FAC.LE.0.0001) FAC=1.	ZCM 280
	DELTA=DDM(I,1)*CHND(I)+(DDM(I+1,1)*FAC-DDM(I,1)*CHND(I))*YF	ZCM 290
	DELTA=DELTA/CHORD	ZCM 300
	IF (IM(I).GT.2) ZQ(1)=DDM(I,2)*CHND(I)	ZCM 310
	IF (IM(I).LE.2) ZQ(1)=(CCM(I,1)+DDM(I,1))*CHND(I)	ZCM 320
	IF (IM(I+1).GT.2) ZQ(2)=DDM(I+1,2)*FAC	ZCM 330
	IF (IM(I+1).LE.2) ZQ(2)=(CCM(I+1,1)+DDM(I+1,1))*FAC	ZCM 340
	DK=(ZQ(1)+(ZQ(2)-ZQ(1))*YF)/CHORD	ZCM 350
	DELTA=DELTA-DK	ZCM 360
	GO TO 110	ZCM 370
40	K=1	ZCM 380
	IF (ICV.EQ.0) GO TO 150	ZCM 390
50	IF (X.GE.XT(I,K).AND.X.LT.XT(I,K+1)) GO TO 60	ZCM 400
	K=K+1	ZCM 410
	IF (K.GE.IM(I)) GO TO 70	ZCM 420
	GO TO 50	ZCM 430
60	SM=X-XT(I,K)	ZCM 440
	ZZ(IK)=3.*AAM(I,K)*SM*SM+2.*BBM(I,K)*SM+CCM(I,K)	ZCM 450
	GO TO 90	ZCM 460
70	IF (X.LT.XT(I,1)) GO TO 80	ZCM 470
	K=IM(I)-1	ZCM 480
	GO TO 60	ZCM 490
80	K=1	ZCM 500
	GO TO 60	ZCM 510
90	IF (IK.EQ.2) GO TO 100	ZCM 520
	I=I+1	ZCM 530
	IK=IK+1	ZCM 540

	GO TO 40	ZCM 550
100	YF=(Y-YT(I-1))/(YT(I)-YT(I-1))	ZCM 560
	ZR=Z7(1)+(Z7(2)-Z7(1))*YF	ZCM 570
	GO TO 150	ZCM 580
110	IF (X.LT.XF) GO TO 140	ZCM 590
	PI=3.14159265	ZCM 600
	C(1)=-DELTA	ZCM 610
	JR=15	ZCM 620
	DO 120 J=2,JP	ZCM 630
	XK=(J-1)*PI*XF	ZCM 640
120	C(J)=-2.*DELTA*SIN(XK)/XK	ZCM 650
	ZR=0.	ZCM 660
	DO 130 J=1,JP	ZCM 670
	XK=(J-1)*PI*X	ZCM 680
130	ZR=ZR+C(J)*COS(XK)	ZCM 690
	GO TO 150	ZCM 700
140	ZR=-DELTA/XF	ZCM 710
150	CONTINUE	ZCM 720
	RETURN	ZCM 730
	END	ZCM 740-

	SUBROUTINE FUNA (XT,YT,ZT,FJ1,FJ2,FJ3)	FNA 10
C	INDUCED VELOCITY DUE TO A VORTEX ELEMENT OF UNIT STRENGTH TRAILING	FNA 20
C	FROM (XT,YT,ZT) TO INFINITY	FNA 30
	COMMON /ALLRA/ AA(21),BETA2,TANPH1,R2PH1,AR,D4,AC(2),D4SQ2	FNA 40
	COMMON /XIYIZI/ XI,YI,ZI	FNA 50
	DIMENSION A(3), B(3), C(3)	FNA 60
	A(1)=XT-XI	FNA 70
	A(2)=YT-YI	FNA 80
	A(3)=ZT-ZI	FNA 90
	B(1)=XT+1-XI	FNA 100
	B(2)=YT-YI	FNA 110
	B(3)=ZT+TANPH1-ZI	FNA 120
	CALL CRSPRD (A,B,C)	FNA 130
	CC=SQRT(C(1)*C(1)+C(2)*C(2)+C(3)*C(3))	FNA 140
	IF (CC.LE.(1.E-10)) GO TO 10	FNA 150
	D5=2.*(R2PH1*(ZT-ZI-XT*TANPH1)-XI)	FNA 160
	D6=XI*XI+BETA2*((YI-YT)**2+(ZT-ZI-XT*TANPH1)**2)	FNA 170
	Q=4.*D4*D6-D5*D5	FNA 180

	IF (Q.LF.(1.E-10)) GO TO 10	FNA 190
	RR=SQRT(D4*XT*XT+D5*XT+D6)	FNA 200
	FJ4=2.*(D4SQ2-(2.*D4*XT+D5)/RR)/Q	FNA 210
	FJ1=(YT-YI)*TANPH1*FJ4	FNA 220
	FJ2=(ZT-ZI+(XI-XT)*TANPH1)*FJ4	FNA 230
	FJ3=- (YT-YI)*FJ4	FNA 240
	RETURN	FNA 250
10	FJ1=0.	FNA 260
	FJ2=0.	FNA 270
	FJ3=0.	FNA 280
	RETURN	FNA 290
	END	FNA 300-

	SUBROUTINE INFL? (X1,Y1,Z1,X2,Y2,Z2,VACL)	INF 10
C	INDUCED VELOCITY DUE TO A VORTEX ELEMENT OF UNIT STRENGTH LYING	INF 20
C	BETWEEN (X1,Y1,Z1) AND (X2,Y2,Z2)	INF 30
	COMMON /ALLRA/ AA(20),BETA	INF 40
	COMMON /XIYIZI/ XI,YI,ZI	INF 50
	DIMENSION VA(3), VL(3), VAP(3), VBP(3), VLP(3), VACL(3), VAPCLP(3)	INF 60
	VA(1)=X1-XI	INF 70
	VA(2)=Y1-YI	INF 80
	VA(3)=Z1-ZI	INF 90
	VL(1)=X2-X1	INF 100
	VL(2)=Y2-Y1	INF 110
	VL(3)=Z2-Z1	INF 120
	VAP(1)=VA(1)	INF 130
	VAP(2)=BETA*VA(2)	INF 140
	VAP(3)=BETA*VA(3)	INF 150
	VBP(1)=X2-XI	INF 160
	VBP(2)=BETA*(Y2-YI)	INF 170
	VBP(3)=BETA*(Z2-ZI)	INF 180
	VLP(1)=VL(1)	INF 190
	VLP(2)=BETA*VL(2)	INF 200
	VLP(3)=BETA*VL(3)	INF 210
	CALL CRSPRD (VA,VL,VACL)	INF 220
	CALL CRSPRD (VAP,VLP,VAPCLP)	INF 230
	CALL DOTPRD (VAPCLP,VAPCLP,DAPCLP)	INF 240
	IF (ABS(DAPCLP).LT.(1.E-10)) GO TO 10	INF 250
	CALL DOTPRD (VBP,VBP,DBP)	INF 260

	RPMOD=SQRT(DRP)	INF 270
	CALL DOTPRD (VAP,VAP,DAP)	INF 280
	APMOD=SQRT(DAP)	INF 290
	CALL DOTPRD (VRP,VLP,DBPLP)	INF 300
	DBPLP=DBPLP/BPMOD	INF 310
	CALL DOTPRD (VAP,VLP,DAPLP)	INF 320
	DAPLP=DAPLP/APMOD	INF 330
	CONST=(DBPLP-DAPLP)/DAPCLP	INF 340
	GO TO 20	INF 350
10	CONST=0.	INF 360
20	CONTINUE	INF 370
	VACL(1)=VACL(1)*CONST	INF 380
	VACL(2)=VACL(2)*CONST	INF 390
	VACL(3)=VACL(3)*CONST	INF 400
	RETURN	INF 410
	END	INF 420-

	SUBROUTINE NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,COVEL	10
	INI,CONJ,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,VEL	20
	2GAMA,YYM)	VEL 30
C	EVALUATES TOTAL VELOCITY AT POINT (XEE,YEE,ZEE)	VEL 40
	COMMON /INDEX/ IND	VEL 50
	COMMON /NCTT/ NCT,NCON,NPT,NCOR(15),KU1,NFSH(15),KUC	VEL 60
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	VEL 70
	COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)	VEL 80
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	VEL 90
	1MJW2(2),WIDTH(5),SWFFP(60),NTS,NC	VEL 100
	COMMON /ALLRA/ AA(17),SINA,COSA,AR(5),BSQD4P	VEL 110
	COMMON /GM/ ITER,L1,L2,L3,L4,L5,L6,L7,L8	VEL 120
	DIMENSION DUMMY(1), CONI(1), CONJ(1), CONK(1), CI(1), CJ(1), CK(1)	VEL 130
	1, C(1), THETP(1), XTF(1), XLE(1), YLE(1), CONS(1), SI(1), CPCW1(1)	VEL 140
	2, XCP(1), YCP(1), GAMA(1), YYM(1), XN(NWNG,2), YN(NWNG,2), NP(4),	VEL 150
	3U(4,3), V(3)	VEL 160
	NSW1=NTS	VEL 170
C	IF POINT IS IN THE WING PLANE, THE REGULAR METHOD FOR VELOCITY	VEL 180
C	EVALUATION IS USED.	VEL 190
	IF (ZEE.LE.0.00001) GO TO 130	VEL 200
	IF (YFF.GT.YYM(NSW1)) GO TO 130	VEL 210
	IF (ITRAKE.NE.1.AND.YEE.GT.PYL(2)) GO TO 10	VEL 220

	CH1=XTE(1)-XLE(1)	VEL 230
	CH2=XTE(2)-XLE(2)	VEL 240
	GO TO 20	VEL 250
10	CH1=PXT(2)-PXL(2)	VEL 260
	CH2=PXT(3)-PXL(3)	VEL 270
20	CONTINUE	VEL 280
	XLY=XLE(1)+(YEE-YLE(1))*(XLE(2)-XLE(1))/(YLE(2)-YLE(1))	VEL 290
	CHY=CH1+(YEE-YLE(1))*(CH2-CH1)/(YLE(2)-YLE(1))	VEL 300
	XC=(XEE-XLY)/CHY	VEL 310
	IF (XC.LT.0.0.OR.XC.GT.1.0) GO TO 130	VEL 320
	ZC=ZEF/CHY	VEL 330
C	IF THE POINT (XFF,YEE,ZEE) IS AT Z/C(LOCAL) LESS THAN ZTOL, THE	VEL 340
C	VELOCITY IS OBTAINED BY LINEAR INTERPOLATION OF THE VELOCITIES	VEL 350
C	CALCULATED ABOVE FOUR WING CONTROL POINTS AMONG WHICH THE POINT IS	VEL 360
C	LOCATED. BY NUMERICAL EXPERIMENTATION ZTOL HAS BEEN OBTAINED TO	VEL 370
C	0.2.	VEL 380
	ZTOL=0.2	VEL 390
	IF (ZC.GE.ZTOL) GO TO 130	VEL 400
	I=1	VEL 410
	IF (YEE.LE.YYM(I)) GO TO 40	VEL 420
30	IF (YEE.GT.YYM(I).AND.YEE.LE.YYM(I+1)) GO TO 40	VEL 430
	I=I+1	VEL 440
	IF (I.LT.NSW1) GO TO 30	VEL 450
40	J=1	VEL 460
	IF (XC.LE.CPCW1(1)) GO TO 70	VEL 470
50	IF (XC.GT.CPCW1(J).AND.XC.LE.CPCW1(J+1)) GO TO 60	VEL 480
	J=J+1	VEL 490
	IF (J.LT.NCW) GO TO 50	VEL 500
60	NP(1)=(I-1)*NCW+J	VEL 510
	NP(2)=NP(1)+1	VEL 520
	NP(3)=NP(1)+NCW	VEL 530
	NP(4)=NP(3)+1	VEL 540
	XC1=CPCW1(J)	VEL 550
	XC2=CPCW1(J+1)	VEL 560
	GO TO 80	VEL 570
70	NP(1)=NCW*NSW1+I	VEL 580
	NP(2)=(I-1)*NCW+1	VEL 590
	NP(3)=NP(1)+1	VEL 600
	NP(4)=NP(2)+NCW	VEL 610
	XC1=0.	VEL 620
	XC2=CPCW1(1)	VEL 630

80	CONTINUE	VEL 640
C	EVALUATION OF INDUCED VELOCITY AT FOUR POINTS	VEL 650
	DO 100 I=1,4	VEL 660
	NN=NP(I)	VEL 670
	CALL VDTWNG (C,THETP,XCP(NN),YCP(NN),ZEE,XN,YN,XTE,YLE,CONS,DUMMY(VEL 680	
	1L1),DUMMY(L2),DUMMY(L3),DUMMY(L4),DUMMY(L5),DUMMY(L6),DUMMY(L7),DUVEL 690	
	2MMY(L8),CONI,CONJ,CONK,SI,NSW1,NCW,NWNG)	VEL 700
	U(I,1)=0.	VEL 710
	U(I,2)=0.	VEL 720
	U(I,3)=0.	VEL 730
	DO 90 J=1,NWNG	VEL 740
	U(I,1)=U(I,1)+CONI(J)*GAMA(J)	VEL 750
	U(I,2)=U(I,2)+CONJ(J)*GAMA(J)	VEL 760
	U(I,3)=U(I,3)+CONK(J)*GAMA(J)	VEL 770
90	CONTINUE	VEL 780
100	CONTINUE	VEL 790
C	INTERPOLATION	VEL 800
	NN1=NP(1)	VEL 810
	NN2=NP(3)	VEL 820
	Y1=YCP(NN1)	VEL 830
	Y2=YCP(NN2)	VEL 840
	DO 110 I=1,3	VEL 850
	UA=U(1,I)+(U(3,I)-U(1,I))*(YEE-Y1)/(Y2-Y1)	VEL 860
	UB=U(2,I)+(U(4,I)-U(2,I))*(YEE-Y1)/(Y2-Y1)	VEL 870
110	V(I)=UA+(UB-UA)*(XC-XC1)/(XC2-XC1)	VEL 880
	UU=V(1)+COSA	VEL 890
	VV=V(2)	VEL 900
	WW=V(3)+SINA	VEL 910
	CALL VDTFRE (XEE,YEE,ZEE,CI,CJ,CK,NSW1,RSQD4P,XLE,YLE)	VEL 920
C	FINAL TOTAL VELOCITY	VEL 930
	DO 120 J=1,MAXL	VEL 940
	JJ=NWNG+J	VEL 950
	UU=UU+CI(J)*GAMA(JJ)	VEL 960
	VV=VV+CJ(J)*GAMA(JJ)	VEL 970
	WW=WW+CK(J)*GAMA(JJ)	VEL 980
120	CONTINUE	VEL 990
	RETURN	VEL1000
C	EVALUATION OF VELOCITY WHEN POINT IS IN THE WING PLANE	VEL1010
130	CONTINUE	VEL1020
	CALL VDTWNG (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY(L1),DUMMVEL1030	
	LY(L2),DUMMY(L3),DUMMY(L4),DUMMY(L5),DUMMY(L6),DUMMY(L7),DUMMY(L8),VEL1040	

	2CONI,CONJ,CONK,SI,NSW1,NCW,NWNG)	VEL1050
	CALL VDTFRE (XEE,YEF,ZEE,CI,CJ,CK,NSW1,BSQD4P,XLE,YLE)	VEL1060
	UU=COSA	VEL1070
	VV=0.	VEL1080
	WW=SINA	VEL1090
C	VELOCITY DUE TO FREE ELEMENTS	VEL1100
	DO 140 I=1,MAXL	VEL1110
	NQ=NWNG+I	VEL1120
	UU=UU+CI(I)*GAMA(NQ)	VEL1130
	VV=VV+CJ(I)*GAMA(NQ)	VEL1140
	WW=WW+CK(I)*GAMA(NQ)	VEL1150
140	CONTINUE	VEL1160
C	VELOCITY DUE TO WING	VEL1170
	DO 150 I=1,NTS	VEL1180
	DO 150 J=1,NCW	VEL1190
	NQ=(I-1)*NCW+J	VEL1200
	UU=UU+CONI(NQ)*GAMA(NQ)	VEL1210
	VV=VV+CONJ(NQ)*GAMA(NQ)	VEL1220
	WW=WW+CONK(NQ)*GAMA(NQ)	VEL1230
150	CONTINUE	VEL1240
	NSW1=NTS	VEL1250
	NSW=NTS+1	VEL1260
	RETURN	VEL1270
	END	VEL1280-
	SUBROUTINE VMSEQN (NC1,K,AA,A,CA)	VMS 10
	DIMENSION AA(1),CA(1),A(1)	VMS 20
	NC=K*NC1	VMS 30
	SUM1=0.	VMS 40
	K1=K-1	VMS 50
	JJ=1	VMS 60
	DO 10 J=1,K1	VMS 70
	SUM1=SUM1+AA(J)*A(JJ)	VMS 80
10	JJ=JJ+NC1+1	VMS 90
	SUM1=SUM1+AA(K)	VMS 100
	DO 30 I=1,NC1	VMS 110
	SUM2=0.	VMS 120
	JJ=I+1	VMS 130
	DO 20 J=1,K1	VMS 140

	SUM2=SUM2+AA(J)*A(JJ)	VMS 150
20	JJ=JJ+NC1+1	VMS 160
	KK=K+I	VMS 170
	SUM2=SUM2+AA(KK)	VMS 180
30	CA(I)=-SUM2/SUM1	VMS 190
	M=1	VMS 200
	L=0	VMS 210
	KNC=(K-1)*NC1	VMS 220
	DO 60 I=1,NC	VMS 230
	IF (I.GT.KNC) GO TO 50	VMS 240
	MM=(M-1)*NC1+1	VMS 250
	IF (I.EQ.MM) GO TO 70	VMS 260
40	KK=KK+1	VMS 270
	IL=I+L	VMS 280
	A(I)=CA(KK)*BASE+A(IL)	VMS 290
	GO TO 60	VMS 300
50	II=I-KNC	VMS 310
	A(I)=CA(II)	VMS 320
60	CONTINUE	VMS 330
	GO TO 80	VMS 340
70	II=MM+M-1	VMS 350
	BASE=A(II)	VMS 360
	KK=0	VMS 370
	L=L+1	VMS 380
	M=M+1	VMS 390
	GO TO 40	VMS 400
80	CONTINUE	VMS 410
	RETURN	VMS 420
	END	VMS 430-

	OVERLAY (LEVSP,1,0)	GEO 10
	PROGRAM GEOM	GEO 20
C	DEFINES THE WING AND FREE ELEMENT GEOMETRY	GEO 30
C	MAXIMUM VALUES	GEO 40
C	** NCW = 9	GEO 50
C	** NNCW = NCW+1 = 10	GEO 60
C	** NSW = 20	GEO 70
C	** NSW1 = NSW-1 = 19	GEO 80
C	** NWNG = NNCW*NSW1 = 190	GEO 90

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C   ** NCPTTL = (NMCW+1)*NSW1 = 209                                GEO 100
COMMON XXL(2),XXT(2),YL(2),CPCWL(10),CPCW1(10),SI(10),SN(10),SNN(10) GEO 110
10),SWP(50),SLOPE(50),XL(2,10),C(19),THETP(19),CONS(19),CPSW1(19),XGEO 120
2LM(19),XTM(19),YLM(19),CTT(19),CPSWL(20),XLE(20),XTE(20),YLE(20),XGEO 130
3AVWNG(190),YAVWNG(190),XN(190,2),YN(190,2),XCP(209),YCP(209),X(10,GEO 140
420),Y(10,20)                                                    GEO 150
COMMON /ALLRR/ AXX(210),ZMIN,NELM(11),NNELM(12),IST                GEO 160
COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),7NF(10),XLF(10,4),     GEO 170
1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZBDY(200)            GEO 180
2,CURV(10),CHND(10),SZBDYV(200)                                  GEO 190
COMMON /ALLI/ NSW,NSW1,NCW,NWNG,NCPTTL,MITER,IPUNCH               GEO 200
COMMON /ALLRA/ TTL(16),ALPHA,SINA,COSA,SWPLE,BETA,RETA2,TANPH1,R2PGEO 210
1H1,BSQD4P,D4,CON,PI,D4SQ2,CBAR,HALFB,AREA                       GEO 220
COMMON /MDFAV/ FYP(40,2,2),FZP(40,2,2)                           GEO 230
COMMON /XSTN/ XRRR(25),NRRR                                       GEO 240
COMMON /COEFF/ CL,FZMINS(10),FHS(2,10),RATIOS(2,10),             GEO 250
1CFCORE(2,10),RATIOC(2,10)                                        GEO 260
COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)                    GEO 270
COMMON /AERO/ NAFPO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC                GEO 280
COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),   GEO 290
1MJW2(2),WIDTH(5),SWEFP(60),NTS,NC                              GEO 300
COMMON /NCTT/ NCT,NCON,NRT,NCOR(15),KU1,NFSH(15),KIIC            GEO 310
COMMON /ABC/ AX(1860),NMAX,NNMAX,NCNTS                            GEO 320
COMMON /LANDA/ FGMA1,FRDA1,FGMA,CLS                               GEO 330
COMMON /TIPVX/ XTIP(15,30),YTIP(15,30),ZTIP(15,30),NTLM(15),NTMAX GEO 340
COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),RBM(10,20),       GEO 350
1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),7RDXV(200)              GEO 360
COMMON /SHPLE/ NLF,YSL(15),AQL(14),BQL(14),CQL(14),DQL(14)     GEO 370
COMMON /SHPTE/ NTE,YST(15),AQT(14),BQT(14),CQT(14),DQT(14)    GEO 380
DIMENSION CPCWR(15),AW(201),CA(201),BA(15)                       GEO 390
THEND=SHEND                                                       GEO 400
C   ***TITLE OF THE CASE TO BE RUN                                  GEO 410
READ (5,490) TTL                                                  GEO 420
IF (TTL(1).EQ.THEND) GO TO 390                                     GEO 430
C   ***NCW = NUMBER OF ROUND ELEMENTS IN IN THE CHORDWISE DIRECTION GEO 440
C   M(I) = NUMBER OF STRIPS IN EACH SPANWISE SECTION PLUS ONE    GEO 450
C   NC = NUMBER OF SPANWISE SECTIONS                               GEO 460
C   NCNTS = 0, ITERS = 0, INITIAL LOCATIONS OF FREE ELEMENTS WILL BE GEO 470
C   CALCULATED IN THE PROGRAM                                     GEO 480
C   NCNTS = 1, ITERS = 3, INITIAL LOCATIONS OF FREE ELEMENTS WILL BE GEO 490
C   READ FROM DATA CARDS                                         GEO 500

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C	ITRAKE = 1, ONE VORTEX CORE SYSTEM	GEO 510
C	ITRAKE = 2, TWO VORTEX CORE SYSTEM	GEO 520
C	ISPAN = 0, LEADING-EDGE VORTEX SYSTEM START FROM LINE OF SYMMETRY	GEO 530
C	ISPAN = 1, LEADING-EDGE VORTEX SYSTEM START FROM OUTBOARD SECTION	GEO 540
	READ (5,520) NCW,NBRR,NCNTS,MITER,IPUNCH,KUI	GEO 550
	READ (5,520) NC,(M1(I),I=1,NC),ICAM,IST,ITERS	GEO 560
	READ (5,520) ISPAN,ITRAKE	GEO 570
	NTS=0	GEO 580
	DO 10 I=1,NC	GEO 590
	NTS=NTS+M1(I)-1	GEO 600
10	CONTINUE	GEO 610
	NSW1=NTS	GEO 620
	NSW=NTS+1	GEO 630
	IF (ISPAN.EQ.0) GO TO 20	GEO 640
	MAXW=NSW-(M1(1)-1)	GEO 650
	MAXL=NSW1-(M1(1)-1)	GEO 660
	GO TO 30	GEO 670
20	MAXL=NSW1	GEO 680
	MAXW=NSW	GEO 690
30	CONTINUE	GEO 700
C	***ALPHA AND AMACH ARE ANGLE OF ATTACK AND FREE FREE STREAM MACH NO	GEO 710
C	DELTA IS THE LENGTH OF A LEADING-EDGE FREE VORTEX SEGMENT	GEO 720
C	DL IS LENGTH OF A SEGMENT OF WAKE ELEMENTS	GEO 730
C	CBAR AND AREA ARE REFERENCE CHORD AND TOTAL REFERENCE WING AREA	GEO 740
C	NFSH(I) = NUMBER OF SEGMENTS ALONG EACH VORTEX ELEMENT ON FREE	GEO 750
C	VORTEX SHEET	GEO 760
	READ (5,510) ALPHA,AMACH,DELTA,DL,XEND,CBAR,AREA,CLS	GEO 770
	READ (5,520) (NFSH(I),I=1,NSW1)	GEO 780
	DO 40 I=1,NSW1	GEO 790
	NCOR(I)=NFSH(I)+6	GEO 800
40	CONTINUE	GEO 810
	READ (5,510) (XBRR(I),I=1,NBRR)	GEO 820
	READ (5,510) (CTT(I),I=1,NSW1)	GEO 830
	WRITE (6,530) TTL	GEO 840
	WRITE (6,520) NCW,NBRR,NCNTS,MITER,IPUNCH,KUI	GEO 850
	WRITE (6,520) NC,(M1(I),I=1,NC),ICAM,IST,ITERS	GEO 860
	WRITE (6,520) ISPAN,ITRAKE	GEO 870
	WRITE (6,510) ALPHA,AMACH,DELTA,DL,XEND,CBAR,AREA,CLS	GEO 880
	WRITE (6,520) (NFSH(I),I=1,NSW1)	GEO 890
	WRITE (6,510) (XBRR(I),I=1,NBRR)	GEO 900
	WRITE (6,510) (CTT(I),I=1,NSW1)	GEO 910

	SS=SIND(ALPHA)	GEO 920
	CS=COSD(ALPHA)	GEO 930
C	***YT(I) IS Y-STATION AT WHICH CAMBER ORDINATES ARE READ IN	GEO 940
C	XNUM IS NUMBER OF CAMBER ORDINATES TO BE READ IN. (LIMITED TO 21)	GEO 950
C	CURV(I) = 0. IF CAMBER IS TO BE FORMED BY CONNECTING STRAIGHT	GEO 960
C	SEGMENTS, WITH FIRST SEGMENT BEING REGARDED AS FLAT L.E. FLAP	GEO 970
C	CURV(I) = 1. IF CUBIC SPLINE INTERPOLATION IS USED	GEO 980
C	CURV(I) = 2. IF CUBIC SPLINE INTERPOLATION IS USED , WITH	GEO 990
C	FIRST SEGMENT BEING FLAT LEADING-EDGE FLAP	GEO1000
C	CHND(I) IS CHORD LENGTH AT YT(I) STATION	GEO1010
C	ICAM = 0 FLAT WING	GEO1020
C	ICAM = 1 CAMBER ORDINATES TO BE READ IN	GEO1030
C	ICAM = 2 CAMBER ORDINATES TO BE DEFINED ANALYTICALLY	GEO1040
C	ICAM = 3 PLANE WITH L.E. FLAPS	GEO1050
	IF (ICAM.NE.1) GO TO 100	GEO1060
	DO 90 I=1,1ST	GEO1070
	READ (5,510) YT(I),XNUM,CURV(I),CHND(I)	GEO1080
	WRITE (6,510) YT(I),XNUM,CURV(I),CHND(I)	GEO1090
	IM(I)=XNUM	GEO1100
	IR=IM(I)	GEO1110
	ICV=CURV(I)	GEO1120
C	***XT(I,J) X/C VALUES AT WHICH CAMBER ORDINATES ARE READ IN FOR	GEO1130
C	YT(I) STATION	GEO1140
C	CA(J) Z/C VALUFS IF CAMBER ORDINATES AT THE CORRESPONDING	GEO1150
C	XT(I,J) LOCATIONS	GEO1160
	READ (5,510) (XT(I,J),J=1,IR)	GEO1170
	WRITE (6,510) (XT(I,J),J=1,IR)	GEO1180
	READ (5,510) (CA(J),J=1,IR)	GEO1190
	WRITE (6,510) (CA(J),J=1,IR)	GEO1200
	DO 50 K=1,IR	GEO1210
50	AW(K)=XT(I,K)	GEO1220
	IF (ICV.EQ.0) GO TO 60	GEO1230
	CALL SPLINE (IR,AW,CA,AAM,BBM,CCM,DDM)	GEO1240
	GO TO 90	GEO1250
60	DO 80 J=2,IR	GEO1260
	AAM(I,J-1)=0.	GEO1270
	BBM(I,J-1)=0.	GEO1280
	IF (ABS(AW(J)-AW(J-1)).LE.1.E-20) GO TO 70	GEO1290
	CCM(I,J-1)=(CA(J)-CA(J-1))/(AW(J)-AW(J-1))	GEO1300
70	DDM(I,J-1)=CA(J-1)	GEO1310
80	CONTINUE	GEO1320

```

90    CONTINUE
100   CONTINUE
      IF (ICAM.NE.3) GO TO 120
C    ***YLEF(I,1) = EXTREME INBOARD Y-COORDINATE OF A L.E. FLAP
C    YLEF(I,2) = EXTREME OUTBOARD Y-COORDINATE OF A L.E. FLAP
C    X1,Y1,Z1, ETC. ARE CORNER POINT COORDINATES OF A L.E. FLAP INPUT
C    IN CLOCKWISE ORDER, FIRST FROM THE MOST INBOARD POINT.
      DO 110 I=1,IST
      READ (5,510) (YLEF(I,K),K=1,2)
      WRITE (6,510) (YLEF(I,K),K=1,2)
      READ (5,510) XLF(I,1),YLF(I,1),Z1,XLF(I,2),YLF(I,2),Z2
      WRITE (6,510) XLF(I,1),YLF(I,1),Z1,XLF(I,2),YLF(I,2),Z2
      READ (5,510) XLF(I,3),YLF(I,3),Z3,XLF(I,4),YLF(I,4),Z4
      WRITE (6,510) XLF(I,3),YLF(I,3),Z3,XLF(I,4),YLF(I,4),Z4
      IF (ABS(XLF(I,4)-XLF(I,1)).GT.1.E-18) SLP1(I)=(YLF(I,4)-YLF(I,1))/
1(XLF(I,4)-XLF(I,1))
      IF (ABS(XLF(I,4)-XLF(I,1)).LE.1.E-18) SLP1(I)=1.E18
      XNF(I)=(YLF(I,4)-YLF(I,1))*(Z3-Z2)-(YLF(I,3)-YLF(I,2))*(Z4-Z1)
      YNF(I)=(XLF(I,3)-XLF(I,2))*(Z4-Z1)-(XLF(I,4)-XLF(I,1))*(Z3-Z2)
      ZNF(I)=(XLF(I,4)-XLF(I,1))*(YLF(I,3)-YLF(I,2))-(XLF(I,3)-XLF(I,2))
1*(YLF(I,4)-YLF(I,1))
      IF (ABS(ZNF(I)).GT.1.E-3) GO TO 110
      XNF(I)=(YLF(I,4)-YLF(I,1))*(Z2-Z1)-(YLF(I,2)-YLF(I,1))*(Z4-Z1)
      YNF(I)=(XLF(I,2)-XLF(I,1))*(Z4-Z1)-(XLF(I,4)-XLF(I,1))*(Z2-Z1)
      ZNF(I)=(XLF(I,4)-XLF(I,1))*(YLF(I,2)-YLF(I,1))-(XLF(I,2)-XLF(I,1))
1*(YLF(I,4)-YLF(I,1))
110   CONTINUE
120   CONTINUE
      IF (ICAM.EQ.0) IST=1
      NNCW=NCW
      NCW=NNCW+1
C    NPRCY=0, USED FOR BOUND ELEMENTS = (NCW+1)
C    NPRCY=1, USED FOR BOUND ELEMENTS = NCW
      NPRCY=0
130   IF (NPRCY.EQ.1) NCW=NNCW
      PI=3.14159265
      FN2=2*NCW
      PIJ=PI/FLOAT(NCW)
      TWOPI=2.*PI
      DO 140 I=1,NCW
      CPCWL(I)=50.*(1.-COS((2.*FLOAT(I)-1.)*PI/FN2))

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GE01330
GE01340
GE01350
GE01360
GE01370
GE01380
GE01390
GE01400
GE01410
GE01420
GE01430
GE01440
GE01450
GE01460
GE01470
GE01480
GE01490
GE01500
GE01510
GE01520
GE01530
GE01540
GE01550
GE01560
GE01570
GE01580
GE01590
GE01600
GE01610
GE01620
GE01630
GE01640
GE01650
GE01660
GE01670
GE01680
GE01690
GE01700
GE01710
GE01720
GE01730

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	CPCW1(I)=50.*(1.-COS(FLOAT(I)*PI/FLOAT(NCW)))	GEO1740
	CC=CPCWL(I)/100.	GEO1750
	SNN(I)=2.*SQRT(CC*(1.-CC))	GEO1760
	PSIJ=(2.*FLOAT(I)-1.)*PIJ/2.	GEO1770
	SN(I)=SIN(PSIJ)/TWOPI	GEO1780
140	SI(I)=TWOPI*SN(I)	GEO1790
	NCS=0	GEO1800
	IPANEL=1	GEO1810
	DO 260 KK=1,NC	GEO1820
	WRITE (6,400) KK	GEO1830
C	***XXL(I),XXT(I),YL(I) DEFINE THE LEADING-EDGE AND TRAILING-EDGE	GEO1840
C	LOCATIONS OF THE ROOT AND TIP CHORDS IN EACH SPANWISE SECTION	GEO1850
	READ (5,510) (XXL(I),XXT(I),YL(I),I=1,2)	GEO1870
	WRITE (6,510) (XXL(I),XXT(I),YL(I),I=1,2)	GEO1880
	ISC=1	GEO1890
C	IF ISC=1, SKIP THE FOLLOWING INPUT DATA	GEO1920
	IF (ISC.EQ.1) GO TO 200	GEO1930
C	***NLE= NUMBER OF INPUT POINTS TO DEFINE THE L.E. LIMITED TO 15	GEO1940
C	NTE= NUMBER OF INPUT POINTS TO DEFINE THE T.E. LIMITED TO 15	GEO1950
C	MCVL=1 IF THE CUBIC SPLINE IS USED TO INTERPOLATE THE L.E. SHAPE	GEO1960
C	MCVL=0 IF STRAIGHT SEGMENTS ARE ASSUMED FOR THE L.E. SHAPE	GEO1970
C	MCVT=1 IF THE CURIC SPLINE IS USED TO INTERPOLATE THE T.E. SHAPE	GEO1980
C	MCVT=0 IF STRAIGHT SEGMENTS ARE ASSUMED FOR THE T.E. SHAPE	GEO1990
	READ (5,520) NLE,NTE,MCVL,MCVT	GEO2000
	WRITE (6,520) NLE,NTE,MCVL,MCVT	GEO2010
C	***BA,YSL = X- AND Y- COORDINATES OF INPUT POINTS TO DEFINE THE L.E.	GEO2020
C	SHAPE RELATIVE TO THE L.E. OF INBOARD CHORD	GEO2030
	READ (5,510) (BA(I),I=1,NLE)	GEO2040
	WRITE (6,510) (BA(I),I=1,NLE)	GEO2050
	READ (5,510) (YSL(I),I=1,NLE)	GEO2060
	WRITE (6,510) (YSL(I),I=1,NLE)	GEO2070
	IF (MCVL.EQ.0) GO TO 150	GEO2080
	CALL SPLINE (NLF,YSL,BA,AQL,BQL,CQL,DQL)	GEO2090
	GO TO 170	GEO2100
150	DO 160 I=2,NLE	GEO2110
	AQL(I-1)=0.	GEO2120
	BQL(I-1)=0.	GEO2130
	CQL(I-1)=(BA(I)-RA(I-1))/(YSL(I)-YSL(I-1))	GEO2140
160	DQL(I-1)=BA(I-1)	GEO2150
C	***BA,YST = X- AND Y- COORDINATES OF INPUT POINTS TO DEFINE THE T.E.	GEO2160
C	SHAPE RELATIVE TO THE T.E. OF INBOARD CHORD	GEO2170

170	CONTINUE	GE02180
	READ (5,510) (RA(I),I=1,NTE)	GE02190
	WRITE (6,510) (RA(I),I=1,NTE)	GE02200
	READ (5,510) (YST(I),I=1,NTE)	GE02210
	WRITE (6,510) (YST(I),I=1,NTE)	GE02220
	IF (MCVT.EQ.0) GO TO 180	GE02230
	CALL SPLINE (NTE,YST,RA,AQT,BQT,CQT,DQT)	GE02240
	GO TO 200	GE02250
180	DO 190 I=2,NTE	GE02260
	AQT(I-1)=0.	GE02270
	BQT(I-1)=0.	GE02280
	CQT(I-1)=(BA(I)-RA(I-1))/(YST(I)-YST(I-1))	GE02290
190	DQT(I-1)=BA(I-1)	GE02300
200	CONTINUE	GE02310
	YBREAK(KK)=YL(2)	GE02320
	XBRR(20+KK)=ATAN((XXL(2)-XXL(1))/(YL(2)-YL(1)))	GE02330
	PXL(KK)=XXL(1)	GE02340
	PXL(KK+1)=XXL(2)	GE02350
	PXT(KK)=XXT(1)	GE02360
	PXT(KK+1)=XXT(2)	GE02370
	PYL(KK)=YL(1)	GE02380
	PYL(KK+1)=YL(2)	GE02390
	FM=M1(KK)	GE02400
	NSW=M1(KK)	GE02410
	NSW1=NSW-1	GE02420
	DO 210 J=1,NSW	GE02430
	FJ=FLOAT(J)*2.	GE02440
210	CPSWL(J)=50.*(1.-COS((FJ-1.)*PI/(2.*FM)))	GE02450
	DO 220 I=1,NSW1	GE02460
	FI=I	GE02470
220	CPSWL(I)=50.*(1.-COS(FI*PI/FLOAT(NSW)))	GE02480
	IF (KK.EQ.NC) GO TO 230	GE02490
	CPSWL(1)=0.	GE02500
	CPSWL(NSW)=100.	GE02510
	GO TO 240	GE02520
230	CPSWL(1)=0.	GE02530
	IF ((XXT(2)-XXL(2)).NE.0.) CPSWL(NSW)=100.	GE02540
240	CONTINUE	GE02550
	CALL PNLWNG (NSW,IPANEL,LPANEL,NCW,NCS,NTS,NC,KK,ISC)	GE02560
	IPANEL=LPANEL+1	GE02570
	NCS=NCS+NSW-1	GE02580

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WIDTH(KK)=YL(2)-YL(1)
IF (KK.NE.NC) GO TO 260
HALFR=PYL(NC+1)
DO 250 I=1,NTS
CH(I)=XTM(I)-XLM(I)
C(I)=CH(I)
YYLM=YLM(I)/HALFR
250 THETP(I)=ARCOS(YYLM)
260 CONTINUE
NCPTTL=NTS+LPANEL
NWNG=LPANEL
IF (NPRCY.EQ.1) GO TO 290
NCW1=NCW
REWIND 1
REWIND 7
WRITE (1) NCW,NWNG
WRITE (1) (SI(I),SNN(I),I=1,NCW)
N2=NCW*NC
WRITE (1) (SWP(I),I=1,N2)
WRITE (1) (XAVWNG(I),YAVWNG(I),I=1,NWNG,NCW)
DO 270 I=1,NCW
270 CPCWR(I)=CPCWL(I)/100.
WRITE (6,430)
WRITE (6,440)
NSW1=NTS
NSW=NTS+1
CALL CAMBER (NPRCY,C,XCP,YCP,XN,YN,XLM,YLM,XAVWNG,YAVWNG)
DO 280 I=1,NSW1
DO 280 J=1,NCW
IJ=(I-1)*NCW+J
WRITE (6,510) ZRD XV(IJ),ZRD YV(IJ)
280 CONTINUE
NPRCY=1
GO TO 130
290 DO 300 I=1,NCW
CPCWL(I)=CPCWL(I)/100.
300 CPCW1(I)=CPCW1(I)/100.
NSW1=NTS
NSW=NTS+1
WRITE (6,450)
CALL CAMBER (NPRCY,C,XCP,YCP,XN,YN,XLM,YLM,XAVWNG,YAVWNG)

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GE02590
GE02600
GE02610
GE02620
GE02630
GE02640
GE02650
GE02660
GE02670
GE02680
GE02690
GE02700
GE02710
GE02720
GE02730
GE02740
GE02750
GE02760
GE02770
GE02780
GE02790
GE02800
GE02810
GE02820
GE02830
GE02840
GE02850
GE02860
GE02870
GE02880
GE02890
GE02900
GE02910
GE02920
GE02930
GE02940
GE02950
GE02960
GE02970
GE02980
GE02990

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	CALL CAMBER (2,C,XCP,YCP,XN,YN,XLM,YLM,XAVWNG,YAVWNG)	GE03000
	WRITE (6,460)	GE03010
	DO 310 I=1,NSW1	GE03020
	DO 310 J=1,NCW	GE03030
	IJ=(I-1)*NCW+J	GE03040
	WRITE (6,510) ZBDX(IJ),ZBDY(IJ),SZRDYV(IJ)	GE03050
310	CONTINUE	GE03060
	WRITE (6,470)	GE03070
	WRITE (6,480)	GE03080
	DO 320 I=1,NSW1	GE03090
	IJ=NWNG+I	GE03100
	WRITE (6,510) ZBDX(IJ),ZBDY(IJ)	GE03110
320	CONTINUE	GE03120
C	EVALUATING THE CONSTANTS	GE03130
	ALPHA=ALPHA*PI/180.	GE03140
	TANPH1=TAN(ALPHA)	GE03150
	TANPH2=TANPH1*TANPH1	GE03160
	BETA2=1.-AMACH*AMACH	GE03170
	BETA=SQRT(BETA2)	GE03180
	B2PH1=BETA2*TANPH1	GE03190
	D4=BETA2*TANPH2+1.	GE03200
	D4SQ2=2.*SQRT(D4)	GE03210
	CON=BETA2/(8.*FLOAT(NCW))	GE03220
	BSQD4P=BETA2/(4.*PI)	GE03230
	DO 330 I=1,NC	GE03240
	SWPLE=XBRR(20+I)	GE03250
	CON1=COS(SWPLE)	GE03260
	CON2=(SIN(SWPLE))/CON1	GE03270
	CON3=FLOAT(NCW)*SQRT(BETA2+CON2*CON2)	GE03280
	CON4=2.*CON1/(PI*SQRT(1.-AMACH*AMACH*CON1*CON1))	GE03290
	AW(I)=CON3	GE03300
	CA(I)=CON4	GE03310
330	CONTINUE	GE03320
	N1=0	GE03330
	DO 350 KI=1,NC	GE03340
	N2=N1+M1(KI)-1	GE03350
	II=N1+1	GE03360
	DO 340 I=II,N2	GE03370
340	CTT(I)=AW(KI)*SQRT(CA(KI)*CTT(I))	GE03380
	N1=N2	GE03390
350	CONTINUE	GE03400

	DO 360 I=1,NSW1	GE03410
360	CONS(I)=CON*C(I)	GE03420
	SINA=SIN(ALPHA)	GE03430
	COSA=COS(ALPHA)	GE03440
	DO 370 I=1,NSW	GE03450
370	CPSWL(I)=YLE(I)/PYL(NC+1)	GE03460
	DO 380 I=1,NSW1	GE03470
380	CPSW1(I)=YLM(I)/PYL(NC+1)	GE03480
	WRITE (1) (SNN(I),I=1,NCW)	GE03490
	N2=NCW*NC	GE03500
	WRITE (1) (SWP(I),I=1,N2)	GE03510
	WRITE (1) (XAVWNG(I),YAVWNG(I),I=1,NWNG)	GE03520
	WRITE (1) (C(I),I=1,NSW1)	GE03530
	WRITE (1) (THETP(I),I=1,NSW1)	GE03540
	WRITE (1) (XTE(I),XLE(I),YLE(I),I=1,NSW)	GE03550
	WRITE (1) (XLM(I),YLM(I),I=1,NSW1)	GE03560
	WRITE (1) (CONS(I),I=1,NSW1)	GE03570
	WRITE (1) (SI(I),SN(I),I=1,NCW)	GE03580
	WRITE (1) (XCP(I),YCP(I),I=1,NCPTTL)	GE03590
	WRITE (1) ((XN(I,J),YN(I,J),J=1,2),I=1,NWNG)	GE03600
	WRITE (1) (CTT(I),I=1,NSW1)	GE03610
	WRITE (1) (CPCWL(I),I=1,NCW)	GE03620
	WRITE (1) (CPCW1(I),I=1,NCW)	GE03630
	WRITE (1) (CPSWL(I),I=1,NSW)	GE03640
	WRITE (1) (CPSW1(I),I=1,NSW1)	GE03650
	IF ((PXT(NC+1)-PXL(NC+1)).NE.0.) MAXW=NTS	GE03660
	CALL FRELM (XXL,XXT,YL,XLE,XTE,YLE,PI,NCW1,NSW1,XEND,DELTA,ALPHA,DGE03670	GE03670
	IL,CPCWL)	GE03680
	RETURN	GE03690
390	WRITE (6,500)	GE03700
	STOP	GE03710
C		GE03730
400	FORMAT (29H SAPNWISE SECTION OF NUMBER ,2X,I2)	GE03740
430	FORMAT (1H0,40H CAMBER SLOPE AT FINE GRID BOUND ELEMENT)	GE03770
440	FORMAT (1H0,3X,5HD7DXV,5X,5HDZDYV)	GE03780
450	FORMAT (1H0,42H CAMBER SLOPE AT COARSE GRID ROUND ELEMENT)	GE03790
460	FORMAT (1H0,3X,4HDZDX,7X,4HDZDY,5X,5HDZDYV)	GE03800
470	FORMAT (1H0,48H CAMBER SLOPE AT THE LEADING EDGE CONTROL POINTS)	GE03810
480	FORMAT (1H0,3X,4HDZDX,7X,4HDZDY)	GE03820
490	FORMAT (16A5)	GE03830
500	FORMAT (1H1,/,10X,19HALL CASES COMPLETED)	GE03840

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510 FORMAT (8F10.5)
520 FORMAT (10I5)
530 FORMAT (1H1,/,17H INPUT DATA CARDS/,16A5)
END

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GE03850
GE03860
GE03870
GE03880-

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SUBROUTINE PNLWNG (NSW,IPANEL,LPANEL,NCW,NCS,NTS,NC,KI,ISC)      PNG 10
C   GENERATES THE GRID OF BOUND AND TRAILING VORTEX ELEMENTS    PNG 20
COMMON XXL(2),XXT(2),YL(2),CPCWL(10),CPCW1(10),SI(10),SN(10),SNN(1PNG 30
10),SWP(50),SLOPE(50),XL(2,10),C(19),THETP(19),CONS(19),CPSW1(19),XPNG 40
2LM(19),XTM(19),YLM(19),CTT(19),CPSWL(20),XLE(20),XTE(20),YLE(20),XPNG 50
3AVWNG(190),YAVWNG(190),XN(190,2),YN(190,2),XCP(209),YCP(209),X(10,PNG 60
420),Y(10,20)                                                    PNG 70
IF (ISC.NE.1) GO TO 80                                           PNG 80
C   STRAIGHT LEADING-EDGE COMPUTATION                             PNG 90
DO 10 I=1,2                                                       PNG 100
D=XXT(I)-XXL(I)                                                  PNG 110
DO 10 J=1,NCW                                                    PNG 120
10 XL(I,J)=XXL(I)+CPCWL(J)*D/100.                                PNG 130
SPAN=YL(2)-YL(1)                                                PNG 140
DO 20 I=1,NCW                                                    PNG 150
II=(KI-1)*NCW+I                                                PNG 160
SLOPE(II)=(XL(2,I)-XL(1,I))/SPAN                                PNG 170
20 SWP(II)=ATAN(SLOPE(II))                                       PNG 180
DO 30 I=1,NCW                                                    PNG 190
II=(KI-1)*NCW+I                                                PNG 200
30 CONTINUE                                                      PNG 210
DO 40 K=1,NSW                                                    PNG 220
YK=CPSWL(K)*SPAN/100.                                           PNG 230
YL1=YL(1)+YK                                                    PNG 240
DO 40 J=1,NCW                                                    PNG 250
JJ=(KI-1)*NCW+J                                                PNG 260
Y(J,K)=YL1                                                       PNG 270
40 X(J,K)=XL(1,J)+SLOPE(JJ)*YK                                  PNG 280
NSW1=NSW-1                                                       PNG 290
IF (NC.FO.1) GO TO 50                                           PNG 300
IF (KI.NE.1) GO TO 60                                           PNG 310
50 CONTINUE                                                       PNG 320
XLE(1)=XXL(1)                                                    PNG 330
XTE(1)=XXT(1)                                                    PNG 340

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	YLF(1)=YL(1)	PNG 350
60	CONTINUE	PNG 360
	X1=XXL(1)	PNG 370
	X2=XXT(1)	PNG 380
	DLE=(XXL(2)-XXL(1))/SPAN	PNG 390
	DTE=(XXT(2)-XXT(1))/SPAN	PNG 400
	DO 70 I=2,NSW	PNG 410
	II=NCS+I	PNG 420
	YLE(II)=Y(1,I)	PNG 430
	YLM(II-1)=YL(1)+CPSW1(I-1)*SPAN/100.	PNG 440
	DLEL=DLE*(Y(1,I)-Y(1,I-1))	PNG 450
	DTET=DTE*(Y(1,I)-Y(1,I-1))	PNG 460
	XLE(II)=XLE(II-1)+DLEL	PNG 470
	XTE(II)=XTE(II-1)+DTET	PNG 480
	XLM(II-1)=X1+SPAN*CPSW1(I-1)*DLE/100.	PNG 490
70	XTM(II-1)=X2+SPAN*CPSW1(I-1)*DTE/100.	PNG 500
	GO TO 110	PNG 510
C	CURVED LEADING-EDGE COMPUTATION	PNG 520
80	SPAN=YL(2)-YL(1)	PNG 530
	DO 90 K=1,NSW	PNG 540
	II=NCS+K	PNG 550
	YK=CPSWL(K)*SPAN/100.	PNG 560
	YC=YL(1)+YK	PNG 570
	XLE(II)=SHAPLE(YK)+XXL(1)	PNG 580
	XTE(II)=SHAPTE(YK)+XXT(1)	PNG 590
	YLE(II)=YC	PNG 600
	CHD=XTE(II)-XLE(II)	PNG 610
	DO 90 J=1,NCW	PNG 620
	Y(J,K)=YC	PNG 630
	X(J,K)=XLE(II)+CPCWL(J)*CHD/100.	PNG 640
90	CONTINUE	PNG 650
	NSW1=NSW-1	PNG 660
	DO 100 I=1,NSW1	PNG 670
	II=NCS+I	PNG 680
	YK1=CPSW1(I)*SPAN/100.	PNG 690
	YC1=YL(1)+YK1	PNG 700
	XLM(II)=XXL(1)+SHAPLE(YK1)	PNG 710
	XTM(II)=XXT(1)+SHAPTE(YK1)	PNG 720
	YLM(II)=YC1	PNG 730
100	CONTINUE	PNG 740
110	CONTINUE	PNG 750

C	DETERMINE THE CONTROL AND VORTEX POINTS ON THE WING SURFACE	PNG 760
	DO 130 K=1,NSW1	PNG 770
	KN=NCS+K	PNG 780
	CC=XTM(KN)-XLM(KN)	PNG 790
	DO 130 J=1,NCW	PNG 800
	NPANEL=IPANEL+(K-1)*NCW+J-1	PNG 810
	XCP(NPANEL)=XLM(KN)+CC*CPCW1(J)/100.	PNG 820
	YCP(NPANEL)=YLM(KN)	PNG 830
	XAVWNG(NPANEL)=XLM(KN)+CC*CPCWL(J)/100.	PNG 840
	YAVWNG(NPANEL)=YLM(KN)	PNG 850
	DO 120 I=1,2	PNG 860
	KA=K+I-1	PNG 870
	XN(NPANEL,I)=X(J,KA)	PNG 880
120	YN(NPANEL,I)=Y(J,KA)	PNG 890
130	CONTINUE	PNG 900
	LPANEL=NPANEL	PNG 910
	IF (KI.NE.NC) RETURN	PNG 920
	DO 140 K=1,NTS	PNG 930
	NP=LPANEL+K	PNG 940
	XCP(NP)=XLM(K)	PNG 950
140	YCP(NP)=YLM(K)	PNG 960
	RETURN	PNG 970
	END	PNG 980-

	FUNCTION SHAPLE(Y)	SHL 10
	COMMON /SHPLE/ NLE,YSL(15),AQL(14),BQL(14),COL(14),DQL(14)	SHL 20
	K=1	SHL 30
10	IF (Y.GE.YSL(K).AND.Y.LT.YSL(K+1)) GO TO 20	SHL 40
	K=K+1	SHL 50
	IF (K.GE.NLE) GO TO 30	SHL 60
	GO TO 10	SHL 70
20	SM=Y-YSL(K)	SHL 80
	SHAPLE=AQL(K)*SM**3+BQL(K)*SM**2+COL(K)*SM+DQL(K)	SHL 90
	GO TO 50	SHL 100
30	IF (Y.LT.YSL(1)) GO TO 40	SHL 110
	K=NLE-1	SHL 120
	GO TO 20	SHL 130
40	K=1	SHL 140
	GO TO 20	SHL 150

50	RETURN	SHL 160
	END	SHL 170-
	FUNCTION SHAPTE(Y)	SHT 10
	COMMON /SHPTE/ NTE,YST(15),AQT(14),BQT(14),CQT(14),DQT(14)	SHT 20
	K=1	SHT 30
10	IF (Y.GE.YST(K).AND.Y.LT.YST(K+1)) GO TO 20	SHT 40
	K=K+1	SHT 50
	IF (K.GE.NTE) GO TO 30	SHT 60
	GO TO 10	SHT 70
20	SM=Y-YST(K)	SHT 80
	SHAPTE=AQT(K)*SM**3+BQT(K)*SM**2+CQT(K)*SM+DQT(K)	SHT 90
	GO TO 50	SHT 100
30	IF (Y.LT.YST(1)) GO TO 40	SHT 110
	K=NTE-1	SHT 120
	GO TO 20	SHT 130
40	K=1	SHT 140
	GO TO 20	SHT 150
50	RETURN	SHT 160
	END	SHT 170-

	SUBROUTINE FRELM (XXL,XXT,YL,XLE,XTE,YLE,PI,NCW1,NSW1,XEND,DELTA,AFLM	10
	1LPHA,DL,CPCWL)	FLM 20
C	FINDS THE INETIAL COORDINATES OF FREE VORTEX ELEMENTS	FLM 30
	COMMON /ALLRB/ XF(40),YE(40),ZE(40),XE(30),YYE(30),ZZE(30),ZMIN,NFLM	40
	1ELM(11),NNELM(12)	FLM 50
	COMMON /XPLOTT/ XMN,YMN,ZMN,XXM,XXY,XXZ	FLM 60
	COMMON /NCTT/ NCT,NCON,NRT,NCOR(15),KUI,NFSH(15),KUC	FLM 70
	COMMON /LOC/ FU1,FU2,YEND,PXL(5),PXT(5),PYL(5)	FLM 80
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	FLM 90
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	FLM 100
	1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC	FLM 110
	COMMON /CAMB/ ICAM	FLM 120
	COMMON /TIPVX/ XTIP(15,30),YTIP(15,30),ZTIP(15,30),NTLM(15),NTMAX	FLM 130
	DIMENSION CPCWL(1)	FLM 140
	COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40),PXXE(11,20),	FLM 150
	1PYE(11,20),PZZE(11,20),NMAX,NNMAX,NCNTS	FLM 160

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DIMENSION XXL(1), XXT(1), YL(1), XLE(1), XTE(1), YLE(1)
AHPI=ALPHA
ALP=ALPHA*180./PI
IF (ALP.LE.15.) AHPI=(22.5-0.5*ALP)*PI/180.
NSW=NSW1+1
THT1=PI/(FLOAT(2*NCW1))
CPC=0.5*(1.-COS(THT1))
ZMIN=(XTE(1)-XLE(1))*TAN(AHPI)/10.
SAHPI=SIN(AHPI)
CAHPI=COS(AHPI)
REWIND 2
REWIND 4
C EVALUATION OF COORDINATES OF LEADING-EDGE ELEMENTS
IF (ISPAN.EQ.0) NSW1=NTS
IF (ISPAN.EQ.0) NSW=NTS+1
IF (ISPAN.EQ.1) NSW1=MAXL
IF (ISPAN.EQ.1) NSW=MAXW
DO 40 I=1,NSW1
IF (I.EQ.NSW1) GO TO 10
XE(1)=XTE(I+1)
YE(1)=YLE(I+1)
ZE(1)=0.
XE(2)=XLE(I+1)+CPC*(XTE(I+1)-XLE(I+1))
YE(2)=YLE(I+1)
ZE(2)=0.
XE(3)=XLE(I)+CPC*(XTE(I)-XLE(I))
YE(3)=YLE(I)
ZE(3)=0.
XE(4)=XLE(I)
YE(4)=YLE(I)
ZE(4)=0.
XE(5)=XLE(I)-0.05*(XTE(I)-XLE(I))
IF (I.EQ.1) XMN=XE(5)
YE(5)=YLE(I)
ZE(5)=0.
XE(6)=XE(4)+0.05*(XTE(I)-XLE(I))
YE(6)=YE(4)
ZE(6)=ZMIN
J=6
XF(7)=XF(6)+DELTA*CAHPI
YE(7)=YE(6)

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FLM 170
FLM 180
FLM 190
FLM 200
FLM 210
FLM 220
FLM 230
FLM 240
FLM 250
FLM 260
FLM 270
FLM 280
FLM 290
FLM 300
FLM 310
FLM 320
FLM 330
FLM 340
FLM 350
FLM 360
FLM 370
FLM 380
FLM 390
FLM 400
FLM 410
FLM 420
FLM 430
FLM 440
FLM 450
FLM 460
FLM 470
FLM 480
FLM 490
FLM 500
FLM 510
FLM 520
FLM 530
FLM 540
FLM 550
FLM 560
FLM 570

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	ZE(7)=ZE(6)+DELTA*SAHPI	FLM 580
	IF (I.EQ.1) GO TO 30	FLM 590
	J=7	FLM 600
	GO TO 20	FLM 610
10	CONTINUE	FLM 620
	XE(1)=PXL(NC+1)+CPC*(PXT(NC+1)-PXL(NC+1))	FLM 630
	YE(1)=PYL(NC+1)	FLM 640
	ZE(1)=0.	FLM 650
	XE(3)=XLE(I)+CPC*(XTE(I)-XLE(I))	FLM 660
	YE(3)=YLE(I)	FLM 670
	ZE(3)=0.	FLM 680
	XE(2)=0.5*(XE(1)+XE(3))	FLM 690
	YE(2)=0.5*(YE(1)+YE(3))	FLM 700
	ZE(2)=0.5*(ZE(1)+ZE(3))	FLM 710
	XE(4)=XLE(I)	FLM 720
	YE(4)=YLE(I)	FLM 730
	ZE(4)=0.	FLM 740
	XE(5)=XLE(I)-0.05*(XTE(I)-XLE(I))	FLM 750
	YE(5)=YLE(I)	FLM 760
	ZE(5)=0.	FLM 770
	XE(6)=XE(4)+0.05*(XTE(I)-XLE(I))	FLM 780
	YE(6)=YE(4)	FLM 790
	ZE(6)=ZMIN	FLM 800
	XE(7)=XE(6)+DELTA*CAHPI	FLM 810
	YE(7)=YE(6)	FLM 820
	ZE(7)=ZE(6)+DELTA*SAHPI	FLM 830
	J=7	FLM 840
20	XE(J+1)=XE(J)+DELTA	FLM 850
	YE(J+1)=YE(J)	FLM 860
	ZE(J+1)=ZE(J)	FLM 870
	IF (XF(J+1).GE.XEND) GO TO 30	FLM 880
	J=J+1	FLM 890
	GO TO 20	FLM 900
30	NELM(I)=J+1	FLM 910
	K=NELM(I)	FLM 920
	IF (NCONTS.NE.0) WRITE (2) (XE(J),YE(J),ZE(J),J=1,5)	FLM 930
40	WRITE (4) K,(XF(J),YF(J),ZE(J),J=1,K)	FLM 940
	NMAX=0	FLM 950
	DO 50 I=1,NSW1	FLM 960
50	IF (NMAX.LT.NELM(I)) NMAX=NELM(I)	FLM 970
C	EVALUATION OF COORDINATES OF WAKE ELEMENTS	FLM 980


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YGL=0.95*(YLE(NSW)-YLE(NSW1))
DO 100 I=1,MAXW
XXE(1)=XTE(I)
YYE(1)=YLE(I)
ZZE(1)=0.
XXE(2)=XXE(1)+(PXT(1)-PXL(1))/10.
YYE(2)=YYE(1)
ZZE(2)=ZZE(1)
XXE(3)=XXE(2)+(PXT(1)-PXL(1))/10.
YYE(3)=YYE(2)
ZZE(3)=ZZE(2)
J=3
IF (I.EQ.NSW) GO TO 60
GO TO 80
60 CONTINUE
IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) GO TO 80
XXE(1)=PXL(NC+1)+CPC*(PXT(NC+1)-PXL(NC+1))
YYE(1)=PYL(NC+1)
ZZE(1)=0.
XXE(2)=XXE(1)+YGL*CAHPI
YYE(2)=YYE(1)
ZZE(2)=ZZE(1)+YGL*SAHPI
J=2
70 IF (XXF(J).GE.XFND) GO TO 90
XXE(J+1)=XXE(J)+DELTA*CAHPI
YYE(J+1)=YYE(J)
ZZE(J+1)=ZZE(J)+DFLTA*SAHPI
J=J+1
GO TO 70.
80 IF (XXE(J).GE.XEND) GO TO 90
XXE(J+1)=XXE(J)+DL
YYE(J+1)=YYE(J)
ZZE(J+1)=ZZE(J)
J=J+1
GO TO 80
90 NNELM(I)=J
K=J
IF (NCONTS.NE.0) WRITE (2) (XXE(J),YYE(J),ZZE(J),J=1,2)
100 WRITE (4) K,(XXE(J),YYE(J),ZZE(J),J=1,K)
NNMAX=0
IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) NT=MAXL

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FLM 990
FLM1000
FLM1010
FLM1020
FLM1030
FLM1040
FLM1050
FLM1060
FLM1070
FLM1080
FLM1090
FLM1100
FLM1110
FLM1120
FLM1130
FLM1140
FLM1150
FLM1160
FLM1170
FLM1180
FLM1190
FLM1200
FLM1210
FLM1220
FLM1230
FLM1240
FLM1250
FLM1260
FLM1270
FLM1280
FLM1290
FLM1300
FLM1310
FLM1320
FLM1330
FLM1340
FLM1350
FLM1360
FLM1370
FLM1380
FLM1390

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	IF ((PXT(NC+1)-PXL(NC+1)).NE.0.) NT=MAXW	FLM1400
	DO 110 I=1,NT	FLM1410
110	IF (NNMAX.LT.NNELM(I)) NNMAX=NNELM(I)	FLM1420
	WRITE (4) NMAX,NNMAX,7MIN,NCNTS	FLM1430
C	EVALUATION OF SIDE EDGE VORTEX ELEMENTS	FLM1440
	NCW=NCW1-1	FLM1450
	CAHPI=COS(AHPI/2.)	FLM1460
	SAHPI=SIN(AHPI/2.)	FLM1470
	IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) GO TO 180	FLM1480
	DO 120 I=1,NCW	FLM1490
	XTIP(I,1)=PXL(NC+1)+CPCWL(I)*(PXT(NC+1)-PXL(NC+1))	FLM1500
	YTIP(I,1)=PYL(NC+1)	FLM1510
	ZTIP(I,1)=0.	FLM1520
120	CONTINUE	FLM1530
	DO 150 I=1,NCW	FLM1540
	FL=(PXT(NC+1)-PXL(NC+1))/2.	FLM1550
	J=1	FLM1560
130	XTIP(I,J+1)=XTIP(I,J)+FL*CAHPI	FLM1570
	YTIP(I,J+1)=PYL(NC+1)+0.01	FLM1580
	ZTIP(I,J+1)=ZTIP(I,J)+FL*SAHPI	FLM1590
	IF (XTIP(I,J+1).GE.XEND) GO TO 140	FLM1600
	IF (XTIP(I,J+1).GE.PXT(NC+1)) FL=DELTA	FLM1610
	J=J+1	FLM1620
	GO TO 130	FLM1630
140	NTLM(I)=J+1	FLM1640
150	CONTINUE	FLM1650
	DO 160 I=1,NCW	FLM1660
	KK=NTLM(I)	FLM1670
	WRITE (6,280) (XTIP(I,J),J=1,KK)	FLM1680
	WRITE (6,280) (YTIP(I,J),J=1,KK)	FLM1690
	WRITE (6,280) (ZTIP(I,J),J=1,KK)	FLM1700
160	CONTINUE	FLM1710
	NTMAX=0	FLM1720
	DO 170 I=1,NCW	FLM1730
	IF (NTMAX.LT.NTLM(I)) NTMAX=NTLM(I)	FLM1740
170	CONTINUE	FLM1750
180	CONTINUE	FLM1760
	XLNT=XEND-XMN	FLM1770
	XMN=XEND	FLM1780
	XMN=XEND+0.20*XLNT	FLM1790
	YMN=0.	FLM1800

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YMX=PYL(NC+1)
ZMN=-PYL(NC+1)*0.6667
ZMX=PYL(NC+1)*0.6667
IF (NCONTS.EQ.0) GO TO 230
C READS LOCATION OF LEADING-EDGE ELEMENTS FROM INPUT DATA CARDS
REWIND 2
REWIND 4
READ (5,300) (NFLM(I),I=1,MAXL)
DO 190 I=1,MAXL
K=NELM(I)
READ (5,290) ((X1,J=1,5),(XE(J),J=6,K))
READ (5,290) ((Y1,J=1,5),(YE(J),J=6,K))
READ (5,290) ((Z1,J=1,5),(ZE(J),J=6,K))
READ (2) (XE(J),YE(J),ZE(J),J=1,5)
190 WRITE (4) K,(XE(J),YE(J),ZE(J),J=1,K)
C READS LOCATION OF WAKE ELEMENTS FROM INPUT DATA CARDS
READ (5,300) (NNELM(I),I=1,MAXW)
DO 200 I=1,MAXW
K=NNELM(I)
READ (5,290) ((X1,J=1,2),(XXE(J),J=3,K))
READ (5,290) ((Y1,J=1,2),(YYE(J),J=3,K))
READ (5,290) ((Z1,J=1,2),(ZZE(J),J=3,K))
READ (2) (XXE(J),YYE(J),ZZE(J),J=1,2)
200 WRITE (4) K,(XXE(J),YYE(J),ZZE(J),J=1,K)
WRITE (4) NMAX,NNMAX,ZMIN,NCONTS
IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) GO TO 220
READ (5,300) (NTLM(I),I=1,NCW)
DO 210 I=1,NCW
K=NTLM(I)
READ (5,290) (XTIP(I,J),J=1,K)
READ (5,290) (YTIP(I,J),J=1,K)
READ (5,290) (ZTIP(I,J),J=1,K)
210 CONTINUE
220 CONTINUE
230 WRITE (6,310)
REWIND 4
DO 250 I=1,MAXL
READ (4) K,(XE(J),YE(J),ZE(J),J=1,K)
DO 240 J=1,K
PXE(I,J)=XE(J)
PYE(I,J)=YE(J)

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FLM1810
FLM1820
FLM1830
FLM1840
FLM1850
FLM1860
FLM1870
FLM1880
FLM1890
FLM1900
FLM1910
FLM1920
FLM1930
FLM1940
FLM1950
FLM1960
FLM1970
FLM1980
FLM1990
FLM2000
FLM2010
FLM2020
FLM2030
FLM2040
FLM2050
FLM2060
FLM2070
FLM2080
FLM2090
FLM2100
FLM2110
FLM2120
FLM2130
FLM2140
FLM2150
FLM2160
FLM2170
FLM2180
FLM2190
FLM2200
FLM2210

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	PZE(I,J)=ZE(J)	FLM2220
240	CONTINUE	FLM2230
250	CONTINUE	FLM2240
	DO 270 I=1,MAXW	FLM2250
	READ (4) K,(XXE(J),YYE(J),ZZE(J),J=1,K)	FLM2260
	DO 260 J=1,K	FLM2270
	PXXE(I,J)=XXE(J)	FLM2280
	PYYE(I,J)=YYE(J)	FLM2290
	PZZE(I,J)=ZZE(J)	FLM2300
260	CONTINUE	FLM2310
270	CONTINUE	FLM2320
	RETURN	FLM2330
C		FLM2340
280	FORMAT (1H0,5X,8F10.5)	FLM2360
290	FORMAT (8F10.4)	FLM2370
300	FORMAT (10I2)	FLM2380
310	FORMAT (18H END OF INPUT DATA,//)	FLM2390
	END	FLM2400-

	SUBROUTINE SPLINE (N,X,Y,A,B,C,D)	SPL 10
C	CUBIC SPLINE INTERPOLATION	SPL 20
	DIMENSION S(125),H(22),CA(22),X(1),Y(1)	SPL 30
	DIMENSION A(1),B(1),C(1),D(1)	SPL 40
	I=1	SPL 50
	NI=N+1	SPL 60
	N1=N-1	SPL 70
	H(NI)=0.	SPL 80
	H(1)=X(3)-X(2)	SPL 90
	H(2)=-X(3)+X(1)	SPL 100
	H(3)=X(2)-X(1)	SPL 110
	DO 10 K=4,N	SPL 120
10	H(K)=0.	SPL 130
	DO 20 K=1,N	SPL 140
20	S(K)=-H(K+1)/H(1)	SPL 150
	NJ=N-1	SPL 160
	DO 70 I=2,N	SPL 170
	IF (I.EQ.N) GO TO 30	SPL 180
	H(NI)=-6.*(Y(I+1)-Y(I))/(X(I+1)-X(I))-(Y(I)-Y(I-1))/(X(I)-X(I-1))	SPL 190
	1)	SPL 200

	GO TO 40	SPL 210
30	H(NI)=0.	SPL 220
40	DO 60 J=1,N	SPL 230
	H(J)=0.	SPL 240
	IF (I.FQ.N) GO TO 50	SPL 250
	IF (J.LT.(I-1).OR.J.GT.(I+1)) GO TO 60	SPL 260
	H(I-1)=X(I)-X(I-1)	SPL 270
	H(I)=2.*(X(I+1)-X(I-1))	SPL 280
	H(I+1)=X(I+1)-X(I)	SPL 290
	GO TO 60	SPL 300
50	H(N-2)=X(N)-X(N-1)	SPL 310
	H(N-1)=-X(N)+X(N-2)	SPL 320
	H(N)=X(N-1)-X(N-2)	SPL 330
60	CONTINUE	SPL 340
	II=I	SPL 350
	CALL VMSEQN (NJ.II.H.S.CA)	SPL 360
	NJ=NJ-1	SPL 370
70	CONTINUE	SPL 380
	DO 80 I=1,N1	SPL 390
	A(I)=(S(I+1)-S(I))/(6.*(X(I+1)-X(I)))	SPL 400
	B(I)=S(I)/2.	SPL 410
	C(I)=(Y(I+1)-Y(I))/(X(I+1)-X(I))- (X(I+1)-X(I))*(2.*S(I)+S(I+1))/6.	SPL 420
	D(I)=Y(I)	SPL 430
80	CONTINUE	SPL 440
	RETURN	SPL 450
	END	SPL 460-

	OVERLAY (LEVSP,2,0)	PLT 10
	PROGRAM APLOTT	PLT 20
C	SETS UP DIMENSIONS FOR PLOTTING LEADING-EDGE AND WAKE ELEMENTS	PLT 30
	COMMON D(1)	PLT 40
	COMMON /ALLI/ NSW,NSW1,NCW	PLT 50
	COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40),PXXE(11,20),	PLT 60
	IPYYE(11,20),PZZE(11,20).NMAX,NNMAX,NCONTS	PLT 70
	COMMON /AERO/ NAFRO,MAXL,MAXW,ISPAN,ISF,ITRAKE.ISC	PLT 80
	NSW=MAXW	PLT 90
	NSW1=MAXL	PLT 100
	MXE=1	PLT 110
	MYE=MXE+NSW1*40	PLT 120

	MZE=MYE+NSW1*40	PLT 130
	MNELM=MZE+NSW1*40	PLT 140
	MNEXT=MNELM+NSW1	PLT 150
C	MNEXT=3*NSW*NMAX-3*NMAX+NSW	PLT 160
	CALL PLOTT (D(MXE),D(MYE),D(MZE),D(MNELM),NSW1,1)	PLT 170
	MXXE=1	PLT 180
	MYYE=MXXE+NSW*(NNMAX+2)	PLT 190
	MZZE=MYYE+NSW*(NNMAX+2)	PLT 200
	MNNELM=MZZE+NSW*(NNMAX+2)	PLT 210
	MNNEXT=MNNELM+NSW	PLT 220
C	MNNEXT=3*NSW*(NNMAX+2)+NSW+1	PLT 230
	CALL PLOTT (D(MXXE),D(MYYE),D(MZZE),D(MNNELM),NSW,2)	PLT 240
	MTXE=1	PLT 250
	MTYE=MTXE+NCW*40	PLT 260
	MTZE=MTYE+NCW*40	PLT 270
	MTELM=MTZE+NCW*40	PLT 280
	MTEXT=MTELM+NCW	PLT 290
C	MTEXT=3*NCW*40+NCW+1	PLT 300
	CALL PLOTT (D(MTXE),D(MTYE),D(MTZE),D(MTELM),NCW,3)	PLT 310
	RETURN	PLT 320
	END	PLT 330-

	SUBROUTINE PLOTT (XE,YE,ZE,NNM,NS,LS)	PTT 10
C	MANIPULATES LEADING-EDGE AND WAKE ELEMENTS COORDINATES IN A FORM	PTT 20
C	SUITABLE FOR PLOTTING	PTT 30
	COMMON /ALLI/ NSW,NSW1,NCW	PTT 40
	COMMON /TIPVX/ XTIP(15,30),YTIP(15,30),ZTIP(15,30),NTLM(15)	PTT 50
	COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)	PTT 60
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	PTT 70
	IMJW2(2),WIDTH(5),SWEEP(60),NTS,NB	PTT 80
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	PTT 90
	COMMON /XPLOT/ XMN,YMN,ZMN,XXM,YYM,ZZM	PTT 100
	COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40),PXXE(11,20),	PTT 110
	1PYE(11,20),PZZE(11,20),NMAX,NNMAX,NCNTS	PTT 120
	COMMON /ALLRB/ AX(210),ZMIN,NELM(11),NNELM(12)	PTT 130
	DIMENSION NNM(1), XE(NS,1), YE(NS,1), ZE(NS,1), LARY(14), LABZ(14)	PTT 140
	DIMENSION LABX(14)	PTT 150
	DATA LABX/6*6H ,6HY VS Z,6*6H ,2H /	PTT 160
	DATA LABY/6*6H ,6HX VS Y,6*6H ,2H /	PTT 170

	DATA LABZ/6*6H	,6HX VS Z,6*6H	,2H /	PTT 180
	NSW=MAXW			PTT 190
	NSW1=MAXL			PTT 200
	IF (LS.EQ.2) GO TO 30			PTT 210
	IF (LS.EQ.3) GO TO 60			PTT 220
	DO 20 I=1,NSW1			PTT 230
	KK=NELM(I)			PTT 240
	DO 10 J=1,KK			PTT 250
	XE(I,J)=PXE(I,J)			PTT 260
	YE(I,J)=PYE(I,J)			PTT 270
	ZE(I,J)=PZE(I,J)			PTT 280
10	CONTINUE			PTT 290
20	NNM(I)=KK			PTT 300
	NC=4			PTT 310
	GO TO 90			PTT 320
30	CONTINUE			PTT 330
	DO 50 I=1,NSW			PTT 340
	KK=NNFLM(I)			PTT 350
	DO 40 J=1,KK			PTT 360
	XE(I,J)=PXXE(I,J)			PTT 370
	YE(I,J)=PYYE(I,J)			PTT 380
	ZE(I,J)=PZZE(I,J)			PTT 390
40	CONTINUE			PTT 400
50	NNM(I)=KK			PTT 410
C	*****			PTT 420
	NC=0			PTT 430
	GO TO 90			PTT 440
60	CONTINUE			PTT 450
	IF (ABS(PXT(NR+1)-PXL(NR+1)).LE.0.00001) RETURN			PTT 460
	DO 80 I=1,NCW			PTT 470
	KK=NTLM(I)			PTT 480
	DO 70 J=1,KK			PTT 490
	XE(I,J)=XTIP(I,J)			PTT 500
	YE(I,J)=YTIP(I,J)			PTT 510
	ZE(I,J)=ZTIP(I,J)			PTT 520
70	CONTINUE			PTT 530
	XE(I,KK+1)=XMN			PTT 540
	YE(I,KK+1)=YMN			PTT 550
	ZE(I,KK+1)=ZMN			PTT 560
	XE(I,KK+2)=XMN			PTT 570
	YE(I,KK+2)=YMN			PTT 580

	ZE(I, KK+2)=ZMX	PTT 590
80	NNM(I)=KK+2	PTT 600
	NS1=NS	PTT 610
	GO TO 120	PTT 620
90	DO 110 L=2, NS	PTT 630
	I=L-1	PTT 640
	K=NNM(L)-NC	PTT 650
	DO 100 J=1, K	PTT 660
	KK=J+NC	PTT 670
	XE(I, J)=XE(L, KK)	PTT 680
	YE(I, J)=YE(L, KK)	PTT 690
100	ZE(I, J)=ZE(L, KK)	PTT 700
	XE(I, K+1)=XMN	PTT 710
	YE(I, K+1)=YMN	PTT 720
	ZE(I, K+1)=ZMN	PTT 730
	XE(I, K+2)=XMX	PTT 740
	YE(I, K+2)=YMX	PTT 750
	ZE(I, K+2)=ZMX	PTT 760
110	NNM(I)=K+2	PTT 770
	NS1=NS-1	PTT 780
120	CONTINUE	PTT 790
	CALL LNPLLOT (XE, YE, NNM, NS1, NS, LABY)	PTT 800
	CALL LNPLLOT (XE, ZE, NNM, NS1, NS, LABZ)	PTT 810
	CALL LNPLLOT (YE, ZE, NNM, NS1, NS, LABX)	PTT 820
	RETURN	PTT 830
	END	PTT 840-

	SUBROUTINE LNPLLOT (X, Y, NELM, M, MMAX, LABEL)	LNP 10
C	GENERATES PLOT ON LINE PRINTER (WRITTEN BY KU COMPUTATION CENTER)	LNP 20
	DIMENSION NELM(MMAX), X(MMAX, 1), Y(MMAX, 1), ALINE(101), YAXIS(101)	LNP 30
	1, SYM(20), LABEL(1)	LNP 40
	COMMON /TAPE/ ITEST, IGOOD, SFAC(10), KU3, NSTOP	LNP 50
	DATA SYM/1H1, 1H2, 1H3, 1H4, 1H5, 1H6, 1H7, 1H8, 1H9, 1H0, 1HA, 1HB, 1HC, 1HD, 1	LNP 60
	1HE, 1HF, 1HG, 1HH, 1HI, 1HJ/	LNP 70
	DATA YAXIS/1HI, 9*1H-, 1HI, 9*1H-, 1HI, 9*1H-, 1HI, 9*1H-, 1HI, 9*1H-, 1HI, 9	LNP 80
	1*1H-, 1HI, 9*1H-, 1HI, 9*1H-, 1HI, 9*1H-, 1HI, 9*1H-, 1HI/	LNP 90
	DATA BLANK, UP, PLUS/1H , 1HI, 1H+ /	LNP 100
	XMAX=X(1, 1)	LNP 110
	XMIN=X(1, 1)	LNP 120

	YMAX=Y(1,1)	LNP 130
	YMIN=Y(1,1)	LNP 140
	DO 10 I=1,M	LNP 150
	N=NELM(I)	LNP 160
	DO 10 J=1,N	LNP 170
	IF (X(I,J).GT.XMAX) XMAX=X(I,J)	LNP 180
	IF (X(I,J).LT.XMIN) XMIN=X(I,J)	LNP 190
	IF (Y(I,J).GT.YMAX) YMAX=Y(I,J)	LNP 200
	IF (Y(I,J).LT.YMIN) YMIN=Y(I,J)	LNP 210
10	CONTINUE	LNP 220
	KEY=1	LNP 230
	ZMAX=XMAX	LNP 240
	ZMIN=XMIN	LNP 250
20	RANGE=ZMAX-ZMIN	LNP 260
	IF (RANGE.EQ.0.0) RANGE=ZMAX/2.	LNP 270
	SCALE=1.0E-9	LNP 280
30	SCALE=10.*SCALE	LNP 290
	IF (SCALE.LT.RANGE) GO TO 30	LNP 300
	ZMIN=ZMIN/SCALE	LNP 310
	ZMAX=ZMAX/SCALE	LNP 320
	MIN=20.*(ZMIN-0.025)	LNP 330
	MAX=20.0*(ZMAX+0.025)	LNP 340
	BOTTOM=0.05*FLOAT(MIN)	LNP 350
	TOP=0.05*FLOAT(MAX)	LNP 360
	RANGE=0.1*(TOP-BOTTOM)	LNP 370
	IF (RANGE.EQ.0.0) RANGE=0.1*(TOP/2.)	LNP 380
40	IF (BOTTOM.LE.ZMIN) GO TO 50	LNP 390
	BOTTOM=BOTTOM-RANGE	LNP 400
	GO TO 40	LNP 410
50	IF (TOP.GE.ZMAX) GO TO 60	LNP 420
	TOP=TOP+RANGE	LNP 430
	GO TO 50	LNP 440
60	CONTINUE	LNP 450
	IF (KEY.EQ.2) GO TO 70	LNP 460
	KEY=2	LNP 470
	ZMAX=YMAX	LNP 480
	ZMIN=YMIN	LNP 490
	YINC=0.01*(TOP-BOTTOM)	LNP 500
	XINC=YINC*SCALE	LNP 510
	XBOT=BOTTOM*SCALE	LNP 520
	GO TO 20	LNP 530

70	CONTINUE	LNP 540
	YINC=0.0125*(TOP-BOTTOM)	LNP 550
	YLOW=TOP+YINC	LNP 560
	YINC=2.*YINC	LNP 570
	WRITE (6,150)	LNP 580
	IF (ITER.GE.KU3) WRITE (ITEST,150)	LNP 590
	KEY=5	LNP 600
80	CONTINUE	LNP 610
	DO 90 IJ=2,101	LNP 620
90	ALINE(IJ)=BLANK	LNP 630
	YHIGH=YLOW	LNP 640
	YLOW=YHIGH-YINC	LNP 650
	YHS=SCALE*YHIGH	LNP 660
	YLS=SCALE*YLOW	LNP 670
	DO 110 I=1,M	LNP 680
	N=NELM(I)	LNP 690
	DO 110 J=1,N	LNP 700
	IF (Y(I,J).GT.YHS.OR.Y(I,J).LE.YLS) GO TO 110	LNP 710
	INDEX=(X(1,J)-XROT)/XINC	LNP 720
	INDEX=INDEX+1	LNP 730
	IF (INDEX.GT.101) INDEX=101	LNP 740
	IF (ALINE(INDEX).NE.BLANK) GO TO 100	LNP 750
	ALINE(INDEX)=SYM(I)	LNP 760
	GO TO 110	LNP 770
100	ALINE(INDEX)=PLUS	LNP 780
110	CONTINUE	LNP 790
	ALINE(1)=UP	LNP 800
	IF (KEY.NE.5) GO TO 120	LNP 810
	TPP=TOP*SCALF	LNP 820
	WRITE (6,160) TPP,ALINE	LNP 830
	IF (ITER.GE.KU3) WRITE (ITEST,160) TPP,ALINE	LNP 840
	GO TO 130	LNP 850
120	WRITE (6,170) ALINE	LNP 860
	IF (ITER.GE.KU3) WRITE (ITEST,170) ALINE	LNP 870
130	CONTINUE	LNP 880
	KEY=KEY-1	LNP 890
	IF (KEY.EQ.0) KEY=5	LNP 900
	TOP=TOP-YINC	LNP 910
	IF (TOP.GE.BOTTOM) GO TO 80	LNP 920
	IF (KEY.NE.4) GO TO 80	LNP 930
	WRITE (6,200) YAXIS	LNP 940

	IF (ITER.GE.KU3) WRITE (ITEST,200) YAXIS	LNP 950
	XINC=10.0*XINC	LNP 960
	ALINE(1)=XBOT	LNP 970
	DO 140 I=2,11	LNP 980
140	ALINE(I)=ALINE(I-1)+XINC	LNP 990
	WRITE (6,180) (ALINE(I),I=1,11)	LNP1000
	IF (ITER.GE.KU3) WRITE (ITEST,180) (ALINE(I),I=1,11)	LNP1010
	WRITE (6,190) (LABEL(I),I=1,14)	LNP1020
	IF (ITER.GE.KU3) WRITE (ITEST,190) (LABEL(I),I=1,14)	LNP1030
	RETURN	LNP1040
C		LNP1050
150	FORMAT (1H1, /)	LNP1070
160	FORMAT (1H ,F10.3,1X,101A1)	LNP1080
170	FORMAT (1H ,11X,101A1)	LNP1090
180	FORMAT (1H ,5X,11F10.3)	LNP1100
190	FORMAT (1H ,//,20X,13A6,A2)	LNP1110
200	FORMAT (1H ,11X,101A1)	LNP1120
	END	LNP1130-

	OVERLAY (LEVSP,3,0)	SLN 10
	PROGRAM SOLN	SLN 20
C	SETS UP DIMENSIONS FOR SOLVING THE STRENGTHS OF WING AND LEADING-	SLN 30
C	EDGE VORTEX SYSTEM	SLN 40
	COMMON D(1)	SLN 50
	COMMON /ALLI/ NSW,NSW1,NCW,NWNG,NCPTTL	SLN 60
	LC=1	SLN 70
	LTHETP=LC+NSW1	SLN 80
	LXTE=LTHETP+NSW1	SLN 90
	LXLE=LXTE+NSW	SLN 100
	LYLE=LXLE+NSW	SLN 110
	LCONS=LYLE+NSW	SLN 120
	LCTT=LCONS+NSW1	SLN 130
	LCPWL=LCTT+NSW1	SLN 140
	LCPSW=LCPWL+NCW	SLN 150
	LSI=LCPSW+NSW1	SLN 160
	LSN=LSI+NCW	SLN 170
	LXCP=LSN+NCW	SLN 180
	LYCP=LXCP+NCPTTL	SLN 190
	LXN=LYCP+NCPTTL	SLN 200

	LYN=LXN+2*NWNG	SLN 210
	LCONI=LYN+2*NWNG	SLN 220
	LCONJ=LCONI+NWNG	SLN 230
	LCONK=LCONJ+NWNG	SLN 240
	LCI=LCONK+NWNG	SLN 250
	LCJ=LCI+NWNG	SLN 260
	LCK=LCJ+NWNG	SLN 270
	LDUMY=LCK+NWNG	SLN 280
	LNEXT=LDUMY+8*NWNG	SLN 290
C	LNEXT=20*NWNG+10*NSW+3*NCW-6	SLN 300
	MNEXT=LCJ+(NWNG+1)**2/4	SLN 310
C	MNEXT=(NWNG+1)**2/4+10*NWNG+10*NSW+3*NCW-6	SLN 320
	CALL AERODN (NWNG,D(LC),D(LTHETP),D(LXTE),D(LXLE),D(LYLE),D(LCONS)	SLN 330
	1,D(LSI),D(LSN),D(LXCP),D(LYCP),D(LXN),D(LYN),D(LCONI),D(LCONJ),D(LSLN	SLN 340
	2CONK),D(LCI),D(LCJ),D(LCK),D(LDUMY),D(LCTT),D(LCPWL),D(LCPSW))	SLN 350
	RETURN	SLN 360
	END	SLN 370-

	SUBROUTINE AERODN (NWNG,C,THETP,XTE,XLE,YLE,CONS,SI,SN,XCP,YCP,XN,AER	10
	1YN,CONI,CONJ,CONK,CI,CJ,CK,DUMMY,CT,CPCWL,CPSW1)	AER 20
C	SOLVES FOR THE STRENGTHS OF WING AND LEADING-EDGE VORTEX SYSTEM	AER 30
	COMMON /TAPE/ ITEST,IGOOD,SFAC(10),KU3,NSTOP	AER 40
	COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4),	AER 50
	1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZBDY(200)	AER 60
	COMMON /ALLI/ NSW,NSW1,NCW,IWNG,NCPTTL	AER 70
	COMMON /ALLRA/ AA(17),SINA,AB(6),BSQD4P	AER 80
	COMMON /GM/ ITER,L1,L2,L3,L4,L5,L6,L7,L8	AER 90
	COMMON /NCTT/ NCT,NCON,NRT,NCOR(15),KU1,NFSH(15),KUC,FLG(10)	AER 100
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	AER 110
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	AER 120
	1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC	AER 130
	COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),BBM(10,20),	AER 140
	1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),ZBDXV(200)	AER 150
	DIMENSION C(1), THETP(1), XTE(1), XLE(1), YLE(1), CONS(1), SI(1),	AER 160
	1SN(1), XCP(1), YCP(1), DUMMY(1), CONI(1), CONJ(1), CONK(1), CI(1),	AER 170
	2 CJ(1), CK(1), CT(1), CPCWL(1), CPSW1(1), XN(NWNG,2), YN(NWNG,2)	AER 180
C	*****	AER 190
	REWIND 1	AER 200
	REWIND 2	AER 210

	REWIND 3	AER 220
	CALL SKIPR (1,7)	AER 230
	READ (1) (C(I),I=1,NSW1)	AER 240
	READ (1) (THETP(I),I=1,NSW1)	AER 250
	READ (1) (XTE(I),XLE(I),YLE(I),I=1,NSW)	AER 260
	CALL SKIPR (1,1)	AER 270
	READ (1) (CONS(I),I=1,NSW1)	AER 280
	READ (1) (SI(I),SN(I),I=1,NCW)	AER 290
	READ (1) (XCP(I),YCP(I),I=1,NCPTTL)	AER 300
	READ (1) ((XN(I,J),YN(I,J),J=1,2),I=1,NWNG)	AER 310
	READ (1) (CT(I),I=1,NSW1)	AER 320
	READ (1) (CPCWL(I),I=1,NCW)	AER 330
	CALL SKIPR (1,2)	AER 340
	RFAD (1) (CPSWI(I),I=1,NSW1)	AER 350
C	*****	AER 360
C	INFLUENCE COEFFICIENT MATRIX EVALUATION	AER 370
	L1=1	AER 380
	L2=L1+NWNG	AER 390
	L3=L2+NWNG	AER 400
	L4=L3+NWNG	AER 410
	L5=L4+NWNG	AER 420
	L6=L5+NWNG	AER 430
	L7=L6+NWNG	AER 440
	L8=L7+NWNG	AER 450
	NCON=0	AER 460
	NCT=0	AER 470
	DO 10 I=1,NCPTTL	AER 480
	ZCP=0.	AER 490
	CALL VDTWNG (C,THETP,XCP(I),YCP(I),ZCP,XN,YN,XTE,YLE,CONS,DUMMY(L1	AER 500
	1),DUMMY(L2),DUMMY(L3),DUMMY(L4),DUMMY(L5),DUMMY(L6),DUMMY(L7),DUMMA	AER 510
	2Y(L8),CONI,CONJ,CONK,SI,NSW1,NCW,NWNG)	AER 520
	WRITE (2) (CONK(J),J=1,NWNG)	AER 530
	CALL VDTFRE (XCP(I),YCP(I),ZCP,CI,CJ,CK,NSW1,BSQD4P,XLE,YLE)	AER 540
	WRITE (3) (CK(J),J=1,MAXL)	AER 550
10	CONTINUE	AER 560
C	GAMA-EVALUATION	AER 570
	REWIND 2	AER 580
	REWIND 3	AER 590
	READ (2) (CONI(I),I=1,NWNG)	AER 600
	NWNG1=NWNG+1	AER 610
	NWNB=NWNG+MAXL	AER 620

	NWNB1=NWNB+1	AER 630
	READ (3) (CONI(I),I=NWNG1,NWNB)	AER 640
	CONI(NWNB1)=(SINA-ZBDX(1)*AB(1))	AER 650
	IJ=1	AER 660
	DO 20 I=1,NWNB	AER 670
20	CJ(I)=-CONI(I+1)/CONI(1)	AER 680
	IJ=2	AER 690
	NJ=NWNB-1	AER 700
30	CONTINUE	AER 710
	READ (2) (CONI(I),I=1,NWNG)	AER 720
	READ (3) (CONI(I),I=NWNG1,NWNB)	AER 730
	CONI(NWNB1)=(SINA-ZBDX(IJ)*AB(1))	AER 740
	IF (IJ.GT.NWNG) CONI(NWNB1)=(SINA-CT(IJ-NWNG)-ZBDX(IJ)*AB(1))	AER 750
	CALL VMSEGN (NJ,IJ,CONI,CJ,CONK)	AER 760
	IJ=IJ+1	AER 770
	NJ=NJ-1	AER 780
	IF (IJ.LE.NWNB) GO TO 30	AER 790
	WRITE (6,80)	AER 800
	IF (ITER.GE.KU3) WRITE (ITEST,80)	AER 810
	DO 40 I=1,NSW1	AER 820
	DO 40 J=1,NCW	AER 830
	NP=(I-1)*NCW+J	AER 840
	IF (ITER.GE.KU3) WRITE (ITEST,90) CPCWL(J),CPSW1(I),CJ(NP)	AER 850
40	WRITE (6,90) CPCWL(J),CPSW1(I),CJ(NP)	AER 860
	WRITE (6,100)	AER 870
	IF (ITER.GE.KU3) WRITE (ITEST,100)	AER 880
	DO 50 I=1,MAXL	AER 890
	J=NWNG+I	AER 900
	FLG(I)=CJ(J)	AER 910
	IF (ITER.GE.KU3) WRITE (ITEST,90) CPSW1(I),CJ(J)	AER 920
50	WRITE (6,90) CPSW1(I),CJ(J)	AER 930
C	EVALUATION OF SECTIONAL LEADING-EDGE THRUST	AER 940
	CALL THRST (CJ,CONI,CONJ)	AER 950
	NERR=0	AER 960
	DO 60 I=1,MAXL	AER 970
60	IF (ABS(CONJ(I)-CT(I)).GE.(1.0E-10)) NERR=1	AER 980
	IF (NERR.EQ.1) WRITE (6,110)	AER 990
	GMSUM=0.	AER1000
	DO 70 I=2,MAXL	AER1010
	KS=NWNG+I	AER1020
70	GMSUM=GMSUM+CJ(KS)	AER1030

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C .....AER1040
  REWIND 2 AER1050
  WRITE (2) (CJ(I),I=1,NWNB) AER1060
  WRITE (7) GMSUM AER1070
C .....AER1080
  RETURN AER1090
C .....AER1100
80  FORMAT (1H1,/,22H WING VORTEX STRENGTHS,/,22H *****AER1120
    1**,/,29H      X/C      2Y/B      GAMAY,/,29H      ***      **** AER1130
    2 *****) AER1140
90  FORMAT (1H ,3F10.5) AER1150
100 FORMAT (1H ,/,32H LEADING-EDGE VORTICES STRENGTHS,/,31H *****AER1160
    1*****/,20H      2Y/B      CAPGAMA,/,20H      **** AER1170
    2 *****) AER1180
110 FORMAT (/,34H ERROR IN SECTIONAL CT CALCULATION,/,10F10.5) AER1190
    END AER1200-

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C SUBROUTINE THRST (SGM,CONK,CT) THR 10
  EVALUATES SECTIONAL LEADING-EDGE THRUST COEFFICIENTS THR 20
  COMMON /ALLI/ NSW,NSW1,NCW,NWNG THR 30
  COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC THR 40
  COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4), THR 50
  1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZBDY(200) THR 60
  COMMON /ALLRA/ AA(17),SINA,COSA,SWPLE,AB,BETA2,AC(5),PI THR 70
  COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),BBM(10,20), THR 80
  1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),ZBDXV(200) THR 90
  DIMENSION SGM(1), CONK(1), CT(1) THR 100
  AM2=1.-BETA2 THR 110
  FCOS=COS(SWPLE) THR 120
  FTAN=TAN(SWPLE) THR 130
  VAR1=FLOAT(NCW)*SQRT(FTAN*FTAN+BETA2) THR 140
  VAR2=SQRT(1.-AM2*FCOS*FCOS) THR 150
  REWIND 2 THR 160
  REWIND 3 THR 170
  CALL SKIPR (2,NWNG) THR 180
  CALL SKIPR (3,NWNG) THR 190
  DO 30 I=1,MAXL THR 200
  WL=0. THR 210
  READ (2) (CONK(J),J=1,NWNG) THR 220

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	DO 10 J=1,NWNG	THR 230
10	WL=WL+CONK(J)*SGM(J)	THR 240
	READ (3) (CONK(J),J=1,MAXL)	THR 250
	DO 20 J=1,MAXL	THR 260
	JJ=NWNG+J	THR 270
20	WL=WL+CONK(J)*SGM(JJ)	THR 280
	THRT1=(WL+(SINA-ZRDX(NWNG+I)*COSA))/VAR1	THR 290
30	CT(I)=(PI/2.)*VAR2*THRT1*THRT1/FCOS	THR 300
	RETURN	THR 310
	END	THR 320-

	OVERLAY (LEVSP,4.0)	LOD 10
	PROGRAM LOADS	LOD 20
C	SETS UP DIMENSIONS FOR EVALUATING AERODYNAMIC CHARACTERSTICS	LOD 30
	COMMON D(1)	LOD 40
	COMMON /ALLI/ NSW,NSW1,NCW,NWNG	LOD 50
	COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	LOD 60
	1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC	LOD 70
	DIMENSION W(5000)	LOD 80
	NNCW=NCW+1	LOD 90
	NWNP=NNCW*NSW1	LOD 100
	LCI=1	LOD 110
	LCJ=LCI+NWNG	LOD 120
	LCK=LCJ+NWNG	LOD 130
	LCONI=LCK+NWNG	LOD 140
	LCONJ=LCONI+NWNG	LOD 150
	LCONK=LCONJ+NWNG	LOD 160
	LXVWNG=LCONK+NWNG	LOD 170
	LYVWNG=LXVWNG+NWNG	LOD 180
	LXLE=LYVWNG+NWNG	LOD 190
	LXTE=LXLE+NSW	LOD 200
	LYLE=LXTE+NSW	LOD 210
	LSI=LYLE+NSW	LOD 220
	LC=LSI+NCW	LOD 230
	LSWP=LC+NSW1	LOD 240
	LXN=LSWP+NCW*NC	LOD 250
	LYN=LXN+2*NWNG	LOD 260
	LSNN=LYN+2*NWNG	LOD 270
	LTHETP=LSNN+NCW	LOD 280

LCONS=LTHETP+NSW1	LOD 290
LDUMMY=LCONS+NSW1	LOD 300
LCT=LDUMMY+8*NWNG	LOD 310
LQI=LCT+NSW1	LOD 320
LQNN=LQI+NNCW	LOD 330
LQSWP=LQNN+NNCW	LOD 340
LXVWNA=LQSWP+NNCW*NC	LOD 350
LYVWNA=LXVWNA+NSW1	LOD 360
LGAMA=LYVWNA+NSW1	LOD 370
LGML=LGAMA+NWNG+NSW1	LOD 380
LXLM=LGML+NSW1	LOD 390
LTHT=LXLM+NSW1	LOD 400
LSCL=LTHT+NNCW	LOD 410
LSCM=LSCL+NSW1	LOD 420
LSCD=LSCM+NSW1	LOD 430
LCOSP=LSCD+NSW1	LOD 440
LCNC=LCOSP+NNCW	LOD 450
LCSWL=LCNC+NSW1	LOD 460
LCSW1=LCSWL+NSW	LOD 470
LDCPA=LCSW1+NSW1	LOD 480
LDCP=LDCPA+NSW	LOD 490
LGMNW=LDCP+NWNP	LOD 500
LGMY=LGMNW+NWNP	LOD 510
LVY=LGMY+NWNG+NSW1	LOD 520
LCOEF=LVY+NWNG	LOD 530
LDCPN=LCOEF+NSW1*(NNCW+1)	LOD 540
LWX=LDCPN+NSW1	LOD 550
LWY=LWX+NWNG+NCW	LOD 560
LNEXT=LWY+NWNG+NCW	LOD 570
C LNEXT=28*NWNG+25*NSW+10*NCW-14	LOD 580
CALL COEFS (D(LCI),D(LCJ),D(LCK),D(LCONI),D(LCONJ),D(LCONK),D(LXVWLOD	590
ING),D(LYVWNG),D(LXLE),D(LXTE),D(LYLE),D(LSI),D(LC),D(LSWP),D(LXN),LOD	600
2D(LYN),D(LSNN),D(LTHETP),D(LCONS),D(LDUMMY),D(LCT),D(LQI),D(LQNN),LOD	610
3D(LQSWP),D(LXVWNA),D(LYVWNA),NWNP,D(LGAMA),D(LGML),D(LXLM),D(LTHT)LOD	620
4,D(LSCL),D(LSCM),D(LSCD),D(LCOSP),D(LCNC),D(LCSWL),D(LCSW1),D(LDCPLOD	630
5A),D(LDCP),D(LGMNW),D(LGMY),D(LVY),D(LCOEF),D(LDCPN),D(LWX),D(LWY)LOD	640
6,W,NSW1)	LOD 650
RETURN	LOD 660
END	LOD 670-

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SUBROUTINE COEFS (CI,CJ,CK,CONI,CONJ,CONK,XAVWNG,YAVWNG,XLE,XTE,YLCOF 10
1E,SI,C,SWP,XN,YN,SNN,THETP,CONS,DUMMY,CT,QI,QNN,QSWP,XAVWNA,YAVWNA COF 20
2,NWNG,GAMA,GML,XLM,THT,SECCL,SECCM,SECCD,COSP,CNC,CPSWL,CPSW1,DCP COF 30
3,DCP,GMNW,GMV,VY,COEF,DCPN,WX,WY,W,NSW1) COF 40
C COMPUTES THE AERODYNAMIC CHARACTERISTICS COF 50
COMMON /COEFF/ CL,FZMINS(10),FHS(2,10),RATIOS(2,10), COF 60
1CFCORE(2,10),RATIOC(2,10) COF 70
COMMON /ALLRB/ AX(210),ZMIN,NELM(11) COF 80
COMMON /GM/ ITER COF 90
COMMON /LEFLP/ YLEF(10,2),XNF(10),YNF(10),ZNF(10),XLF(10,4), COF 100
1YLF(10,4),SLP1(10),SS,CS,ITERS,ZBDYV(200),ZRDY(200) COF 110
2,CURV(10),CHND(10),SZBDYV(200) COF 120
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC COF 130
COMMON /ALLI/ NSW,NSWB,NCW,LWNG,NCPTTL,MITER COF 140
COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5) COF 150
COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2), COF 160
1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC COF 170
COMMON /ALLRA/ AA(17),SINA,COSA,AB(8),PI,AC,CBAR,HALFR,AREA COF 180
COMMON /NCT/ NCT,NCON,NBT,NCOR(15),KU1,NFSH(15),KUC,FLG(10) COF 190
COMMON /XSTN/ XRR(25),NBRR COF 200
COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),BBM(10,20), COF 210
1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),ZBDXV(200) COF 220
DIMENSION CI(1),CJ(1),CK(1),CONI(1),CONJ(1),CONK(1),XAVWNG(1COF 230
1),YAVWNG(1),XLE(1),XTE(1),YLE(1),SI(1),C(1),SWP(1),SNN(1),COF 240
2 CT(1),XN(NWNG,2),YN(NWNG,2),DUMMY(1),GAMA(1),GML(1),XLM(1),COF 250
3 THT(1),SECCL(1),SECCM(1),SECCD(1),COSP(1),CNC(1),CPSWL(1),COF 260
4CPSW1(1),DCPA(1),DCP(1),GMNW(1),GMV(1),VY(1),DCPN(1),WX(1),COF 270
5 WY(1),W(1),COEF(NSW1,1),CONS(1),THETP(1),QI(1),QNN(1),QSWPCOF 280
6(1),XAVWNA(1),YAVWNA(1) COF 290
DIMENSION CONST(3),XCP(100),YCP(100),CPCW1(10),YLM(15) COF 300
DIMENSION AW(4000),AWX(100),AWY(100) COF 310
COMMON /TAPE/ ITEST,IGOOD,SFAC(10),KU3,NSTOP COF 320
DIMENSION F(3),FTX(10,10),FTY(10,10),FTZ(10,10),A(3),B(3),GA(3) COF 330
DIMENSION GT(20) COF 340
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40) COF 350
C ***** COF 360
NSW1=NTS COF 370
NSW=NTS+1 COF 380
REWIND 1 COF 390
READ (1) NNCW,NWNP COF 400

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	READ (1) (QI(I),QNN(I),I=1,NNCW)	COF 410
	N2=NNCW*NC	COF 420
	READ (1) (QSWP(I),I=1,N2)	COF 430
	READ (1) (XAVWNA(I),YAVWNA(I),I=1,NSW1)	COF 440
	READ (1) (SNN(I),I=1,NCW)	COF 450
	N3=NCW*NC	COF 460
	READ (1) (SWP(I),I=1,N3)	COF 470
	READ (1) (XAVWNG(I),YAVWNG(I),I=1,NWNG)	COF 480
	READ (1) (C(I),I=1,NSW1)	COF 490
	READ (1) (THETP(I),I=1,NSW1)	COF 500
	READ (1) (XTE(I),XLE(I),YLE(I),I=1,NSW)	COF 510
	READ (1) (XLM(I),YLM(I),I=1,NSW1)	COF 520
	READ (1) (CONS(I),I=1,NSW1)	COF 530
	READ (1) (SI(I),ADUM,I=1,NCW)	COF 540
	READ (1) (XCP(I),YCP(I),I=1,NCPTTL)	COF 550
	READ (1) ((XN(I,J),YN(I,J),J=1,2),I=1,NWNG)	COF 560
	READ (1) (CT(I),I=1,NSW1)	COF 570
	CALL SKIPR (1,1)	COF 580
	READ (1) (CPCW1(I),I=1,NCW)	COF 590
	READ (1) (CPSWL(I),I=1,NSW)	COF 600
	READ (1) (CPSW1(I),I=1,NSW1)	COF 610
	NWNB=NWNG*NSW1	COF 620
	REWIND 2	COF 630
	READ (2) (GAMA(I),I=1,NWNB)	COF 640
C	*****	COF 650
	PIJ=PI/(2.*FLOAT(NCW))	COF 660
	DO 10 J=1,NCW	COF 670
10	COSP(J)=COS((2.*FLOAT(J)-1.)*PIJ)	COF 680
	IJ=M1(1)	COF 690
	Y1=YLE(IJ)	COF 700
	MSW=M1(1)	COF 710
	CONST(1)=Y1*PI/(AREA*FLOAT(MSW))	COF 720
	IF (ITRAKE.EQ.1) GO TO 20	COF 730
	Y2=HALFB-Y1	COF 740
	MSW=M1(2)	COF 750
	CONST(2)=Y2*PI/(AREA*FLOAT(MSW))	COF 760
20	CONTINUE	COF 770
	DO 40 I=1,NSW1	COF 780
	GT(I)=0.	COF 790
	K1=1	COF 800
	IF (ITRAKE.NE.1.AND.I.GE.M1(1)) K1=M1(1)	COF 810

30	GT(I)=GT(I)+GAMA(NWNG+K1)	COF 820
	K1=K1+1	COF 830
	IF (K1,GT,I) GO TO 40	COF 840
	GO TO 30	COF 850
40	CONTINUE	COF 860
C	CALCULATION OF GMY-VALUES FOR WING SURFACE	COF 870
	NCON=0	COF 880
	NCT=0	COF 890
	NBT=0	COF 900
	KI=1	COF 910
	MX=M1(KI)-1	COF 920
	DO 70 II=1,NSW1	COF 930
	IF (II,GT,MX) GO TO 50	COF 940
	GO TO 60	COF 950
50	KI=KI+1	COF 960
	MX=MX+M1(KI)-1	COF 970
60	CONTINUE	COF 980
	DO 70 J=1,NCW	COF 990
	I=(II-1)*NCW+J	COF1000
	JJ=(KI-1)*NCW+J	COF1010
	XEE=XAVWNG(I)	COF1020
	YEE=YAVWNG(I)	COF1030
	ZEE=0.	COF1040
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONCOF1050	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,ADUM,BDUM,CDUM,GAMA,COF1060	
	2YLM)	COF1070
	UU=UU	COF1080
	VV=VV	COF1090
	ST=SQRT(1.+SZRDYV(I)**2)	COF1100
	SD=SZRDYV(I)/ST	COF1110
	TNSP=TAN(SWP(JJ))	COF1120
	PHIY=ATAN(SZRDYV(I))	COF1130
	ACP=SS*SIN(PHIY)	COF1140
	GMY(I)=GAMA(I)*(UU-(VV*COS(PHIY)+ACP)*TNSP)	COF1150
70	CONTINUE	COF1160
C	CALCULATION OF INDUCED VELOCITIES AT BOUND ELEMENT END-POINTS ON	COF1180
C	WING SURFACE	COF1190
	NAERO=0	COF1200
	DO 90 I=1,NSW1	COF1210
	DO 80 J=1,NCW	COF1220
	NP=(I-1)*NCW+J	COF1230

	XEE=XN(NP,2)	COF1240
	YEE=YN(NP,2)	COF1250
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONCOF1260	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,ADUM,BDUM,CDUM,GAMA,COF1270	
	2YLM)	COF1280
	ST=SQRT(1.+S7BDYV(NP)**2)	COF1290
	SD=S7BDYV(NP)	COF1300
	VY(NP)=VV	COF1310
80	CONTINUE	COF1320
90	CONTINUE	COF1330
C	CALCULATION OF GMY-VALUES FOR BOUND ELEMENTS NEAR LEADING-EDGE	COF1340
	DO 100 J=1,NNCW	COF1350
	FJ=J	COF1360
100	THT(J)=(2.*FJ-1.)*PI/(2.*FLOAT(NNCW))	COF1370
	SURA=8.*FLOAT(NNCW)/(4.*PI*SIN(THT(1)))	COF1380
	DO 110 I=1,MAXL	COF1390
	NGI=NWNG+I	COF1400
110	GML(I)=GAMA(NGI)*SURA/C(I)	COF1410
C	COF1420
	REWIND 3	COF1430
	WRITE (3) (GML(I),I=1,NSW1)	COF1440
C	COF1450
	NAERO=1	COF1460
	DO 140 II=1,MAXL	COF1470
	XEE=XAVWNA(II)	COF1480
	YEE=YAVWNA(II)	COF1490
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONCOF1500	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,ADUM,BDUM,CDUM,GAMA,COF1510	
	2YLM)	COF1520
	JJ=1	COF1530
	KI=1	COF1540
	MX=M1(KI)-1	COF1550
	TNSP=TAN(QSWP(JJ))	COF1560
	IF (II.GT.MX) GO TO 120	COF1570
	GO TO 130	COF1580
120	KI=KI+1	COF1590
	MX=MX+M1(KI)-1	COF1600
	JJ=(KI-1)*NNCW+1	COF1610
	TNSP=TAN(QSWP(JJ))	COF1620
130	CONTINUE	COF1630
	NWNGII=NWNG+II	COF1640

	IJ=(II-1)*NNCW+1	COF1650
	ST=SQRT(1.+ZRDYV(IJ)**2)	COF1660
	SD=ZRDYV(IJ)/ST	COF1670
	PHIY=ATAN(ZRDYV(IJ))	COF1680
	ACP=SS*SIN(PHIY)	COF1690
	GMY(NWNGII)=GML(II)*(UU-(VV*COS(PHIY)+ACP)*TNSP)	COF1700
140	CONTINUE	COF1710
C	CALCULATION OF DCP-VALUES FOR WING POINTS	COF1720
	PN=PI/(FLOAT(NCW))	COF1730
	DO 150 I=1,NCW	COF1740
	W(I)=0.	COF1750
	WX(I)=XN(I,1)	COF1760
150	WY(I)=YN(I,1)	COF1770
	DO 230 I=1,NSW1	COF1780
	DO 220 J=1,NCW	COF1790
	NP=(I-1)*NCW+J	COF1800
	VYY=VY(NP)	COF1810
	CPG=0.	COF1820
	CPH=0.	COF1830
	CPI=0.	COF1840
	IF (I.EQ.NSW1.AND.(PXT(NC+1)-PXL(NC+1)).NE.0.) GO TO 210	COF1850
	DO 170 JJ=1,J	COF1860
	NPIN=(I-1)*NCW+JJ	COF1870
	IF (J.EQ.JJ) GO TO 160	COF1880
	CPG=CPG+GAMA(NPIN)*SI(JJ)	COF1890
	GO TO 170	COF1900
160	CPG=CPG+0.5*GAMA(NPIN)*SI(JJ)	COF1910
170	CONTINUE	COF1920
	IF (I.EQ.NSW1) ACPG=CPG*C(I)*PN	COF1930
	CPG=-CPG*PN*C(I)*VYY	COF1940
	IF (I.EQ.NSW1) GO TO 200	COF1950
	DO 190 JJ=1,J	COF1960
	NPOT=I*NCW+JJ	COF1970
	IF (J.EQ.JJ) GO TO 180	COF1980
	CPH=CPH+GAMA(NPOT)*SI(JJ)	COF1990
	GO TO 190	COF2000
180	CPH=CPH+0.5*GAMA(NPOT)*SI(JJ)	COF2010
190	CONTINUE	COF2020
	CPH=CPH*PN*C(I+1)*VYY	COF2030
	GO TO 210	COF2040
200	YI=YLE(NSW)	COF2050

	A1=SQRT(1.-(Y1/HALFR)**2)	COF2060
	A2=SQRT(1.-(YLM(I)/HALFR)**2)	COF2070
	CPH=ACPG*A1/A2*VYY	COF2080
210	CPI=2.*GAMA(NWNG+I)*VYY	COF2090
	IF (I.NE.NSW1) W(NP+NCW)=2.*(CPG+CPH+CPI)/(YLE(I+2)-YLE(I))	COF2100
	IF (I.EQ.NSW1) W(NP+NCW)=(CPG+CPH+CPI)/(YLE(I+1)-YLE(I))	COF2110
	WX(NP+NCW)=XN(NP,2)	COF2120
	WY(NP+NCW)=YN(NP,2)	COF2130
220	CONTINUE	COF2140
230	CONTINUE	COF2150
C	STRAKE SECTION INTERPOLATION	COF2160
	LL=1	COF2170
	INIP=0	COF2180
	MSX=M1(1)-1	COF2190
	MPX=M1(1)	COF2200
	N3=NCW*M1(1)+3	COF2210
	DO 240 I=1,MPX	COF2220
	DO 240 J=1,NCW	COF2230
	NP=(I-1)*NCW+J	COF2240
	AW(NP)=W(NP)	COF2250
	AWX(NP)=WX(NP)	COF2260
	AWY(NP)=WY(NP)	COF2270
240	CONTINUE	COF2280
	GO TO 270	COF2290
C	WING SECTION INTERPOLATION	COF2300
250	LL=2	COF2310
	INIP=NCW*(M1(1)-1)	COF2320
	MSX=M1(2)-1	COF2330
	MPX=M1(2)	COF2340
	N3=NCW*M1(2)+3	COF2350
	DO 260 I=1,MPX	COF2360
	DO 260 J=1,NCW	COF2370
	NP=(I-1)*NCW+J	COF2380
	MP=NP+INIP	COF2390
	AW(NP)=W(MP)	COF2400
	AWX(NP)=WX(MP)	COF2410
	AWY(NP)=WY(MP)	COF2420
260	CONTINUE	COF2430
270	CALL SURFSET (N3,AWX,AWY,AW,CI)	COF2440
	DO 290 K=1,NCW	COF2450
	DO 280 J=1,MSX	COF2460

	NP=INIP+(J-1)*NCW+K	COF2470
	DCP1=2.*GMY(NP)	COF2480
	XEE=XAVWNG(NP)	COF2490
	YEE=YAVWNG(NP)	COF2500
	CALL SURFORD (AW,XEE,YEE,VV,N3)	COF2510
	DCPD=VV	COF2520
	DCP(NP)=DCP1+DCPD	COF2530
280	CONTINUE	COF2540
290	CONTINUE	COF2550
	IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 250	COF2560
C	CALCULATION OF INDUCED VELOCITIES AT END-POINTS OF BOUND ELEMENTS	COF2570
C	NEAR LEADING-EDGE	COF2580
	NAERO=0	COF2590
	CPC=0.5*(1.-COS(THT(1)))	COF2600
	DO 300 I=2,NSW	COF2610
	XEE=XLE(I)+CPC*(XTE(I)-XLE(I))	COF2620
	YEE=YLE(I)	COF2630
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONC	COF2640
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,ADUM,BDUM,CDUM,GAMA,	COF2650
	2YLM)	COF2660
	IJ=(I-2)*NNCW+1	COF2670
	ST=SQRT(1.+ZBDYV(IJ)**2)	COF2680
	SD=ZRDYV(IJ)/ST	COF2690
300	VY(I)=VV	COF2700
C	DCP-INTERPOLATION FOR BOUND ELEMENTS OF WING	COF2710
	CALL INTGMY (NCW,NSW1,DCP,SNN,COEF,DUMMY(1),DUMMY(NNCW))	COF2720
C	CALCULATION OF DECREASE IN DCP-VALUES AT THE LEADING-EDGE	COF2730
	DO 310 I=1,NSW1	COF2740
	CNC(I)=-2.*GMY(NWNG+I)	COF2750
310	CONTINUE	COF2760
C	FINAL DCP-VALUES AT LARGER WING GRID	COF2770
	DO 350 I=1,NSW1	COF2780
	DO 340 J=1,NNCW	COF2790
	NP=(I-1)*NNCW+J	COF2800
	GMNW(NP)=COEF(I,1)	COF2810
	DO 320 K=1,NCW	COF2820
	FK=K	COF2830
	AMI1=COS(FK*THT(J))	COF2840
	AMI2=AMI1*COEF(I,K+1)	COF2850
	GMNW(NP)=GMNW(NP)+AMI2	COF2860
320	CONTINUE	COF2870

	GMNW(NP)=GMNW(NP)/(SIN(THT(J)))	COF2880
	IF (J.NE.1) GO TO 330	COF2890
	NGI=NWNG+I	COF2900
	GMNW(NP)=GMNW(NP)+CNC(I)	COF2910
330	CONTINUE	COF2920
340	CONTINUE	COF2930
350	CONTINUE	COF2940
	DO 360 I=1,NWNP	COF2950
360	DCP(I)=GMNW(I)	COF2960
	DO 370 I=1,NWNP	COF2970
370	CONTINUE	COF2980
	PIJ=PI/(2.*FLOAT(NNCW))	COF2990
	WRITE (6,650)	COF3000
	IF (ITER.GE.KU3) WRITE (ITEST,650)	COF3010
	DO 380 I=1,NSWI	COF3020
	DO 380 J=1,NNCW	COF3030
	NP=(I-1)*NNCW+J	COF3040
	CPCW=0.5*(1.-COS((2.*FLOAT(J)-1.)*PIJ))	COF3050
	IF (ITER.GE.KU3) WRITE (ITEST,660) CPCW,CPSW1(I),DCP(NP)	COF3060
380	WRITE (6,660) CPCW,CPSW1(I),DCP(NP)	COF3070
	DO 390 J=1,NNCW	COF3080
390	COSP(J)=COS((2.*FLOAT(J)-1.)*PIJ)	COF3090
C	EVALUATION OF SECTIONAL AND TOTAL AERODYNAMIC CHARACTERSTICS	COF3100
	CL=0.	COF3110
	CM=0.	COF3120
	CD=0.	COF3130
	CTT=0.	COF3140
	DO 430 I=1,NSWI	COF3150
	SECCL(I)=0.	COF3160
	SECCD(I)=0.	COF3170
	SECCM(I)=0.	COF3180
	KS=1	COF3190
	MSW=M1(1)	COF3200
	NIM=0	COF3210
	IF (ITRAKE.NE.1.AND.I.GT.M1(1)-1) GO TO 400	COF3220
	GO TO 410	COF3230
400	KS=2	COF3240
	MSW=M1(2)	COF3250
	NIM=M1(1)-1	COF3260
410	CONTINUE	COF3270
	PHII=PI*FLOAT(I-NIM)/FLOAT(MSW)	COF3280

	SPI=SIN(PHI I)	COF3290
	DO 420 J=1,NNCW	COF3300
	NP=(I-1)*NNCW+J	COF3310
	FT=SQRT(1.+ZBDXV(NP)**2+ZBDYV(NP)**2)	COF3320
	FAC=(7BDXV(NP)*SS+CS)/FT	COF3330
	FAS=(-7BDXV(NP)*CS+SS)/FT	COF3340
	SECCL(I)=SECCL(I)+DCP(NP)*QI(J)*FAC	COF3350
	SECCD(I)=SECCD(I)+DCP(NP)*QI(J)*FAS	COF3360
	SECCM(I)=SECCM(I)-DCP(NP)*QI(J)*(XLM(I)+0.5*C(I)*(1.-COSP(J)))/CBAC	COF3370
	1R/FT	COF3380
420	CONTINUE	COF3390
	SECCL(I)=SECCL(I)*PI/(2.*FLOAT(NNCW))	COF3400
	SECCM(I)=SECCM(I)*PI/(2.*FLOAT(NNCW))	COF3410
	SECCD(I)=SECCD(I)*PI/(2.*FLOAT(NNCW))	COF3420
	NL=NWNG+I	COF3430
	FAS=(-7BDXV(NL)*CS+SS)/FT	COF3440
	FAC=(7BDXV(NL)*SS+CS)/FT	COF3450
	FT=SQRT(1.+ZBDXV(NL)**2+ZBDYV(NL)**2)	COF3460
	SECCL(I)=SECCL(I)+CT(I)*FAC	COF3470
	SECCD(I)=SECCD(I)-CT(I)*FAS	COF3480
	CL=CL+SECCL(I)*C(I)*SPI*CONST(KS)	COF3490
	CM=CM+SECCM(I)*C(I)*SPI*CONST(KS)	COF3500
	CD=CD+SECCD(I)*C(I)*SPI*CONST(KS)	COF3510
430	CTT=CTT+CT(I)*C(I)*SPI*CONST(KS)	COF3520
C	COF3530
	WRITE (7) CL,CM,CD,CTT	COF3540
C	COF3550
	WRITE (6,620) (I,SECCL(I),SECCM(I),SECCD(I),CT(I),I=1,NSW1)	COF3560
	IF (ITER.GE.KU3) WRITE (ITEST,620) (I,SECCL(I),SECCM(I),SECCD(I),CT(I),I=1,NSW1)	COF3570
	1T(I),I=1,NSW1)	COF3580
	WRITE (6,630) CL,CM,CD,CTT	COF3590
	IF (ITER.GE.KU3) WRITE (ITEST,630) CL,CM,CD,CTT	COF3600
	NNCW1=NNCW+1	COF3610
	CALL INTGMY (NNCW,NSW1,DCP,QNN,COEF,DUMMY(1),DUMMY(NNCW1))	COF3620
	REWIND 1	COF3630
	CALL SKIPR (1,10)	COF3640
	READ (1) (XLM(I),CI(I),I=1,NSW1)	COF3650
C	EVALUATION OF DCP AT CONSTANT X LOCATIONS	COF3660
	DO 520 K=1,NBRR	COF3670
	XBR=XBRR(K)	COF3680
	IF (XBR.GE.PXL(NC+1)) GO TO 460	COF3690

	KY=1	COF3700
440	IF (XBR.LT.XLM(KY)) GO TO 450	COF3710
	KY=KY+1	COF3720
	IF (KY.LE.NSW1) GO TO 440	COF3730
450	KY=KY-1	COF3740
	BLOCAL=CI(KY)+(CI(KY+1)-CI(KY))*(XBR-XLM(KY))/(XLM(KY+1)-XLM(KY))	COF3750
	GO TO 470	COF3760
460	BLOCAL=PYL(NC+1)	COF3770
	KY=NSW1	COF3780
470	CONTINUE	COF3790
	DO 490 I=1,KY	COF3800
	CJ(I)=CI(I)/BLOCAL	COF3810
	XC=(XRP-XLM(I))/C(I)	COF3820
	THTA=ARCOS(1.-2.*XC)	COF3830
	DCPN(I)=COEF(I,1)	COF3840
	DO 480 J=1,NNCW	COF3850
480	DCPN(I)=DCPN(I)+COEF(I,J+1)*COS(FLOAT(J)*THTA)	COF3860
	DCPN(I)=DCPN(I)/(SIN(THTA))	COF3870
C	WHENEVER THE NEGATIVE CP OCCURS AFTER SPANWISE INTERPOLATION, THE	COF3880
C	FOLLOWING CORRECTION WILL BE MADE	COF3890
	IF (DCPN(I).GT.0.) GO TO 490	COF3900
	IF (I.EQ.1) GO TO 490	COF3910
	DX=CJ(I-1)-1.0	COF3920
	DY=DCPN(I-1)-0.	COF3930
	DYDX=DY/DX	COF3940
	DX1=CJ(I)-1.0	COF3950
	DCPN(I)=DYDX*DX1	COF3960
490	CONTINUE	COF3970
	IF (DCPN(1).LT.0.) GO TO 500	COF3980
	GO TO 510	COF3990
500	DX=CJ(2)	COF4000
	DY=DCPN(2)-0.5*DCPN(2)	COF4010
	DYDX=DY/DX	COF4020
	DX1=CJ(1)	COF4030
	DCPN(1)=0.5*DCPN(2)+DYDX*DX1	COF4040
510	CONTINUE	COF4050
	WRITE (6,640) XBR,(CI(I),CJ(I),DCPN(I),I=1,KY)	COF4060
	IF (ITER.GE.KU3) WRITE (ITEST,640) XBR,(CI(I),CJ(I),DCPN(I),I=1,KY	COF4070
	1)	COF4080
520	CONTINUE	COF4090
C	COMPUTE THE FORCE ON THE FREE SHEET SEGMENTS AFTER SATISFING	COF4100

C	BOUNDARY CONDITION	COF4110
	IF (ITER.LT.KU1+1) GO TO 610	COF4120
	SFAC(ITER)=0.	COF4130
	NCT=0	COF4140
	LL=1	COF4150
	L1=1	COF4160
	KS=2	COF4170
	KE=M1(1)-1	COF4180
	GO TO 540	COF4190
530	LL=2	COF4200
	L1=M1(1)	COF4210
	KS=M1(1)+1	COF4220
	KE=MAXL	COF4230
540	CONTINUE	COF4240
	NAERO=0	COF4250
	NCR2=NCOR(L1)-2	COF4260
	DO 550 J=5,NCR2	COF4270
	DO 550 I=KS,KF	COF4280
	GMA=GAMA(NWNG+I)	COF4290
	NBT=0	COF4300
	NCON=I	COF4310
	XEE=0.5*(XE(I,J)+XE(I,J+1))	COF4320
	YEE=0.5*(YE(I,J)+YE(I,J+1))	COF4330
	ZEE=0.5*(ZE(I,J)+ZE(I,J+1))	COF4340
	IF (J.EQ.5) FZMINS(I)=0.50*ZE(I,J+1)	COF4350
	CALL NEWVEL (C,THFTP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONC	COF4360
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YC	COF4370
	2LM)	COF4380
	A(1)=XE(I,J+1)-XE(I,J)	COF4390
	A(2)=YE(I,J+1)-YE(I,J)	COF4400
	A(3)=ZE(I,J+1)-ZE(I,J)	COF4410
	GA(1)=GMA*A(1)/AREA	COF4420
	GA(2)=GMA*A(2)/AREA	COF4430
	GA(3)=GMA*A(3)/AREA	COF4440
	B(1)=UU	COF4450
	B(2)=VV	COF4460
	B(3)=WW	COF4470
	CALL CRSPRD (B,GA,F)	COF4480
	FTX(I,J)=F(1)	COF4490
	FTY(I,J)=F(2)	COF4500
	FTZ(I,J)=F(3)	COF4510

550	CONTINUE	COF4520
	NSW5=NELM(L1)-NCOR(L1)	COF4530
	NAERO=1	COF4540
	CFTX=0.	COF4550
	CFTY=0.	COF4560
	CFTZ=0.	COF4570
	FCXYZ=0.	COF4580
	DO 560 I=1,NSW5	COF4590
	II=NCOR(L1)+I	COF4600
	NCON=(L1-1)+I	COF4610
	IF (NCON.GE.KE) NCON=KE	COF4620
	NBT=1	COF4630
	XEE=0.5*(XE(L1,II-1)+XE(L1,II))	COF4640
	YEE=0.5*(YE(L1,II-1)+YE(L1,II))	COF4650
	ZEE=0.5*(ZE(L1,II-1)+ZE(L1,II))	COF4660
	GMA=GT(NCON)	COF4670
	A(1)=XE(L1,II)-XE(L1,II-1)	COF4680
	A(2)=YE(L1,II)-YE(L1,II-1)	COF4690
	A(3)=ZE(L1,II)-ZE(L1,II-1)	COF4700
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONCOF4710	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YCOF4720	
	2LM)	COF4730
	GA(1)=GMA*A(1)/AREA	COF4740
	GA(2)=GMA*A(2)/AREA	COF4750
	GA(3)=GMA*A(3)/AREA	COF4760
	B(1)=UU	COF4770
	B(2)=VV	COF4780
	B(3)=WW	COF4790
	CALL CRSPRD (B,GA,F)	COF4800
	FCXYZ=FCXYZ+SQRT(F(1)**2+F(2)**2+F(3)**2)	COF4810
	CFTX=CFTX+F(1)	COF4820
	CFTY=CFTY+F(2)	COF4830
	CFTZ=CFTZ+F(3)	COF4840
560	CONTINUE	COF4850
	CFTXYZ=SQRT(CFTX**2+CFTY**2+CFTZ**2)	COF4860
	CFCORE(LL,ITER)=CFTXYZ	COF4870
	TFTX=0.	COF4880
	TFTY=0.	COF4890
	TFTZ=0.	COF4900
	FSXYZ=0.	COF4910
	DO 580 I=KS,KE	COF4920

	NCC=NCOR(I)-2	COF4930
	DO 570 J=5,NCC	COF4940
	TFTX=TFTX+FTX(I,J)	COF4950
	TFTY=TFTY+FTY(I,J)	COF4960
	TFTZ=TFTZ+FTZ(I,J)	COF4970
	FSXYZ=FSXYZ+SQRT(FTX(I,J)**2+FTY(I,J)**2+FTZ(I,J)**2)	COF4980
570	CONTINUE	COF4990
580	CONTINUE	COF5000
	TFXYZ=SQRT(TFTX**2+TFTY**2+TFTZ**2)	COF5010
	FHS(LL,ITER)=TFXYZ	COF5020
	SFAC(ITER)=SFAC(ITER)+(FCXYZ+FSXYZ)	COF5030
	IF (ITRAKE.NF.1.AND.LL.EQ.1) GO TO 530	COF5040
	IF (ITER.EQ.KU3) GO TO 600	COF5050
	IF (ITER.GE.KU3+1) GO TO 590	COF5060
	GO TO 610	COF5070
590	CONTINUE	COF5080
	IF (SFAC(ITER).LE.SFAC(ITER-1)) GO TO 600	COF5090
	REWIND ITEST	COF5100
	NSTOP=1	COF5110
	MITER=ITER	COF5120
	GO TO 610	COF5130
600	I=ITEST	COF5140
	ITEST=IGOOD	COF5150
	IGOOD=I	COF5160
	NSTOP=0	COF5170
	REWIND ITEST	COF5180
610	CONTINUE	COF5190
	RETURN	COF5200
C		COF5210
620	FORMAT (1H1,/,9X,20HSECTIONAL PROPERTIES,/,9X,20H*****	COF5230
	1****,/,9X,38HI CL CM CD CT,/,9X,38H*	COF5240
	2 ** */, (I10,4F10.5))	COF5250
630	FORMAT (1H ,/,9X,23HTOTAL LIFT COEFFICIENT=,F10.5,/,9X,34HTOTAL PICOF5260	
	ITCHING MOMENT COEFFICIENT=,F10.5,/,9X,23HTOTAL DRAG COEFFICIENT=,FCOF5270	
	210.5,/,9X,25HTOTAL THRUST COEFFICIENT=,F10.5)	COF5280
640	FORMAT (1H ,/,34H SPANWISE PRESSURE AT CONSTANT X=,F10.5,/,8X,25HCOF5290	
	1Y 2Y/B (LOCAL) DELTA-CP,/, (1X,2F10.5,2X,F10.5))	COF5300
650	FORMAT (1H1,/,5X,21HDELTA-CP DISTRIBUTION,/,5X,21H*****	COF5310
	1*****/,30H X/C 2Y/B DELTA-CP,/,30H *** ***)	COF5320
	2* *****)	COF5330
660	FORMAT (1H ,3F10.5)	COF5340

END

COF5350-

```
C SUBROUTINE INTGMY (NCW,NSWI,SGM,SNN,COEF,F,THETA)          INT 10
  SETS UP COEFFICIENTS OF A MATRIX FOR DCP-INTERPOLATION  INT 20
  DIMENSION SGM(1), SNN(1), F(1), THETA(1), COEF(NSWI,1)  INT 30
  PI=3.14159265                                           INT 40
  N1=NCW+1                                               INT 50
  FN=NCW                                                 INT 60
  DO 40 I=1,NSWI                                         INT 70
  DO 10 J=1,NCW                                          INT 80
  NK=(I-1)*NCW+J                                        INT 90
  FJ=J                                                  INT 100
  THETA(J)=(2.*FJ-1.)*PI/(2.*FN)                        INT 110
10 F(J)=SGM(NK)*SNN(J)                                  INT 120
  DO 30 J=1,N1                                          INT 130
  COEF(I,J)=0.                                          INT 140
  FJ=J                                                  INT 150
  DO 20 K=1,NCW                                         INT 160
20 COEF(I,J)=COEF(I,J)+F(K)*COS((FJ-1.)*THETA(K))      INT 170
  IF (J.EQ.1) COEF(I,J)=COEF(I,J)/FN                   INT 180
  IF (J.NE.1) COEF(I,J)=COEF(I,J)*2./FN                INT 190
30 CONTINUE                                             INT 200
40 CONTINUE                                             INT 210
  RETURN                                               INT 220
  END                                                 INT 230-
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C SUBROUTINE SURFSET (N3,X,Y,W,IWK)                      SRF 10
  SET UP PROGRAM FOR SURFACE SPLINE                    SRF 20
C   WRITTEN BY - ROBERT N. DESMARAIS, STRUCTURES AND DYNAMICS DIV. SRF 30
C   LANGLEY RESEARCH CENTER, HAMPTON, VA.23665         SRF 40
C   DIMENSION X(I), Y(I), W(N3,I), IWK(I)              SRF 50
  E=1.E-10                                             SRF 60
  NZ=1                                                 SRF 70
  N=N3-3                                               SRF 80
  N1=N+1                                               SRF 90
  N2=N+2                                               SRF 100
  N4=N3+1                                             SRF 110
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	RN=1./N	SRF 120
	N3Z=N3+NZ	SRF 130
	NZ3=NZ+3	SRF 140
C	COMPUTE SCALING PARAMETERS, UB,UX,UY,VB,VX,XY	SRF 150
	XB=0.	SRF 160
	YB=0.	SRF 170
	PXX=0.	SRF 180
	PXY=0.	SRF 190
	PYY=0.	SRF 200
	TH=0.	SRF 210
	DO 10 I=1,N	SRF 220
	XB=XB+X(I)	SRF 230
	YB=YB+Y(I)	SRF 240
	PXX=PXX+X(I)*X(I)	SRF 250
	PXY=PXY+X(I)*Y(I)	SRF 260
10	PYY=PYY+Y(I)*Y(I)	SRF 270
	XB=RN*XB	SRF 280
	YB=RN*YB	SRF 290
	PXX=RN*PXX-XB*XB	SRF 300
	PXY=RN*PXY-XB*YB	SRF 310
	PYY=RN*PYY-YB*YB	SRF 320
	IF (PXY.NE.0) TH=.5*ATAN2(2.*PXY,PYY-PXX)	SRF 330
	CT=COS(TH)	SRF 340
	ST=SIN(TH)	SRF 350
	C2=CT*CT	SRF 360
	CS=2.*CT*ST	SRF 370
	S2=ST*ST	SRF 380
	SU=1./SQRT(PXX*C2-PXY*CS+PYY*S2)	SRF 390
	SV=1./SQRT(PXX*S2+PXY*CS+PYY*C2)	SRF 400
	UX=SU*CT	SRF 410
	UY=-SU*ST	SRF 420
	VX=SV*ST	SRF 430
	VY=SV*CT	SRF 440
	UB=-(UX*XB+UY*YB)	SRF 450
	VB=-(VX*XB+VY*YB)	SRF 460
C	PUT Z INTO ITS W LOCATION	SRF 470
	IZ=N*NZ	SRF 480
	DO 30 J=N4,N3Z	SRF 490
	DO 20 I=1,3	SRF 500
20	W(I,J)=0	SRF 510
	DO 30 I=4,N3	SRF 520

	W(I,N37+N4-J)=W(IZ,I)	SRF 530
30	IZ=IZ-1	SRF 540
C	PUT U,V (SCALED X,Y) INTO THEIR W LOCATIONS	SRF 550
	DO 40 J=N1,N3	SRF 560
	DO 40 I=1,3	SRF 570
40	W(I,J)=0	SRF 580
	DO 50 J=1,N	SRF 590
	JB=N4-J	SRF 600
	W(1,J)=1.	SRF 610
	W(JB,N1)=W(1,J)	SRF 620
	W(2,J)=UB+UX*X(J)+UY*Y(J)	SRF 630
	W(JB,N2)=W(2,J)	SRF 640
	W(3,J)=VB+VX*X(J)+VY*Y(J)	SRF 650
50	W(JB,N3)=W(3,J)	SRF 660
	DO 60 J=1,N	SRF 670
	JB=N4-J	SRF 680
C	COMPUTE H MATRIX IN W	SRF 690
	DO 60 I=4,JB	SRF 700
	IB=N4-I	SRF 710
	R2=(W(2,J)-W(2,IB))**2+(W(3,J)-W(3,IB))**2	SRF 720
	W(I,J)=R2*ALOG(R2+E)	SRF 730
60	W(JB,IR)=W(I,J)	SRF 740
C	MATOPS IS THE SYSTEM LIBRARY ROUTINE FOR SOLVING LINEAR EQUATIONS	SRF 750
	N31=N3+1	SRF 760
	CALL MATINV (N3,N3,W.1,W(1,N31),1,DET,ISC,IWK,IWK(N4))	SRF 770
C	PUT S,U,V IN LOW W	SRF 780
	W(1,1)=N3*(3.+NZ)	SRF 790
	W(2,1)=N	SRF 800
	W(3,1)=E	SRF 810
	DO 70 I=1,N	SRF 820
	W(I+3,1)=0	SRF 830
	W(I,2)=UB+UX*X(I)+UY*Y(I)	SRF 840
70	W(I,3)=VB+VX*X(I)+VY*Y(I)	SRF 850
	W(N1,2)=UB	SRF 860
	W(N2,2)=UX	SRF 870
	W(N3,2)=UY	SRF 880
	W(N1,3)=VB	SRF 890
	W(N2,3)=VX	SRF 900
	W(N3,3)=VY	SRF 910
	IF (NZ.EQ.0) RETURN	SRF 920
	DO 80 J=4,NZ3	SRF 930

	DO 80 I=1,N3	SRF 940
C	LEFT SHIFT A,B MATRICES N COLUMNS	SRF 950
80	W(I,J)=W(I,N+J)	SRF 960
	RETURN	SRF 970
	END	SRF 980-

	SUBROUTINE SUPFORD (W,XP,YP,ZP,N3)	FRD 10
C	SURFACE SPLINE INTERPOLATION (ORDINATES)	FRD 20
C	WRITTEN BY - ROBERT N. DESMARAIS, STRUCTURES AND DYNAMICS DIV.	FRD 30
C	LANGLEY RESEARCH CENTER, HAMPTON, VA.23665	FRD 40
	DIMENSION W(N3,1)	FRD 50
	N=N3-3	FRD 60
	N1=N+1	FRD 70
	N2=N+2	FRD 80
	U=W(N1,2)+W(N2,2)*XP+W(N3,2)*YP	FRD 90
	V=W(N1,3)+W(N2,3)*XP+W(N3,3)*YP	FRD 100
	ZP=W(N1,4)+W(N2,4)*II+W(N3,4)*V	FRD 110
	DO 10 I=1,N	FRD 120
	R2=(U-W(I,2))**2+(V-W(I,3))**2	FRD 130
10	ZP=ZP+W(I,4)*R2*ALOG(R2+W(3,1))	FRD 140
	RETURN	FRD 150
	END	FRD 160-

	SUBROUTINE MATINV (MAX,N,A,M,B,IOP,DETERM,ISCALE,IPIVOT,IWK)	MAT 10
C	MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS	MAT 20
C	PROVIDED BY - ANALYSIS AND COMPUTATION DIVISION	MAT 30
C	LANGLEY RESEARCH CENTER	MAT 40
C	HAMPTON, VA. 23665	MAT 50
	DIMENSION IPIVOT(N), A(MAX,N), B(MAX,N), IWK(MAX,2)	MAT 60
	EQUIVALENCE (IROW,JROW), (ICOLUM,JCOLUM), (AMAX,T,SWAP)	MAT 70
C		MAT 80
C	INITIALIZATION	MAT 90
C		MAT 100
	ISCALE=0	MAT 110
	R1=10.0**100	MAT 120
	R2=1.0/R1	MAT 130
	DETERM=1.0	MAT 140

	DO 10 J=1,N	MAT 150
10	IPIVOT(J)=0	MAT 160
	DO 370 I=1,N	MAT 170
C		MAT 180
C	SEARCH FOR PIVOT ELEMENT	MAT 190
C		MAT 200
	AMAX=0.0	MAT 210
	DO 60 J=1,N	MAT 220
	IF (IPIVOT(J)-1) 20,60,20	MAT 230
20	DO 50 K=1,N	MAT 240
	IF (IPIVOT(K)-1) 30,50,410	MAT 250
30	IF (ABS(AMAX)-ABS(A(J,K))) 40,50,50	MAT 260
40	IROW=J	MAT 270
	ICOLUM=K	MAT 280
	AMAX=A(J,K)	MAT 290
50	CONTINUE	MAT 300
60	CONTINUE	MAT 310
	IF (AMAX) 80,70,80	MAT 320
70	DETERM=0.0	MAT 330
	ISCALE=0	MAT 340
	GO TO 410	MAT 350
80	IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1	MAT 360
C		MAT 370
C	INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL	MAT 380
C		MAT 390
	IF (IROW-ICOLUM) 90,130,90	MAT 400
90	DETERM=-DETERM	MAT 410
	DO 100 L=1,N	MAT 420
	SWAP=A(IROW,L)	MAT 430
	A(IROW,L)=A(ICOLUM,L)	MAT 440
100	A(ICOLUM,L)=SWAP	MAT 450
	IF (M) 130,130,110	MAT 460
110	DO 120 L=1,M	MAT 470
	SWAP=R(IROW,L)	MAT 480
	B(IROW,L)=B(ICOLUM,L)	MAT 490
120	B(ICOLUM,L)=SWAP	MAT 500
130	IWK(I,1)=IROW	MAT 510
	IWK(I,2)=ICOLUM	MAT 520
	PIVOT=A(ICOLUM,ICOLUM)	MAT 530
	IF (IOP.EQ.1) GO TO 270	MAT 540
	IF (PIVOT) 140,70,140	MAT 550

C		MAT 560
C	SCALE THE DETERMINANT	MAT 570
C		MAT 580
140	PIVOTI=PIVOT	MAT 590
	IF (ABS(DETERM)-R1) 170,150,150	MAT 600
150	DETERM=DETERM/R1	MAT 610
	ISCALE=ISCALE+1	MAT 620
	IF (ABS(DETERM)-R1) 200,160,160	MAT 630
160	DETERM=DETERM/R1	MAT 640
	ISCALE=ISCALE+1	MAT 650
	GO TO 200	MAT 660
170	IF (ABS(DETERM)-R2) 180,180,200	MAT 670
180	DETERM=DETERM*R1	MAT 680
	ISCALE=ISCALE-1	MAT 690
	IF (ABS(DETERM)-R2) 190,190,200	MAT 700
190	DETERM=DETERM*R1	MAT 710
	ISCALE=ISCALE-1	MAT 720
200	IF (ABS(PIVOTI)-R1) 230,210,210	MAT 730
210	PIVOTI=PIVOTI/R1	MAT 740
	ISCALE=ISCALE+1	MAT 750
	IF (ABS(PIVOTI)-R1) 260,220,220	MAT 760
220	PIVOTI=PIVOTI/R1	MAT 770
	ISCALE=ISCALE+1	MAT 780
	GO TO 260	MAT 790
230	IF (ABS(PIVOTI)-R2) 240,240,260	MAT 800
240	PIVOTI=PIVOTI*R1	MAT 810
	ISCALE=ISCALE-1	MAT 820
	IF (ABS(PIVOTI)-R2) 250,250,260	MAT 830
250	PIVOTI=PIVOTI*R1	MAT 840
	ISCALE=ISCALE-1	MAT 850
260	DETERM=DETERM*PIVOTI	MAT 860
C		MAT 870
C	DIVIDE PIVOT ROW BY PIVOT ELEMENT	MAT 880
C		MAT 890
270	IF (PIVOT) 280,70,280	MAT 900
280	A(ICOLUM,ICOLUM)=1.0	MAT 910
	DO 290 L=1,N	MAT 920
290	A(ICOLUM,L)=A(ICOLUM,L)/PIVOT	MAT 930
	IF (M) 320,320,300	MAT 940
300	DO 310 L=1,M	MAT 950
310	B(ICOLUM,L)=B(ICOLUM,L)/PIVOT	MAT 960

C		MAT 970
C	REDUCE NON-PIVOT ROWS	MAT 980
C		MAT 990
320	DO 370 L1=1,N	MAT1000
	IF (L1-ICOLUM) 330,370,330	MAT1010
330	T=A(L1,ICOLUM)	MAT1020
	A(L1,ICOLUM)=0.0	MAT1030
	DO 340 L=1,N	MAT1040
340	A(L1,L)=A(L1,L)-A(ICOLUM,L)*T	MAT1050
	IF (M) 370,370,350	MAT1060
350	DO 360 L=1,M	MAT1070
360	B(L1,L)=B(L1,L)-B(ICOLUM,L)*T	MAT1080
370	CONTINUE	MAT1090
C		MAT1100
C	INTERCHANGE COLUMNS	MAT1110
C		MAT1120
	DO 400 I=1,N	MAT1130
	L=N+1-I	MAT1140
	IF (IWK(L,1)-IWK(L,2)) 380,400,380	MAT1150
380	JROW=IWK(L,1)	MAT1160
	JCOLUM=IWK(L,2)	MAT1170
	DO 390 K=1,N	MAT1180
	SWAP=A(K,JROW)	MAT1190
	A(K,JROW)=A(K,JCOLUM)	MAT1200
	A(K,JCOLUM)=SWAP	MAT1210
390	CONTINUE	MAT1220
400	CONTINUE	MAT1230
410	RETURN	MAT1240
	END	MAT1250-
	OVERLAY (LEVSP,5,0)	NSP 10
	PROGRAM NEWSHAP	NSP 20
C	SETS UP DIMENSIONS FOR COMPUTING THE NEW LOCATIONS OF LEADING-EDGE	NSP 30
C	AND TRAILING-EDGE VORTICES BY MAKING THOSE FORCE-FREE	NSP 40
	COMMON D(1)	NSP 50
	COMMON /ALLI/ NSW,NSW1,NCW,NWNG,NCPTTL	NSP 60
	COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40),PXXE(11,20),	NSP 70
	1PYE(11,20),PZZE(11,20),NMAX,NNMAX,NCNTS	NSP 80
	LC=1	NSP 90

LTHETP=LC+NSW1	NSP 100
LXN=LTHETP+NSW1	NSP 110
LYN=LXN+2*NWNG	NSP 120
LXTE=LYN+2*NWNG	NSP 130
LXLE=LXTE+NSW	NSP 140
LYLE=LXLE+NSW	NSP 150
LCONS=LYLE+NSW	NSP 160
LSI=LCONS+NSW1	NSP 170
LXCP=LSI+NCW	NSP 180
LYCP=LXCP+NCPTTL	NSP 190
LCI=LYCP+NCPTTL	NSP 200
LCJ=LCI+NWNG	NSP 210
LCK=LCJ+NWNG	NSP 220
LCONI=LCK+NWNG	NSP 230
LCONJ=LCONI+NWNG	NSP 240
LCONK=LCONJ+NWNG	NSP 250
LDUMY=LCONK+NWNG	NSP 260
LGAMA=LDUMY+R*NWNG	NSP 270
LGML=LGAMA+NCPTTL	NSP 280
LYLM=LGML+NSW1	NSP 290
LCPCW=LYLM+NSW1	NSP 300
LNEXT=LCPCW+NSW1	NSP 310
C LNEXT=21*NWNG+14*NSW+NCW-9	NSP 320
CALL NEWELM (D(LC),D(LTHETP),D(LXN),D(LYN),D(LXTE),D(LXLE),D(LYLE)	NSP 330
1,D(LCONS),D(LSI),D(LXCP),D(LYCP),D(LCI),D(LCJ),D(LCK),D(LCONI),D(LNSP	NSP 340
2CONJ),D(LCONK),D(LDUMY),NWNG,NCPTTL,NSW1,NSW,NCW,D(LGAMA),D(LGML),	NSP 350
3D(LYLM),D(LCPCW))	NSP 360
RETURN	NSP 370
END	NSP 380-

SUBROUTINE NEWELM (C,THETP,XN,YN,XTE,XLE,YLE,CONS,SI,XCP,YCP,CI,CJNL	10
1,CK,CONI,CONJ,CONK,DUMMY,NWNG,NCPTTL,NSW1,NSW,NCW,GAMA,GML,YLM,CPCNLM	20
2W1)	NLM 30
C COMPUTES THE NEW LOCATIONS OF LEADING-EDGE AND TRAILING-EDGE	NLM 40
C VORTICES BY MAKING THOSE FORCE-FREE	NLM 50
COMMON /INDEX/ IND	NLM 60
COMMON /GM/ ITER	NLM 70
COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5),ICL	NLM 80
COMMON /GENCF/ M1(5),NW(2),YBREAK(5),CH(90),SJ(31,3),MJW1(2),	NLM 90

1MJW2(2),WIDTH(5),SWEEP(60),NTS,NC	NLM 100
COMMON /LANDA/ FGMA1,FBDA1,FGMA,CLS	NLM 110
COMMON/CAMB/ ICAM,IM(10),XT(10,21),AAM(10,20),BRM(10,20),	NLM 120
1CCM(10,20),DDM(10,20),YT(10),ZBDX(200),ZBDXV(200)	NLM 130
COMMON /TIPVX/ XTIP(15,30),YTIP(15,30),ZTIP(15,30),NTLM(15),NTMAX	NLM 140
COMMON /NCTT/ NCT,NCON,NBT,NCOR(15),KUI,NFSH(15),KUC	NLM 150
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40),XXE(11,20),	NLM 160
1YYE(11,20),ZZE(11,20),NMAX,NNMAX,NCONTS	NLM 170
COMMON /OABC/ DXE(10,40),DYE(10,40),DZE(10,40)	NLM 180
COMMON /ALLRB/ AX(210),ZMIN,NELM(11),NNELM(12)	NLM 190
COMMON /LOCSP/ FTANTY(10,15),FTANTZ(10,15),CTANTY(40,2),CTANTZ(40,	NLM 200
12)	NLM 210
COMMON /INFAV/ FYT(20),FZT(20),FYI(40),FZI(40),VXI(40),VYI(40),VZINLM	NLM 220
1(40),FXT(20),TFORCE(20)	NLM 230
COMMON /MDFAV/ FYP(40,2,2),FZP(40,2,2)	NLM 240
COMMON /ALLRA/ TTL(16),ALPHA,SINA,AA(9),PI,AB(2),HALFB,AREA	NLM 250
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	NLM 260
COMMON /XSTN/ XBRR(25)	NLM 270
DIMENSION DUMMY(1),CONI(1),CONJ(1),CONK(1),CI(1),CJ(1),CK(1)	NLM 280
1,C(1),THETP(1),XTE(1),XLE(1),YLE(1),CONS(1),SI(1),XCP(1),	NLM 290
2YCP(1),GAMA(1),GML(1),YLM(1),CPCW1(1),XN(NWNG,2),YN(NWNG,2),	NLM 300
3A(3),B(3),F(3)	NLM 310
DIMENSION FTX(10,10),FTY(10,10),FTZ(10,10),SFRDA(40,2),SFGMA(40,2)	NLM 320
COMMON /COEFF/ CL,FZMINS(10),FHS(2,10),RATIOS(2,10),	NLM 330
1CFCORE(2,10),RATIOC(2,10)	NLM 340
DIMENSION GT(10),GA(3),XB(40,2),YB(40,2),ZB(40,2)	NLM 350
DIMENSION FSIN(4),XF1(10,40),YE1(10,40),ZE1(10,40)	NLM 360
DIMENSION XE2(10,40),YE2(10,40),ZE2(10,40),TOS(15)	NLM 370
.....	NLM 380
REWIND 1	NLM 390
CALL SKIPR (1,7)	NLM 400
READ (1) (C(I),I=1,NSW1)	NLM 410
READ (1) (THETP(I),I=1,NSW1)	NLM 420
READ (1) (XTE(I),XLE(I),YLE(I),I=1,NSW)	NLM 430
READ (1) (XLM,YLM(I),I=1,NSW1)	NLM 440
READ (1) (CONS(I),I=1,NSW1)	NLM 450
READ (1) (SI(I),AC,I=1,NCW)	NLM 460
READ (1) (XCP(I),YCP(I),I=1,NCPTTL)	NLM 470
READ (1) ((XN(I,J),YN(I,J),J=1,2),I=1,NWNG)	NLM 480
CALL SKIPR (1,2)	NLM 490
READ (1) (CPCW1(I),I=1,NCW)	NLM 500

	REWIND 2	NLM 510
	READ (2) (GAMA(I),I=1,NCPTTL)	NLM 520
	REWIND 3	NLM 530
	READ (3) (GML(I),I=1,NSW1)	NLM 540
	BHALF=1.25*HALFB	NLM 550
	ATL=1.-0.1*FLOAT(ITER)	NLM 560
	IF (NCONTS.NE.0) ATL=0.75	NLM 570
	IF (ATL.LT.0.75) ATL=0.75	NLM 580
	BTL=1.-ATL	NLM 590
	IF (ITER.LE.KU1) GO TO 70	NLM 600
	KU5=KU1+1	NLM 610
	KU6=KU1+2	NLM 620
	KU7=KU1+3	NLM 630
	NSW1=MAXL	NLM 640
	DO 20 J=1,NSW1	NLM 650
	GT(I)=0.	NLM 660
	K1=1	NLM 670
	IF (ITRAKE.NE.1.AND.I.GE.M1(1)) K1=M1(1)	NLM 680
10	GT(I)=GT(I)+GAMA(NWNG+K1)	NLM 690
	K1=K1+1	NLM 700
	IF (K1.GT.I) GO TO 20	NLM 710
	GO TO 10	NLM 720
20	CONTINUE	NLM 730
C	COMPUTATIONS OF RELAXATION PARAMETERS FOR THE CORE MODEL	NLM 740
	ALPHA=ALPHA*180./PI	NLM 750
	ALPHB=ALPHA	NLM 760
	IF (ALPA.LT.10.) ALPHB=10.*PI/180.	NLM 770
	IF (ITER.EQ.KU5) GO TO 30	NLM 780
	IF (ITER.EQ.KU6) GO TO 40	NLM 790
	IF (ITER.GE.KU7) GO TO 70	NLM 800
30	CONTINUE	NLM 810
	FRDA=0.	NLM 820
	FGMA=0.	NLM 830
	IF (CL.GT.CLS) FRDA=-(CL-CLS)*SIN(ALPHA)/CLS	NLM 840
	FBDA=2.*FBDA	NLM 850
	IF (CL.LT.CLS) FGMA=-1.5*(CLS-CL)/(CLS*TAN(ALPHB))	NLM 860
	IF (CL.LT.CLS.AND.ALPA.LT.20..AND.ALPA.GE.10.) FGMA=0.5*FGMA	NLM 870
	IF (CL.LT.CLS.AND.ALPA.LT.10.) FGMA=0.50*FGMA	NLM 880
	FGMA1=FGMA	NLM 890
	GO TO 60	NLM 900
40	CONTINUE	NLM 910

	FBDA=0.	NLM 920
	FGMA=0.	NLM 930
	FGMA1=0.	NLM 940
	IF (ICL.EQ.1) GO TO 50	NLM 950
	FBDA=- (CL-CLS)*SIN(ALPHA)/CLS	NLM 960
	GO TO 60	NLM 970
50	FGMA=0.75*(CL-CLS)/(CLS*TAN(ALPHB))	NLM 980
	FGMA1=FGMA	NLM 990
60	CONTINUE	NLM1000
	IF (CL.GT.CLS) CONST=FBDA	NLM1010
	IF (CL.LT.CLS) CONST=FGMA1	NLM1020
	IF (CL.GT.CLS) ICL=1	NLM1030
	IF (CL.LT.CLS) ICL=0	NLM1040
70	CONTINUE	NLM1050
	IF (ITER.EQ.KU1) GO TO 220	NLM1060
	IF (ITER.GT.KU1) GO TO 260	NLM1070
C	DIFFUSED VORTEX FILAMENT MODEL	NLM1080
C	CALCULATION OF THE COORDINATES OF LEADING-EDGE ELEMENTS BY	NLM1090
C	SATISFYING FORCE-FREE CONDITION	NLM1100
	NBT=0	NLM1110
	DO 120 J=5,NMAX	NLM1120
	DO 120 I=2,MAXL	NLM1130
	NCON=I	NLM1140
	K=NELM(I)-1	NLM1150
	IF (J.GT.K) GO TO 120	NLM1160
	XXX=XE(I,J+1)	NLM1170
	YYY=YE(I,J+1)	NLM1180
	ZZZ=ZE(I,J+1)	NLM1190
	DLS=SQRT((XE(I,J+1)-XE(I,J))**2+(YE(I,J+1)-YE(I,J))**2+(ZE(I,J+1)-	NLM1200
	ZE(I,J))**2)	NLM1210
	XEE=(XE(I,J)+XE(I,J+1))/2.	NLM1220
	YEE=(YE(I,J)+YE(I,J+1))/2.	NLM1230
	ZEE=(ZE(I,J)+ZE(I,J+1))/2.	NLM1240
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONN	NLM1250
	1J,CONK,SI,NSW1,NCW,NWNG,CT,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YN	NLM1260
	2LM)	NLM1270
	UVW=SQRT(UU*UU+VV*VV+WW*WW)	NLM1280
	IF (J.EQ.5) GO TO 80	NLM1290
	VVA=ATL*VV/UVW	NLM1300
	WWA=ATL*WW/UVW	NLM1310
	DLY=VVA*DLS+BTL*(YE(I,J+1)-YE(I,J))	NLM1320

	DLZ=WWA*DLS+8TL*(ZE(I,J+1)-ZE(I,J))	NLM1330
	GO TO 90	NLM1340
80	CONTINUE	NLM1350
	VVA=0.5*VV/UVW	NLM1360
	WWA=0.5*WW/UVW	NLM1370
	DLY=VVA*DLS+0.5*(YE(I,J+1)-YE(I,J))	NLM1380
	DLZ=WWA*DLS+0.5*(ZE(I,J+1)-ZE(I,J))	NLM1390
	GO TO 100	NLM1400
90	CONTINUE	NLM1410
	IF ((DLZ/DLS).GT.SINA) DLZ=DLS*SINA	NLM1420
100	CONTINUE	NLM1430
	YINT=YE(I,J)+DLY	NLM1440
	ZINT=ZF(I,J)+DLZ	NLM1450
	IF (YINT.LE.YE(2,5)) YINT=YE(2,5)	NLM1460
	IF (YINT.GE.RHALF) YINT=RHALF	NLM1470
	IF (ZINT.LE.ZMIN) ZINT=ZMIN	NLM1480
	DLY2=YINT-YE(I,J)	NLM1490
	DLZ2=ZINT-ZE(I,J)	NLM1500
	DLX22=DLS*DLS-DLY2*DLY2-DLZ2*DLZ2	NLM1510
	IF (DLX22.LE.0.) DLY2=DLY2/2.	NLM1520
	IF (DLX22.LE.0.) DLZ2=DLZ2/2.	NLM1530
	DLX2=SQRT(DLS*DLS-DLY2*DLY2-DLZ2*DLZ2)	NLM1540
	XE(I,J+1)=XE(I,J)+DLX2	NLM1550
	YE(I,J+1)=YE(I,J)+DLY2	NLM1560
	ZE(I,J+1)=ZE(I,J)+DLZ2	NLM1570
	DX=XE(I,J+1)-XXX	NLM1580
	DY=YE(I,J+1)-YYY	NLM1590
	DZ=ZE(I,J+1)-ZZZ	NLM1600
	J2=J+2	NLM1610
	KP=K+1	NLM1620
	IF (J2.GT.KP) GO TO 120	NLM1630
	DO 110 JK=J2,KP	NLM1640
	XE(I,JK)=XE(I,JK)+DX	NLM1650
	YE(I,JK)=YE(I,JK)+DY	NLM1660
110	ZE(I,JK)=ZE(I,JK)+DZ	NLM1670
120	CONTINUE	NLM1680
130	CONTINUE	NLM1690
C	CALCULATION OF THE COORDINATES OF WAKE ELEMENTS BY SATISFYING	NLM1700
C	FORCE-FREE CONDITION	NLM1710
	NAERO=0	NLM1720
	CTL=0.5	NLM1730

DTL=1.-CTL	NLM1740
NCON=0	NLM1750
NBT=0	NLM1760
DO 160 J=1,NNMAX	NLM1770
DO 160 I=2,MAXW	NLM1780
NCT=I	NLM1790
K=NNELM(I)-1	NLM1800
IF (J.GT.K) GO TO 160	NLM1810
XXX=XXE(I,J+1)	NLM1820
YYY=YYE(I,J+1)	NLM1830
ZZZ=ZZE(I,J+1)	NLM1840
WLS=SQRT((XXE(I,J+1)-XXE(I,J))**2+(YYE(I,J+1)-YYE(I,J))**2+(ZZE(I,	NLM1850
1J+1)-ZZE(I,J))**2)	NLM1860
XEE=(XXE(I,J)+XXE(I,J+1))/2.	NLM1870
YEE=(YYE(I,J)+YYE(I,J+1))/2.	NLM1880
ZEE=(ZZE(I,J)+ZZE(I,J+1))/2.	NLM1890
CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONNLM	NLM1900
1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YNLM	NLM1910
2LM)	NLM1920
UVW=SQRT(UU*UU+VV*VV+WW*WW)	NLM1930
IF (J.EQ.1) GO TO 150	NLM1940
VVA=CTL*VV/UVW	NLM1950
WWA=CTL*WW/UVW	NLM1960
DLY=VVA*WLS+DTL*(YYE(I,J+1)-YYE(I,J))	NLM1970
DLZ=WWA*WLS+DTL*(ZZE(I,J+1)-ZZE(I,J))	NLM1980
IF ((DLZ/WLS).GT.SINA) DLZ=WLS*SINA	NLM1990
YINT=YYE(I,J)+DLY	NLM2000
IF (YINT.LE.(YLE(2)/2.)) YINT=YLE(2)/2.	NLM2010
IF (YINT.GE.RHALF) YINT=RHALF	NLM2020
DLY2=YINT-YYE(I,J)	NLM2030
DLZ2=DLZ	NLM2040
DLX22=WLS*WLS-DLY2*DLY2-DLZ2*DLZ2	NLM2050
IF (DLX22.LE.0.) DLY2=DLY2/2.	NLM2060
IF (DLX22.LE.0.) DLZ2=DLZ2/2.	NLM2070
DLX2=SQRT(WLS*WLS-DLY2*DLY2-DLZ2*DLZ2)	NLM2080
XXE(I,J+1)=XXE(I,J)+DLX2	NLM2090
YYE(I,J+1)=YYE(I,J)+DLY2	NLM2100
ZZE(I,J+1)=ZZE(I,J)+DLZ2	NLM2110
DX=XXE(I,J+1)-XXX	NLM2120
DY=YYE(I,J+1)-YYY	NLM2130
DZ=ZZE(I,J+1)-ZZZ	NLM2140

	J2=J+2	NLM2150
	KP=K+1	NLM2160
	IF (J2.GT.KP) GO TO 150	NLM2170
	DO 140 JK=J2,KP	NLM2180
	XXE(I,JK)=XXF(I,JK)+DX	NLM2190
	YYE(I,JK)=YYE(I,JK)+DY	NLM2200
140	ZZE(I,JK)=ZZE(I,JK)+DZ	NLM2210
150	CONTINUE	NLM2220
160	CONTINUE	NLM2230
C	CALCULATION OF THE COORDINATES OF TIP VORTICES BY SATISFYING	NLM2240
C	FORCE FREE CONDITION	NLM2250
	IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) GO TO 210	NLM2260
	CTL=0.5	NLM2270
	DTL=1.-CTL	NLM2280
	NCON=0	NLM2290
	NBT=0	NLM2300
	DO 190 J=1,NTMAX	NLM2310
	DO 190 I=1,NCW	NLM2320
	NCT=I	NLM2330
	K=NTLM(I)-1	NLM2340
	IF (J.GT.K) GO TO 190	NLM2350
	XXX=XTIP(I,J+1)	NLM2360
	YYY=YTIP(I,J+1)	NLM2370
	ZZZ=ZTIP(I,J+1)	NLM2380
	TLS=SQRT((XTIP(I,J+1)-XTIP(I,J))**2+(YTIP(I,J+1)-YTIP(I,J))**2+(ZTIP(I,J+1)-ZTIP(I,J))**2)	NLM2390
	XEE=0.5*(XTIP(I,J+1)+XTIP(I,J))	NLM2400
	YEE=0.5*(YTIP(I,J+1)+YTIP(I,J))	NLM2410
	ZEE=0.5*(ZTIP(I,J+1)+ZTIP(I,J))	NLM2420
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONNLM2440	NLM2430
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YNLM2450	NLM2440
	2LM)	NLM2460
	UVW=SQRT(UU**2+VV**2+WW**2)	NLM2470
	IF (J.EQ.1) GO TO 180	NLM2480
	VVA=CTL*VV/UVW	NLM2490
	WWA=CTL*WW/UVW	NLM2500
	DLY=VVA*TLS+DTL*(YTIP(I,J+1)-YTIP(I,J))	NLM2510
	DLZ=WWA*TLS+DTL*(ZTIP(I,J+1)-ZTIP(I,J))	NLM2520
	DLX=SQRT(TLS**2-DLY**2-DLZ**2)	NLM2530
	XTIP(I,J+1)=XTIP(I,J)+DLX	NLM2540
	YTIP(I,J+1)=YTIP(I,J)+DLY	NLM2550

	ZTIP(I,J+1)=ZTIP(I,J)+DLZ	NLM2560
	IF (ZTIP(I,J+1).LE.0..AND.YTIP(I,J+1).LE.HALFB.AND.XTIP(I,J+1).LE.	NLM2570
	1PXT(NC+1)) ZTIP(I,J+1)=ZMIN	NLM2580
	DX=XTIP(I,J+1)-XXX	NLM2590
	DY=YTIP(I,J+1)-YYY	NLM2600
	DZ=ZTIP(I,J+1)-777	NLM2610
	J2=J+2	NLM2620
	KP=K+1	NLM2630
	IF (J2.GT.KP) GO TO 180	NLM2640
	DO 170 JK=J2,KP	NLM2650
	XTIP(I,JK)=XTIP(I,JK)+DX	NLM2660
	YTIP(I,JK)=YTIP(I,JK)+DY	NLM2670
170	ZTIP(I,JK)=ZTIP(I,JK)+DZ	NLM2680
180	CONTINUE	NLM2690
190	CONTINUE	NLM2700
	DO 200 I=1,NCW	NLM2710
	KK=NTLM(I)	NLM2720
	WRITE (6,740) (XTIP(I,J),J=1,KK)	NLM2730
	WRITE (6,740) (YTIP(I,J),J=1,KK)	NLM2740
	WRITE (6,740) (ZTIP(I,J),J=1,KK)	NLM2750
200	CONTINUE	NLM2760
210	CONTINUE	NLM2770
	RETURN	NLM2780
220	CONTINUE	NLM2790
C	DETERMINE THE INITIAL SHAPE OF FREE SHEET AND CORE FROM THE	NLM2800
C	ESTABLISHED LEADING-EDGE VORTEX FILAMENT SYSTEM	NLM2810
	NSW1=MAXL	NLM2820
	CALL CORE (XB,YB,ZB,XEND,GAMA,NSW1,NELM,NWNG,NXB)	NLM2830
	CALL MODEL (XB,YB,ZB,NELM,NXB,M1,LASTE)	NLM2840
	CALL LIRITN (NCOP,NELM,M1,LASTE)	NLM2850
	CALL APEXC (NELM,NCOR,M1)	NLM2860
	NSW1=MAXL	NLM2870
	NSW=MAXW	NLM2880
C	PUNCH CARDS FOR ANGLE OF ATTACK IS LESS THAN TWENTY DEGREES	NLM2890
	PUNCH 760, (NELM(I),I=1,NSW1)	NLM2900
	DO 230 I=1,NSW1	NLM2910
	K=NELM(I)	NLM2920
	PUNCH 750, (XF(I,J),J=1,K)	NLM2930
	PUNCH 750, (YE(I,J),J=1,K)	NLM2940
	PUNCH 750, (ZE(I,J),J=1,K)	NLM2950
230	CONTINUE	NLM2960

	PUNCH 760, (NNFLM(I),I=1,NSW)	NLM2970
	DO 240 I=1,NSW	NLM2980
	K=NNELM(I)	NLM2990
	PUNCH 750, (XE(I,J),J=1,K)	NLM3000
	PUNCH 750, (YE(I,J),J=1,K)	NLM3010
	PUNCH 750, (ZF(I,J),J=1,K)	NLM3020
240	CONTINUE	NLM3030
	IF ((PXT(NC+1)-PXL(NC+1)).EQ.0.) RETURN	NLM3040
	PUNCH 760, (NTLM(I),I=1,NCW)	NLM3050
	DO 250 I=1,NCW	NLM3060
	K=NTLM(I)	NLM3070
	PUNCH 750, (XTIP(I,J),J=1,K)	NLM3080
	PUNCH 750, (YTIP(I,J),J=1,K)	NLM3090
	PUNCH 750, (ZTIP(I,J),J=1,K)	NLM3100
250	CONTINUE	NLM3110
	RETURN	NLM3120
260	CONTINUE	NLM3130
C	VORTEX CORE MODEL	NLM3140
	NAERO=1	NLM3150
	CALL CFAEC (C,THETP,XN,YN,XTE,XLE,YLE,YLM,CONS,CONI,CONJ,CONK,DUMM	NLM3160
	1Y,SI,NSW1,NCW,NWNG,CI,CJ,CK,CPCW1,XCP,YCP,GAMA,AREA,ITER,GT,1)	NLM3170
C	CALCULATION OF THE NEW LOCATIONS OF FREE SHEET SEGMENTS BY	NLM3180
C	SATISFING FORCE FREE CONDITION	NLM3190
	NAERO=0	NLM3200
	DO 290 I=2,MAXL	NLM3210
	IF (ITRAKE.NE.1.AND.I.EQ.M1(1)) GO TO 290	NLM3220
	NCR2=NCOR(I)-2	NLM3230
	DO 280 J=5,NCR2	NLM3240
	A(1)=XE(I,J+1)-XE(I,J)	NLM3250
	A(2)=YE(I,J+1)-YE(I,J)	NLM3260
	A(3)=ZF(I,J+1)-ZF(I,J)	NLM3270
	IF (J.EQ.NCR2) GO TO 270	NLM3280
	FTANTY(I,J)=A(2)/A(1)	NLM3290
	FTANTZ(I,J)=A(3)/A(1)	NLM3300
	GO TO 280	NLM3310
270	TOS(I)=A(3)	NLM3320
280	CONTINUE	NLM3330
290	CONTINUE	NLM3340
	LL=1	NLM3350
	L1=1	NLM3360
	KS=2	NLM3370

	KE=M1(1)-1	NLM3380
	GO TO 310	NLM3390
300	LL=2	NLM3400
	L1=M1(1)	NLM3410
	KS=M1(1)+1	NLM3420
	KE=MAXL	NLM3430
310	CONTINUE	NLM3440
	IF (ITRAKE.NE.1.AND.ITER.GE.KU7) GO TO 320	NLM3450
	IF (ITER.EQ.KU5) GO TO 330	NLM3460
	IF (ITRAKE.EQ.1.AND.ITER.GE.KU7.AND.RATIOS(LL,ITER).LE.0.05) GO TO	NLM3470
	1 320	NLM3480
	ATL=0.5	NLM3490
	BTL=0.75	NLM3500
	GO TO 340	NLM3510
320	ATL=0.90	NLM3520
	BTL=0.95	NLM3530
	GO TO 340	NLM3540
330	ATL=0.5	NLM3550
	BTL=0.5	NLM3560
340	CONTINUE	NLM3570
	NCR2=NCOR(L1)-2	NLM3580
	DO 430 J=5,NCR2	NLM3590
	DO 420 I=KS,KE	NLM3600
	GMA=GAMA(NWNG+I)	NLM3610
	XXX=XE(I,J+1)	NLM3620
	YYY=YE(I,J+1)	NLM3630
	ZZZ=ZE(I,J+1)	NLM3640
	NBT=0	NLM3650
	NCON=I	NLM3660
	XEE=0.5*(XE(I,J)+XE(I,J+1))	NLM3670
	YEE=0.5*(YE(I,J)+YE(I,J+1))	NLM3680
	ZEE=0.5*(ZE(I,J)+ZE(I,J+1))	NLM3690
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONNLM3700	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YNLM3710	
	2LM)	NLM3720
	A(1)=XE(I,J+1)-XE(I,J)	NLM3730
	A(2)=YE(I,J+1)-YE(I,J)	NLM3740
	A(3)=ZE(I,J+1)-ZE(I,J)	NLM3750
	DLS=SQRT(A(1)**2+A(2)**2+A(3)**2)	NLM3760
	GA(1)=GMA*A(1)/APEA	NLM3770
	GA(2)=GMA*A(2)/AREA	NLM3780

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GA(3)=GMA*A(3)/ARFA
B(1)=UU
B(2)=VV
B(3)=WW
CALL CRSPRD (R,GA,F)
FTX(I,J)=F(1)
FTY(I,J)=F(2)
FTZ(I,J)=F(3)
IF (I.EQ.KS.AND.LL.EQ.1) GO TO 420
IF (J.EQ.NCR2) GO TO 410
TANTY=VV/UU
TANTZ=WW/UU
IF (J.EQ.5) GO TO 350
TANTY=(1.-ATL)*TANTY+ATL*FTANTY(I,J)
TANTZ=(1.-ATL)*TANTZ+ATL*FTANTZ(I,J)
GO TO 360
350 TANTY=(1.-BTL)*TANTY+BTL*FTANTY(I,J)
TANTZ=(1.-BTL)*TANTZ+BTL*FTANTZ(I,J)
360 CONTINUE
DLX=DLS/SQRT(1.+TANTY**2+TANTZ**2)
DLY=DLX*TANTY
DLZ=DLX*TANTZ
XE(I,J+1)=XE(I,J)+DLX
YE(I,J+1)=YE(I,J)+DLY
ZE(I,J+1)=ZE(I,J)+DLZ
IF (ITER.EQ.KU5) GO TO 380
IF (ZE(I,J+1).LT.FZMINS(I).AND.J.EQ.5) GO TO 370
GO TO 380
370 ZE(I,J+1)=FZMINS(I)
DLZ=ZE(I,J+1)-Z77
DLY=SQRT(DLS**2-DLX**2-DLZ**2)
YE(I,J+1)=YE(I,J)+DLY
380 CONTINUE
DX=XE(I,J+1)-XXX
DY=YE(I,J+1)-YYY
DZ=ZE(I,J+1)-ZZZ
J2=J+2
KP=NCOR(I)-1
IF (J2.GT.KP) GO TO 400
DO 390 JK=J2,KP
XE(I,JK)=XE(I,JK)+DX

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NLM3790
NLM3800
NLM3810
NLM3820
NLM3830
NLM3840
NLM3850
NLM3860
NLM3870
NLM3880
NLM3890
NLM3900
NLM3910
NLM3920
NLM3930
NLM3940
NLM3950
NLM3960
NLM3970
NLM3980
NLM3990
NLM4000
NLM4010
NLM4020
NLM4030
NLM4040
NLM4050
NLM4060
NLM4070
NLM4080
NLM4090
NLM4100
NLM4110
NLM4120
NLM4130
NLM4140
NLM4150
NLM4160
NLM4170
NLM4180
NLM4190

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	YE(I,JK)=YE(I,JK)+DY	NLM4200
	ZE(I,JK)=ZE(I,JK)+DZ	NLM4210
390	CONTINUE	NLM4220
400	CONTINUE	NLM4230
	GO TO 420	NLM4240
410	NCR3=NCR2+1	NLM4250
	XE(I,NCR3)=XE(I,NCR2)	NLM4260
	YE(I,NCR3)=YE(I,NCR2)	NLM4270
	ZE(I,NCR3)=ZE(I,NCR2)+TOS(I)	NLM4280
420	CONTINUE	NLM4290
430	CONTINUE	NLM4300
	IF (LL.EQ.2) GO TO 450	NLM4310
C	LINEAR INTERPOLATION	NLM4320
	RXE=(XE(KS,4)-PXL(LL))/(XE(KS+1,4)-PXL(LL))	NLM4330
	RYE=(YE(KS,4)-PYL(LL))/(YE(KS+1,4)-PYL(LL))	NLM4340
	NXOR=NCOR(KS)-1	NLM4350
	DO 440 L=6,NXOR	NLM4360
	XE(KS,L)=(XE(KS+1,L)-PXL(LL))*RXE+PXL(LL)	NLM4370
	YE(KS,L)=(YE(KS+1,L)-PYL(LL))*RYE+PYL(LL)	NLM4380
	ZE(KS,L)=ZE(KS+1,L)*RYE	NLM4390
440	CONTINUE	NLM4400
450	CONTINUE	NLM4410
	IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 300	NLM4420
	CALL NEWDA	NLM4430
C	CALCULATION OF THE NEW LOCATIONS OF CONCENTRATED CORE BY	NLM4440
C	SATISFING THE FORCE FREE CONDITION	NLM4450
	LL=1	NLM4460
	L1=1	NLM4470
	L3=L1+1	NLM4480
	LMAX=M1(1)-1	NLM4490
	KS=2	NLM4500
	KE=LMAX	NLM4510
	LO=L1-1	NLM4520
	GO TO 470	NLM4530
460	LL=2	NLM4540
	L1=M1(1)	NLM4550
	L3=L1+1	NLM4560
	LMAX=MAXL	NLM4570
	KS=M1(1)+1	NLM4580
	KE=LMAX	NLM4590
	LO=L1-1	NLM4600

470	CONTINUE	NLM4610
	FSMIN=FHS(LL,ITER)	NLM4620
	NAERO=1	NLM4630
	NFINAL=0	NLM4640
	CALL CFAEC (C,THETP,XN,YN,XTE,XLE,YLE,YLM,CONS,CONI,CONJ,CONK,DUMMNLM4650	
	1Y,SI,NSW1,NCW,NWNG,CI,CJ,CK,CPCW1,XCP,YCP,GAMA,AREA,ITER,GT,2)	NLM4660
	IF (ITER.EQ.KU5.OR.ITER.EQ.KU6) GO TO 480	NLM4670
	A1=TFORCE(LL)	NLM4680
	B1=TFORCE(LL)	NLM4690
	CALL SEGMNT (A1,R1,NELM,NCOR,SFGMA,SFBDA)	NLM4700
480	CONTINUE	NLM4710
490	CONTINUE	NLM4720
	NCT=0	NLM4730
	NFINAL=NFINAL+1	NLM4740
	FACTOR=1.0	NLM4750
	IF (ITER.GE.KU7.AND.PATIOC(LL,ITER).LT.0.05) FACTOR=0.1	NLM4760
	NAERO=1	NLM4770
	NSW5=NELM(L1)-NCOR(L1)	NLM4780
	DO 570 I=1,NSW5	NLM4790
	IF (I.EQ.1) GO TO 570	NLM4800
	II=NCOR(L1)+I	NLM4810
	NCON=L0+I	NLM4820
	IF (NCON.GE.LMAX) NCON=LMAX	NLM4830
	NBT=1	NLM4840
	XXX=XE(L1,II)	NLM4850
	YYY=YE(L1,II)	NLM4860
	ZZZ=ZE(L1,II)	NLM4870
	XEE=0.5*(XE(L1,II-1)+XE(L1,II))	NLM4880
	YEE=0.5*(YE(L1,II-1)+YE(L1,II))	NLM4890
	ZEE=0.5*(ZE(L1,II-1)+ZE(L1,II))	NLM4900
	GMA=GT(NCON)	NLM4910
	A(1)=XE(L1,II)-XE(L1,II-1)	NLM4920
	A(2)=YE(L1,II)-YE(L1,II-1)	NLM4930
	A(3)=ZE(L1,II)-ZE(L1,II-1)	NLM4940
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONNLM4950	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YNLM4960	
	2LM)	NLM4970
	GA(1)=GMA*A(1)/AREA	NLM4980
	GA(2)=GMA*A(2)/ARFA	NLM4990
	GA(3)=GMA*A(3)/AREA	NLM5000
	B(1)=UU	NLM5010

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B(2)=VV
B(3)=WW
CALL CRSPRD (R,GA,F)
FYI(I)=F(2)
FZI(I)=F(3)
IF (ITER.EQ.KU5.OR.ITER.EQ.KU6) GO TO 530
IF (NFINAL.EQ.1.OR.NFINAL.EQ.3) SIGN=1.0
IF (NFINAL.EQ.2.OR.NFINAL.EQ.4) SIGN=-1.0
GO TO (510,510,500,500), NFINAL
500 CONTINUE
FGMA1=SIGN*SFGMA(I,LL)
FBDA=0.
CONST=FGMA1
GO TO 520
510 FBDA=SIGN*SFRDA(I,LL)
FGMA1=0.
CONST=FRDA
520 CONTINUE
530 CONTINUE
TANTY=CTANTY(I,LL)-FRDA*ARS(FZI(I))/(GA(1)*B(1))*FACTOR
TANTZ=CTANTZ(I,LL)+FGMA1*ABS(FYI(I))/(GA(1)*B(1))*FACTOR
DLS=SQRT(A(1)**2+A(2)**2+A(3)**2)
DLX=DLS/SQRT(1.+TANTY**2+TANTZ**2)
DLY=DLX*TANTY
DLZ=DLX*TANTZ
XE(L1,II)=XE(L1,II-1)+DLX
YE(L1,II)=YE(L1,II-1)+DLY
ZE(L1,II)=ZE(L1,II-1)+DLZ
IF (ZE(L1,II).LT.0.) ZE(L1,II)=ZMIN
C TO ADJUST THE ENTIRE CORE SIMULTANEOUSLY
IF (I.EQ.NSW5) GO TO 550
DX=XE(L1,II)-XXX
DY=YE(L1,II)-YYY
DZ=ZE(L1,II)-ZZZ
KN=II+1
KK=NELM(L1)
DO 540 IL=KN,KK
XE(L1,IL)=XE(L1,IL)+DX
YE(L1,IL)=YE(L1,IL)+DY
ZE(L1,IL)=ZE(L1,IL)+DZ
540 CONTINUE

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NLM5020
NLM5030
NLM5040
NLM5050
NLM5060
NLM5070
NLM5080
NLM5090
NLM5100
NLM5110
NLM5120
NLM5130
NLM5140
NLM5150
NLM5160
NLM5170
NLM5180
NLM5190
NLM5200
NLM5210
NLM5220
NLM5230
NLM5240
NLM5250
NLM5260
NLM5270
NLM5280
NLM5290
NLM5300
NLM5310
NLM5320
NLM5330
NLM5340
NLM5350
NLM5360
NLM5370
NLM5380
NLM5390
NLM5400
NLM5410
NLM5420

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550	CONTINUE	NLM5430
	DO 560 IK=L3,LMAX	NLM5440
	NK=NELM(IK)	NLM5450
	JK=NCOR(IK)	NLM5460
	DO 560 L=JK,NK	NLM5470
	XE(IK,L)=XE(IK-1,L+1)	NLM5480
	YE(IK,L)=YE(IK-1,L+1)	NLM5490
	ZE(IK,L)=ZE(IK-1,L+1)	NLM5500
560	CONTINUE	NLM5510
570	CONTINUE	NLM5520
	IF (ITRAKE.NE.1) GO TO 580	NLM5530
	IF (ITER.GT.KU6) GO TO 580	NLM5540
C	ADJUST THE 2ND END POINT OF THE FIRST CORE SEGMENT BY	NLM5550
C	LINEAR INTERPOLATION FROM THE THIRD POINT AND APEX.	NLM5560
	NXOR1=NCOR(L1)+1	NLM5570
	NXOR2=NCOR(L1)+2	NLM5580
	NXOR=NCOR(L1)	NLM5590
	RY=(YE(L1,NXOR2)-PYL(LL))/(XE(L1,NXOR2)-PXL(LL))	NLM5600
	RZ=(ZE(L1,NXOR2)-0.)/(XE(L1,NXOR2)-PXL(LL))	NLM5610
	YE(L1,NXOR1)=RY*(XE(L1,NXOR1)-PXL(LL))+PYL(LL)	NLM5620
	ZE(L1,NXOR1)=RZ*(XE(L1,NXOR1)-PXL(LL))	NLM5630
	ZE(L1,NXOR1)=0.5*(ZE(L1,NXOR1)+ZE(L1,NXOR2))	NLM5640
	YE(L1+1,NXOR)=YE(L1,NXOR1)	NLM5650
	ZE(L1+1,NXOR)=ZE(L1,NXOR1)	NLM5660
580	CONTINUE	NLM5670
C	CHECK FREE SHEET AND CORE LOCATION AFTER CORE ADJUSTMENTS	NLM5680
C	NOTE THAT FIRST CORE SEGMENT FROM APEX IS COVERED BY FREE SHEET	NLM5690
	DO 600 II=KS,KE	NLM5700
	NXOR=NCOR(II)	NLM5710
	NCA=NCOR(II)-1	NLM5720
	IF (YE(II,NXOR).LT.YE(II,NCA)) GO TO 590	NLM5730
	GO TO 600	NLM5740
590	NCB=NXOR-2	NLM5750
	YE(II,NCA)=YE(II,NXOR)	NLM5760
	YE(II,NCB)=YE(II,NXOR)	NLM5770
600	CONTINUE	NLM5780
	CALL CFAEC (C,THETP,XN,YN,XTE,XLE,YLE,YLM,CONS,CONI,CONJ,CONK,DUMM	NLM5790
	1Y,SI,NSW1,NCW,NWNG,CI,CJ,CK,CPCW1,XCP,YCP,GAMA,AREA,ITER,GT,2)	NLM5800
	NCR2=NCOR(L1)-2	NLM5810
	NAERO=0	NLM5820
	FTX1=0.	NLM5830

	FTY1=0.	NLM5840
	FTZ1=0.	NLM5850
	FR123=0.	NLM5860
	DO 610 J=5,NCR2	NLM5870
	DO 610 I=KS,KE	NLM5880
	GMA=GAMA(NWNG+I)	NLM5890
	NRT=0	NLM5900
	NCON=I	NLM5910
	XEE=0.5*(XE(I,J)+XE(I,J+1))	NLM5920
	YEE=0.5*(YE(I,J)+YE(I,J+1))	NLM5930
	ZFE=0.5*(ZE(I,J)+ZE(I,J+1))	NLM5940
	CALL NEWVEL (C,THETP,XEE,YEE,ZEE,XN,YN,XTE,YLE,CONS,DUMMY,CONI,CONNLM5950	
	1J,CONK,SI,NSW1,NCW,NWNG,CI,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YNLM5960	
	2LM)	NLM5970
	A(1)=XE(I,J+1)-XE(I,J)	NLM5980
	A(2)=YE(I,J+1)-YE(I,J)	NLM5990
	A(3)=ZE(I,J+1)-ZE(I,J)	NLM6000
	GA(1)=GMA*A(1)/AREA	NLM6010
	GA(2)=GMA*A(2)/AREA	NLM6020
	GA(3)=GMA*A(3)/AREA	NLM6030
	B(1)=UU	NLM6040
	B(2)=VV	NLM6050
	B(3)=WW	NLM6060
	CALL CRSPRD (B,GA,F)	NLM6070
	FTX1=FTX1+F(1)	NLM6080
	FTY1=FTY1+F(2)	NLM6090
	FTZ1=FTZ1+F(3)	NLM6100
	FR123=FR123+SQRT(F(1)**2+F(2)**2+F(3)**2)	NLM6110
610	CONTINUE	NLM6120
	FSIN(NFINAL)=SQRT(FTX1**2+FTY1**2+FTZ1**2)	NLM6130
	IF (ITER.GT.KU6) GO TO 620	NLM6140
	CALL NEWDA	NLM6150
	GO TO 730	NLM6160
620	CONTINUE	NLM6170
C	COMPARE THE FREE SHEET FORCE AFTER EACH INNER CYCLE (+Y, -Y,	NLM6180
C	+Z, -Z) OF VORTEX CORE'S MOVEMENT	NLM6190
	IF (NFINAL.EQ.1.OR.NFINAL.EQ.3) GO TO 630	NLM6200
	IF (NFINAL.EQ.2.OR.NFINAL.EQ.4) GO TO 650	NLM6210
630	CONTINUE	NLM6220
	DO 640 I=L1,LMAX	NLM6230
	JK=NCOR(I)	NLM6240

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NK=NELM(I)
DO 640 J=JK,NK
XE1(I,J)=XE(I,J)
YE1(I,J)=YE(I,J)
ZE1(I,J)=ZE(I,J)
640 CONTINUE
CALL NEWBC (MAXL)
GO TO 490
650 DO 660 I=L1,LMAX
JK=NCOR(I)
NK=NELM(I)
DO 660 J=JK,NK
XE2(I,J)=XE(I,J)
YE2(I,J)=YE(I,J)
ZE2(I,J)=ZE(I,J)
660 CONTINUE
CALL NFWBC (MAXL)
C COMPARE THE FREE SHEET FORCE IN THE INNER ITERATION
X1=FSIN(NFINAL-1)
X2=FSIN(NFINAL)
CALL MINMAX (X1,X2,XMN,XMx)
IF (XMN.GT.FSMIN) GO TO 720
IF (X2.LT.X1) ID=2
IF (X1.LT.X2) ID=1
IF (ID.EQ.2) GO TO 670
GO TO 690
670 DO 680 I=L1,LMAX
JK=NCOR(I)
NK=NELM(I)
DO 680 J=JK,NK
XE(I,J)=XE2(I,J)
YE(I,J)=YE2(I,J)
ZE(I,J)=ZE2(I,J)
680 CONTINUE
GO TO 710
690 DO 700 I=L1,LMAX
JK=NCOR(I)
NK=NELM(I)
DO 700 J=JK,NK
XE(I,J)=XE1(I,J)
YE(I,J)=YE1(I,J)

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NLM6250
NLM6260
NLM6270
NLM6280
NLM6290
NLM6300
NLM6310
NLM6320
NLM6330
NLM6340
NLM6350
NLM6360
NLM6370
NLM6380
NLM6390
NLM6400
NLM6410
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NLM6470
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NLM6560
NLM6570
NLM6580
NLM6590
NLM6600
NLM6610
NLM6620
NLM6630
NLM6640
NLM6650

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	ZE(I,J)=ZE1(I,J)	NLM6660
700	CONTINUE	NLM6670
710	CONTINUE	NLM6680
	IF (ID.EQ.1) FSMIN=X1	NLM6690
	IF (ID.EQ.2) FSMIN=X2	NLM6700
	CALL NEWDA	NLM6710
720	CONTINUE	NLM6720
	IF (NFINAL.EQ.4) GO TO 730	NLM6730
	GO TO 490	NLM6740
730	CONTINUE	NLM6750
	IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 460	NLM6760
	GO TO 130	NLM6770
C		NLM6780
740	FORMAT (1H0,5X,8F10.5)	NLM6800
750	FORMAT (8F10.4)	NLM6810
760	FORMAT (10I2)	NLM6820
	END	NLM6830-

	SUBROUTINE CORE (XB,YB,ZB,XEND,GAMA,NSW1,NELM,NWNG,NXR)	CRE 10
C	FIND THE CENTROID OF THE DIFFUSED LEADING-EDGE VORTEX	CRE 20
C	ELEMENT SYSTEM	CRE 30
	DIMENSION XB(40,2),YB(40,2),ZB(40,2),GAMA(1),YSTN(40),ZSTN(40),	CRE 40
	INELM(1)	CRE 50
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	CRE 60
	COMMON /AERO/ NAEPO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	CRE 70
	COMMON /GENCF/ M1(5)	CRE 80
	COMMON /LOC/ FU1,FU2,BEND,PXL(5),PXT(5),PYL(5)	CRE 90
	SEGL=(PXT(1)-PXL(1))/8.	CRE 100
	IF (ITRAKE.NE.1) GO TO 10	CRE 110
	LL=1	CRE 120
	L1=1	CRE 130
	NSW2=NSW1-1	CRE 140
	L2=2	CRE 150
	ISECT=1	CRE 160
	L3=L2	CRE 170
	NSW1=MAXL	CRE 180
	GO TO 30	CRE 190
10	LL=1	CRE 200
	L1=1	CRE 210

	NSW2=(M1(1)-1)-1	CRE 220
	L2=2	CRE 230
	ISECT=1	CRE 240
	L3=L2	CRE 250
	NSW1=M1(1)-1	CRE 260
	GO TO 30	CRE 270
20	LL=2	CRE 280
	L1=M1(1)	CRE 290
	NSW2=(M1(1)-1)+(M1(2)-1)-1	CRE 300
	L2=L1+1	CRE 310
	ISECT=2	CRE 320
	L3=L1+1	CRE 330
	NSW1=MAXL	CRE 340
30	CONTINUE	CRE 350
	XB(1,LL)=XE(L1,4)	CRE 360
	YB(1,LL)=YE(L1,4)	CRE 370
	ZB(1,LL)=ZE(L1,4)	CRE 380
	II=1	CRE 390
	DO 40 I=L2,NSW2	CRE 400
	II=II+1	CRE 410
	XB(II,LL)=0.5*(XE(I+1,4)+XE(I,4))	CRE 420
40	CONTINUE	CRE 430
	K=II	CRE 440
50	K=K+1	CRE 450
	XB(K,LL)=XB(K-1,LL)+SEGL	CRE 460
	IF (XB(K,LL).LT.XEND) GO TO 50	CRE 470
	NXB=K	CRE 480
	J=2	CRE 490
60	XBAR=XB(J,LL)	CRE 500
	CALL CENTRD (XBAR,YSTN,7STN,NMAX,NSW1,NELM,ISECT)	CRE 510
	SUMY=0.	CRE 520
	SUMZ=0.	CRE 530
	GMSUM=0.	CRE 540
	DO 70 I=L3,NMAX	CRE 550
	II=NWNG+I	CRE 560
	GMSUM=GMSUM+GAMA(II)	CRE 570
	SUMY=SUMY+YSTN(I)*GAMA(II)	CRE 580
70	SUMZ=SUMZ+ZSTN(I)*GAMA(II)	CRE 590
	YBAR=SUMY/GMSUM	CRE 600
	ZBAR=SUMZ/GMSUM	CRE 610
	YB(J,LL)=YBAR	CRE 620

ZB(J,LL)=ZBAR	CRE 630
J=J+1	CRE 640
IF (J.LE.NXP) GO TO 60	CRE 650
IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 20	CRE 660
RETURN	CRE 670
END	CRE 680-

SUBROUTINE CFAEC (C,THETP,XN,YN,XTE,XLE,YLE,YLM,CONS,CONI,CONJ,CONCFC	10
1K,DUMMY,SI,NSW1,NCW,NWNG,CI,CJ,CK,CPCW1,XCP,YCP,GAMA,AREA,ITER,GT,CFC	20
2N)	CFC 30
DIMENSION DUMMY(1),CONS(1),CONI(1),CONJ(1),CONK(1),CI(1),CJ(1),	CFC 40
1CK(1),C(1),THETP(1),XLE(1),XTE(1),YLE(1),YLM(1),SI(1),GAMA(1),	CFC 50
2XCP(1),YCP(1),CPCW1(1),XN(NWNG,2),YN(NWNG,2),A(3),B(3),F(3),GA(3),	CFC 60
3GT(3),FXP(40,2,2)	CFC 70
COMMON /NCTT/ NCT,NCON,NRT,NCOR(15)	CFC 80
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	CFC 90
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	CFC 100
COMMON /ALLRB/ AX(210),ZMIN,NELM(11)	CFC 110
COMMON /GENCF/ M1(5)	CFC 120
COMMON /MUFV/ FYP(40,2,2),FZP(40,2,2)	CFC 130
COMMON /INFV/ FYT(20),FZT(20),FYI(40),FZI(40),VXI(40),VYI(40),	CFC 140
1VZI(40),FXT(20),TFORCE(20)	CFC 150
NCT=0	CFC 160
LL=1	CFC 170
L1=1	CFC 180
L0=L1-1	CFC 190
L2=M1(1)-1	CFC 200
GO TO 20	CFC 210
10 LL=2	CFC 220
L1=M1(1)	CFC 230
L0=L1-1	CFC 240
L2=MAXL	CFC 250
20 CONTINUE	CFC 260
FXT(LL)=0.	CFC 270
FYT(LL)=0.	CFC 280
FZT(LL)=0.	CFC 290
NSW5=NFLM(L1)-NCOR(L1)	CFC 300
DO 30 I=1,NSW5	CFC 310
II=NCOP(L1)+I	CFC 320

	NCON=10+I	CFC 330
	IF (NCON.GE.L2) NCON=L2	CFC 340
	NRT=1	CFC 350
	XEE=0.5*(XE(L1,II-1)+XE(L1,II))	CFC 360
	YEE=0.5*(YE(L1,II-1)+YE(L1,II))	CFC 370
	ZEE=0.5*(ZE(L1,II-1)+ZE(L1,II))	CFC 380
	GMA=GT(NCON)	CFC 390
	A(1)=XE(L1,II)-XE(L1,II-1)	CFC 400
	A(2)=YE(L1,II)-YE(L1,II-1)	CFC 410
	A(3)=ZE(L1,II)-ZE(L1,II-1)	CFC 420
	CALL NEWVEL (C,THETP,XEF,YEE,ZEE,XN,YN,XTE,YLE,CONS,DIJMMY,CONI,CONCFC	430
	1J,CONK,SI,NSW1,NCW,NWNG,CJ,CJ,CK,XLE,UU,VV,WW,CPCW1,XCP,YCP,GAMA,YCFC	440
	2LM)	CFC 450
	GA(1)=GMA*A(1)/AREA	CFC 460
	GA(2)=GMA*A(2)/AREA	CFC 470
	GA(3)=GMA*A(3)/AREA	CFC 480
	B(1)=UU	CFC 490
	B(2)=VV	CFC 500
	B(3)=WW	CFC 510
	CALL CRSPRD (R,GA,F)	CFC 520
	FXP(I,N,LL)=F(1)	CFC 530
	FYP(I,N,LL)=F(2)	CFC 540
	FZP(I,N,LL)=F(3)	CFC 550
	FXT(LL)=FXT(LL)+F(1)	CFC 560
	FYT(LL)=FYT(LL)+F(2)	CFC 570
	FZT(LL)=FZT(LL)+F(3)	CFC 580
30	CONTINUE	CFC 590
	TFORCE(LL)=SQRT(FXT(LL)**2+FYT(LL)**2+FZT(LL)**2)	CFC 600
	IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 10	CFC 610
	RETURN	CFC 620
	END	CFC 630-
	SUBROUTINE SEGMENT (ASTAR,BSTAR,NELM,NCOR,SFGMA,SFRDA)	SEG 10
C	COMPUTE THE SEGMENT FORCE OF THE CORE	SEG 20
	DIMENSION NELM(1),NCOR(1),SFBDA(40,2),SFGMA(40,2)	SEG 30
	COMMON /MDFAV/ FYP(40,2,2),FZP(40,2,2)	SEG 40
	COMMON /GENCF/ M1(5)	SEG 50
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	SEG 60
	LL=1	SEG 70

	L1=1	SEG 80
	GO TO 20	SEG 90
10	LL=2	SEG 100
	L1=M1(1)	SEG 110
20	CONTINUE	SEG 120
	NSW5=NFLM(L1)-NCOR(L1)	SEG 130
	DO 30 I=1,NSW5	SEG 140
	IF (FZP(I,2,LL).GT.0..AND.FZP(I,1,LL).GT.0.) FZ=0.1	SEG 150
	IF (FZP(I,2,LL).LT.0..AND.FZP(I,1,LL).LT.0.) FZ=-0.1	SEG 160
	IF (F7P(I,2,LL).GT.0..AND.FZP(I,1,LL).LT.0.) FZ=0.1	SEG 170
	IF (FZP(I,2,LL).LT.0..AND.FZP(I,1,LL).GT.0.) FZ=-0.1	SEG 180
	SFGMA(I,LL)=FZ*(FZP(I,2,LL)-FZP(I,1,LL))/(ABS(FZP(I,1,LL)))*BSTAR	SEG 190
	SFGMA(I,LL)=10.*SFGMA(I,LL)	SEG 200
	IF (FZP(I,2,LL)*FZP(I,1,LL).LT.0.) SFGMA(I,LL)=0.	SEG 210
	IF (FYP(I,2,LL).GT.0..AND.FYP(I,1,LL).GT.0.) FY=0.5	SEG 220
	IF (FYP(I,2,LL).LT.0..AND.FYP(I,1,LL).LT.0.) FY=-0.5	SEG 230
	IF (FYP(I,2,LL).GT.0..AND.FYP(I,1,LL).LT.0.) FY=0.5	SEG 240
	IF (FYP(I,2,LL).LT.0..AND.FYP(I,1,LL).GT.0.) FY=-0.5	SEG 250
	SFBDA(I,LL)=FY*(FYP(I,2,LL)-FYP(I,1,LL))/(ABS(FYP(I,1,LL)))*ASTAR	SEG 260
	IF (FYP(I,2,LL)*FYP(I,1,LL).LT.0.) SFBDA(I,LL)=-0.25*ABS((FYP(I,2,	SEG 270
	1LL)-FYP(I,1,LL))/FYP(I,1,LL))	SEG 280
	IF (ABS(SFGMA(I,LL)).GT.1.0) SFGMA(I,LL)=0.	SEG 290
	IF (ABS(SFBDA(I,LL)).GT.1.0) SFBDA(I,LL)=0.	SEG 300
30	CONTINUE	SEG 310
	IF (ITRAKE.NF.1.AND.LL.EQ.1) GO TO 10	SEG 320
	RETURN	SEG 330
	END	SEG 340-

	SUBROUTINE NEWRC (NSW1)	NBC 10
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	NBC 20
	COMMON /ALLRR/ AX(210),7MIN,NELM(11)	NBC 30
	COMMON /OABC/ DXE(10,40),DYE(10,40),DZE(10,40)	NBC 40
	DO 20 I=1,NSW1	NBC 50
	K=NELM(I)	NBC 60
	DO 10 J=1,K	NBC 70
	XE(I,J)=DXE(I,J)	NBC 80
	YE(I,J)=DYE(I,J)	NBC 90
	ZE(I,J)=DZE(I,J)	NBC 100
10	CONTINUE	NBC 110

20 CONTINUE
RETURN
END

NBC 120
NBC 130
NBC 140-

SUBROUTINE NEWDA
DIMENSION A(3)
COMMON /ABC/ XF(10,40),YE(10,40),ZE(10,40)
COMMON /ALLRB/ AX(210),ZMIN,NELM(11)
COMMON /OABC/ DXE(10,40),DYF(10,40),DZE(10,40)
COMMON /GENCF/ M1(5)
COMMON /AERO/ NAFRO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC
COMMON /LOCSP/ RX(300),CTANTY(40,2),CTANTZ(40,2)
COMMON /NCTT/ NCT,NCON,NBT,NCOR(15)
COMMON /MDFAV/ FYP(40,2,2),FZP(40,2,2)
DO 20 I=1,MAXL
K=NELM(I)
DO 10 J=1,K
DXE(I,J)=XE(I,J)
DYE(I,J)=YE(I,J)
DZE(I,J)=ZE(I,J)
10 CONTINUE
20 CONTINUE
LL=1
L1=1
GO TO 40
30 LL=2
L1=M1(1)
40 CONTINUE
NSW5=NELM(L1)-NCOR(L1)
DO 50 I=1,NSW5
II=NCOR(L1)+I
A(1)=XF(L1,II)-XF(L1,II-1)
A(2)=YF(L1,II)-YF(L1,II-1)
A(3)=ZF(L1,II)-ZF(L1,II-1)
CTANTY(I,LL)=A(2)/A(1)
CTANTZ(I,LL)=A(3)/A(1)
50 CONTINUE
IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 30
RETURN

NDA 10
NDA 20
NDA 30
NDA 40
NDA 50
NDA 60
NDA 70
NDA 80
NDA 90
NDA 100
NDA 110
NDA 120
NDA 130
NDA 140
NDA 150
NDA 160
NDA 170
NDA 180
NDA 190
NDA 200
NDA 210
NDA 220
NDA 230
NDA 240
NDA 250
NDA 260
NDA 270
NDA 280
NDA 290
NDA 300
NDA 310
NDA 320
NDA 330
NDA 340
NDA 350

END

NDA 360-

```
SUBROUTINE MODEL (XR,YB,ZB,NELM,NXB,M1,LASTE) MOD 10
DIMENSION M1(1) MOD 20
DIMENSION XR(40,2),YB(40,2),ZB(40,2), MOD 30
IFXE(10),FYE(10),FZE(10),RXE(10),BYE(10),BZE(10),NELM(1) MOD 40
COMMON /NCTT/ NCT,NCON,NBT,NCOR(15),KUI,NFSH(15) MOD 50
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC MOD 60
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40) MOD 70
NSW1=MAXL MOD 80
IF (ISPAN.EQ.0) IX=1 MOD 90
IF (ISPAN.EQ.1) IX=2 MOD 100
DO 110 I=2,NSW1 MOD 110
IF (ITRAKE.EQ.1) GO TO 10 MOD 120
NN2=M1(1)+2 MOD 130
LL=0 MOD 140
IF (I.EQ.M1(1)-2) LL=1 MOD 150
IF (I.EQ.NN2) LL=2 MOD 160
IF (LL.EQ.0) GO TO 110 MOD 170
GO TO 20 MOD 180
10 LL=1 MOD 190
20 CONTINUE MOD 200
NIT=NFSH(I) MOD 210
NN=NELM(I) MOD 220
J=5 MOD 230
30 IC=1 MOD 240
CALL CHOPS (LL,IC,I,J,XR,YB,ZB,NXB,NGB,FXE,FYE,FZE,XCA,XCB,ZCA,ZCB) MOD 250
1) MOD 260
IF (NGP.EQ.1) GO TO 50 MOD 270
IF ((J+1).EQ.NELM(I)) GO TO 40 MOD 280
J=J+1 MOD 290
IF (J.LT.NN) GO TO 30 MOD 300
40 CONTINUE MOD 310
ISF=0 MOD 320
WRITE (6,120) MOD 330
LASTE=I MOD 340
RETURN MOD 350
50 CONTINUE MOD 360
XE(I,J+1)=FXE(I) MOD 370
```

	YE(I,J+1)=FYE(I)	MOD 380
	ZF(I,J+1)=FZE(I)	MOD 390
	NOC=(J-4)+1	MOD 400
	IF (NOC.GE.4) GO TO 90	MOD 410
	IF (NOC.EQ.2) GO TO 60	MOD 420
	IF (NOC.EQ.3) GO TO 80	MOD 430
60	DO 70 MK=1,3	MOD 440
	FM=MK	MOD 450
	XE(I,MK+5)=FM/3.*(FXE(I)-XE(I,5))+XE(I,5)	MOD 460
	YE(I,MK+5)=FM/3.*(FYE(I)-YE(I,5))+YE(I,5)	MOD 470
	ZE(I,MK+5)=FM/3.*(FZE(I)-ZE(I,5))+ZE(I,5)	MOD 480
70	CONTINUE	MOD 490
	NOC=4	MOD 500
	GO TO 90	MOD 510
80	XE(I,8)=FXE(I)	MOD 520
	YE(I,8)=FYE(I)	MOD 530
	ZE(I,8)=FZE(I)	MOD 540
	XE(I,7)=XE(I,6)	MOD 550
	YE(I,7)=YE(I,6)	MOD 560
	ZE(I,7)=ZE(I,6)	MOD 570
	XE(I,6)=0.5*(XE(I,5)+XE(I,6))	MOD 580
	YE(I,6)=0.5*(YE(I,5)+YE(I,6))	MOD 590
	ZE(I,6)=0.5*(ZE(I,5)+ZE(I,6))	MOD 600
	NOC=4	MOD 610
90	CALL LEADLM (NOC,BXE,BYE,BZE,NIT,I)	MOD 620
	DO 100 MJ=1,NIT	MOD 630
	JJ=MJ+5	MOD 640
	XE(I,JJ)=BXE(MJ)	MOD 650
	YE(I,JJ)=BYE(MJ)	MOD 660
	ZE(I,JJ)=BZE(MJ)	MOD 670
100	CONTINUE	MOD 680
	ZBZ=ZCA+(FXE(I)-XCA)*(ZCB-ZCA)/(XCR-XCA)	MOD 690
	NCR=NCOP(I)	MOD 700
	NCR1=NCR-1	MOD 710
	XE(I,NCR)=FXE(I)	MOD 720
	YE(I,NCR)=FYE(I)	MOD 730
	ZE(I,NCR)=ZBZ	MOD 740
110	CONTINUE	MOD 750
	ISF=1	MOD 760
	RETURN	MOD 770
C		MOD 780

C		MOD 790
120	FORMAT (1H1,,68H FAIL TO GET INTERSECFION BY THE WELL DEFINED FREEMOD	800
	1 VORTEX ELEMENTS)	MOD 810
	END	MOD 820-

	SUBROUTINE CHOPS (LL,IC,I,J,XB,YB,ZB,NXB,NGB,FXE,FYE,FZE,XCA,XCB,ZCPS	10
	1CA,ZCR)	CPS 20
C	FIND THE INTERSECTION BETWEEN THE LEADING EDGE VORTEX FILAMENT	CPS 30
C	AND THE CENTROID OF THE LEADING EDGE VORTEX SYSTEM	CPS 40
	DIMENSION FXE(10),FYE(10),FZE(10)	CPS 50
	DIMENSION XB(40,2),YB(40,2),ZB(40,2),A(3),B(3),C(3)	CPS 60
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	CPS 70
	NGB=0	CPS 80
C	CHECK POINT 1 AND 2 ON VORTEX FILAMENT	CPS 90
10	CONTINUE	CPS 100
	A(1)=XF(I,J+1)-XB(IC,LL)	CPS 110
	A(2)=YE(I,J+1)-YB(IC,LL)	CPS 120
	A(3)=0.	CPS 130
	B(1)=XB(IC+1,LL)-XB(IC,LL)	CPS 140
	B(2)=YB(IC+1,LL)-YB(IC,LL)	CPS 150
	B(3)=0.	CPS 160
	CALL CRSPRD (A,B,C)	CPS 170
	C1=C(3)	CPS 180
	A(1)=XE(I,J)-XB(IC,LL)	CPS 190
	A(2)=YE(I,J)-YB(IC,LL)	CPS 200
	A(3)=0.	CPS 210
	CALL CRSPRD (A,B,C)	CPS 220
	C2=C(3)	CPS 230
	IF (C1+C2.GT.0.) GO TO 20	CPS 240
C	CHECK POINT 3 AND 4 ON CENTROID	CPS 250
	A(1)=XB(IC+1,LL)-XE(I,J)	CPS 260
	A(2)=YB(IC+1,LL)-YE(I,J)	CPS 270
	A(3)=0.	CPS 280
	B(1)=XE(I,J+1)-XE(I,J)	CPS 290
	B(2)=YE(I,J+1)-YE(I,J)	CPS 300
	B(3)=0.	CPS 310
	CALL CRSPRD (A,B,C)	CPS 320
	C1=C(3)	CPS 330
	A(1)=XB(IC,LL)-XE(I,J)	CPS 340

A(2)=YB(IC,LL)-YF(I,J)	CPS 350
A(3)=0.	CPS 360
CALL CRSPRD (A,B,C)	CPS 370
C2=C(3)	CPS 380
IF (C1*C2.GT.0.) GO TO 20	CPS 390
NGB=1	CPS 400
XCA=XE(I,J)	CPS 410
CALL CFSET (XCA,YCA,ZCA,IC,XB,YB,ZB,LL)	CPS 420
XCB=XF(I,J+1)	CPS 430
CALL CFSET (XCB,YCB,ZCB,IC,XB,YB,ZB,LL)	CPS 440
XYAB=(XCB-XCA)/(YCB-YCA)	CPS 450
XYE=(XE(I,J+1)-XE(I,J))/(YE(I,J+1)-YE(I,J))	CPS 460
BR1=XCA-(XYAB*YCA)	CPS 470
BB2=XE(I,J)-(XYE*YE(I,J))	CPS 480
DENOM=XYAB-XYE	CPS 490
FXE(I)=(XYAB*BB2-XYE*BR1)/DENOM	CPS 500
FYE(I)=(BB2-BR1)/DENOM	CPS 510
FZE(I)=ZE(I,J)+(FXE(I)-XE(I,J))*(ZE(I,J+1)-ZE(I,J))/(XE(I,J+1)-XE(I,J))	CPS 520
1 I,J)	CPS 530
RETURN	CPS 540
20 IC=IC+1	CPS 550
IF (IC.GE.NXB) RETURN	CPS 560
GO TO 10	CPS 570
END	CPS 580-

SUBROUTINE LIPITN (NCOR,NELM,M1,LASTE)	LRN 10
COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)	LRN 20
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	LRN 30
COMMON /ALLRA/ TTL(16),ALPHA	LRN 40
COMMON /ABC/ PXE(10,40),PYE(10,40),PZE(10,40)	LRN 50
DIMENSION M1(1),NCOR(1),NELM(1)	LRN 60
C	LRN 70
C	LRN 80
C	LRN 90
IF (ISPAN.EQ.0) IX=1	LRN 100
IF (ISPAN.EQ.1) IX=2	LRN 110
NSW1=MAXL	LRN 120
IF (ITRAKE.EQ.1) GO TO 50	LRN 130
NN2=M1(1)+2	LRN 140

	DO 40 I=2,MAXL	LRN 150
	IF (I.EQ.M1(1)) GO TO 40	LRN 160
	IF (I.EQ.M1(1)-2.OR.I.EQ.NN2) GO TO 40	LRN 170
	IF (I.LE.M1(1)-1) GO TO 20	LRN 180
	LAXN=NN2	LRN 190
	RXE=(PXE(I,5)-PXL(IX+1))/(PXE(LAXN,5)-PXL(IX+1))	LRN 200
	RYE=PYE(I,5)/PYE(LAXN,5)	LRN 210
	NXOR=NCOR(I)	LRN 220
	DO 10 L=6,NXOR	LRN 230
	PXE(I,L)=PXL(IX+1)+(PXE(LAXN,L)-PXL(IX+1))*RXE	LRN 240
	PYE(I,L)=PYE(LAXN,L)*RYE	LRN 250
	PZE(I,L)=PZE(LAXN,L)*RYE	LRN 260
10	CONTINUE	LRN 270
	GO TO 40	LRN 280
20	CONTINUE	LRN 290
	N=M1(1)-2	LRN 300
	RXE=(PXE(I,5)-PXL(IX))/(PXE(N,5)-PXL(IX))	LRN 310
	RYE=PYE(I,5)/PYE(N,5)	LRN 320
	NXOR=NCOR(I)	LRN 330
	DO 30 M=6,NXOR	LRN 340
	PXE(I,M)=PXL(IX)+(PXE(N,M)-PXL(IX))*RXE	LRN 350
	PYE(I,M)=PYE(N,M)*RYE	LRN 360
	PZE(I,M)=PZE(N,M)*RYE	LRN 370
30	CONTINUE	LRN 380
40	CONTINUE	LRN 390
	GO TO 150	LRN 400
50	CONTINUE	LRN 410
	IF (ISF.EQ.0) GO TO 60	LRN 420
	GO TO 80	LRN 430
60	NST=NSW1/2	LRN 440
	DO 70 I=LASTE,NSW1	LRN 450
	NXOR=NCOR(I)	LRN 460
	DO 70 L=6,NXOR	LRN 470
	X1=(PXE(NST,L-1)-PXL(1))*2	LRN 480
	Y1=(PYE(NST,L-1)-PYL(1))*2	LRN 490
	Z1=(PZE(NST,L-1))*2	LRN 500
	FL1=SQRT(X1+Y1+Z1)	LRN 510
	X2=(PXF(I,L-1)-PXL(1))*2	LRN 520
	Y2=(PYE(I,L-1)-PYL(1))*2	LRN 530
	Z2=(PZE(I,L-1))*2	LRN 540
	FL2=SQRT(X2+Y2+Z2)	LRN 550

	FK=FL1/FL2	LRN 560
	PXE(I,L)=PXE(I,L-1)+(PXE(NST,L)-PXE(NST,L-1))/FK	LRN 570
	PYE(I,L)=PYE(I,L-1)+(PYE(NST,L)-PYE(NST,L-1))/FK	LRN 580
	PZE(I,L)=PZE(I,L-1)+(PZF(NST,L)-PZE(NST,L-1))/FK	LRN 590
70	CONTINUE	LRN 600
80	CONTINUE	LRN 610
	RXE=(PXE(2,5)-PXL(1))/(PXE(3,5)-PXL(1))	LRN 620
	RYE=(PYE(2,5)-PYL(1))/(PYE(3,5)-PYL(1))	LRN 630
	NXOB=NCOR(2)-1	LRN 640
	DO 90 L=6,NXOB	LRN 650
	PXE(2,L)=(PXE(3,L)-PXL(1))*RXE+PXL(1)	LRN 660
	PYE(2,L)=(PYE(3,L)*RYE)+PYL(1)	LRN 670
	PZE(2,L)=PZF(3,L)*RYE	LRN 680
90	CONTINUE	LRN 690
	NELM(NSW1)=12	LRN 700
	NSW5=NSW1+NFLM(NSW1)-NCOR(NSW1)-1	LRN 710
	NCR=NCOR(NSW1)	LRN 720
	NCA=NCOR(NSW1-1)	LRN 730
	DY=(PYE(NSW1,NCR)-PYE(NSW1-1,NCA))	LRN 740
	DX=(PXE(NSW1,NCR)-PXE(NSW1-1,NCA))	LRN 750
	DYDX=DY/DX	LRN 760
	DO 100 I=NSW1,NSW5	LRN 770
	J=I-NSW1+1	LRN 780
	JJ=J-1	LRN 790
	DXX=PXE(NSW1,NCR+J)-PXE(NSW1,NCR+JJ)	LRN 800
	PYE(NSW1,NCR+J)=PYE(NSW1,NCR+JJ)+(DYDX*DXX)	LRN 810
	PXE(NSW1,NCR+J)=PXE(NSW1,NCR+JJ)+DX	LRN 820
100	CONTINUE	LRN 830
	DO 130 I=2,NSW5	LRN 840
	IF (I.GE.NSW1) GO TO 110	LRN 850
	JK=NCOR(I)+1	LRN 860
	NK=NCOR(I+1)	LRN 870
	II=I	LRN 880
	GO TO 120	LRN 890
110	CONTINUE	LRN 900
	II=NSW1-1	LRN 910
	JK=NCOR(II)+(I-II)+1	LRN 920
	NK=NCOR(NSW1)+I-NSW1+1	LRN 930
120	IF (II.LT.2) GO TO 130	LRN 940
	PXE(II,JK)=PXE(II+1,NK)	LRN 950
	PYE(II,JK)=PYE(II+1,NK)	LRN 960

	PZF(II,JK)=PZE(II+1,NK)	LRN 970
	II=II-1	LRN 980
	NK=JK	LRN 990
	JK=NCOR(II)+(I-II)+1	LRN1000
	GO TO 120	LRN1010
130	CONTINUE	LRN1020
	LL=1	LRN1030
	L1=NSW1	LRN1040
	L3=2	LRN1050
	DO 140 I=2,NSW1	LRN1060
	NELM(I)=NELM(NSW1)+(NSW1-I)	LRN1070
140	CONTINUE	LRN1080
	GO TO 250	LRN1090
150	CONTINUE	LRN1100
	LL=1	LRN1110
	L1=M1(1)-1	LRN1120
	L2=L1-1	LRN1130
	NSW6=L2	LRN1140
	L3=2	LRN1150
	GO TO 170	LRN1160
160	LL=2	LRN1170
	L1=MAXL	LRN1180
	L2=L1-1	LRN1190
	NSW6=L2	LRN1200
	L3=M1(1)+1	LRN1210
170	CONTINUE	LRN1220
	NCA=NCOR(L2)	LRN1230
	NCR=NCOR(L1)	LRN1240
	DXX=PXE(L1,NCR)-PXE(L2,NCA)	LRN1250
	DYY=PYE(L1,NCR)-PYE(L2,NCA)	LRN1260
	DZZ=PZE(L1,NCR)-PZE(L2,NCA)	LRN1270
	DYDX=DYY/DXX	LRN1280
	DZDX=DZZ/DXX	LRN1290
	DX=(PXT(LL)-PXL(LL))/4.	LRN1300
	IC=1	LRN1310
	PAV=0.5*(PXT(LL)+PXT(LL+1))+0.5*(PXT(LL)-PXL(LL))	LRN1320
	PAX=PXE(L1,NCR)+DX	LRN1330
180	IF (PAX.GT.PAV) GO TO 190	LRN1340
	IC=IC+1	LRN1350
	PAX=PAX+DX	LRN1360
	GO TO 180	LRN1370

190	JJ=NCR+IC	LRN1380
	I=L1	LRN1390
	J=NCR+1	LRN1400
	DO 200 K=J,JJ	LRN1410
	PXE(I,K)=PXE(I,K-1)+DX	LRN1420
	PYE(I,K)=PYE(I,K-1)+DX*DYDX	LRN1430
	PZE(I,K)=PZE(I,K-1)+DX*DZDX	LRN1440
200	CONTINUE	LRN1450
	NFLM(L1)=JJ	LRN1460
	DO 210 I=L3,NSW6	LRN1470
	NELM(I)=NELM(L1)+(L1-I)	LRN1480
210	CONTINUE	LRN1490
C	UP TO THIS STEP, THE NODE POINT OF THE CORE IS NO. 11	LRN1500
	KK=L1-1	LRN1510
220	LA=NELM(KK)-NCOR(KK)	LRN1520
	DO 230 I=1,LA	LRN1530
	J=NCOR(KK)+I	LRN1540
	PXE(KK,J)=PXE(KK+1,J-1)	LRN1550
	PYE(KK,J)=PYE(KK+1,J-1)	LRN1560
	PZE(KK,J)=PZE(KK+1,J-1)	LRN1570
230	CONTINUE	LRN1580
	KK=KK-1	LRN1590
	IF (KK.LT.L3) GO TO 240	LRN1600
	GO TO 220	LRN1610
240	CONTINUE	LRN1620
250	CONTINUE	LRN1630
	DO 260 I=L3,L1	LRN1640
	NCOR(I)=NCOR(I)+1	LRN1650
	NELM(I)=NELM(I)+1	LRN1660
	M=NCOR(I)	LRN1670
	K=NELM(I)	LRN1680
	DO 260 J=M,K	LRN1690
	JJ=K-(J-M)	LRN1700
	PXE(I,JJ)=PXE(I,JJ-1)	LRN1710
	PYE(I,JJ)=PYE(I,JJ-1)	LRN1720
	PZE(I,JJ)=PZE(I,JJ-1)	LRN1730
260	CONTINUE	LRN1740
C	THE ORDER OF THE NODE POINT ALONG THE CORE IS 12TH	LRN1750
	TT=TAN(ALPHA)	LRN1760
	CALL AZCORE (TT,PXL,PXT,PYL,NCOR,NELM,L1,L3,LL)	LRN1770
	IF (ITRAKE.NE.1.AND.LL.EQ.1) GO TO 160	LRN1780

RETURN
END

LRN1790
LRN1800-

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SUBROUTINE AZCORE (TT,PXL,PXT,PYL,NCOR,NELM,L1,L3,LL)
DIMENSION PXL(1),PXT(1),PYL(1),NCOR(1),NELM(1)
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC
COMMON /CAMB/ ICAM
IF (ITRAKE.NE.1) GO TO 20
C SMITH&S. RESULTS ARE APPLIED ONLY TO THE ONE CORE SYSTEM
PXP=PXL(LL)
TANG=(PYL(LL+1)-PYL(LL))/(PXT(LL)-PXL(LL))
TRT=TT/TANG
DO 10 I=L3,L1
K=NELM(I)
NN=NCOR(I)
DO 10 IK=NN,K
TZAE=TANG*(XE(I,IK)-PXP)
IF (TRT.LT.1.2) ZE(I,IK)=TZAE*(0.189*TRT+0.08)
IF (TRT.GE.1.2.AND.TR.T.LT.2.2) ZE(I,IK)=TZAE*(0.1333*TRT+0.158)
IF (TRT.GE.2.2) ZE(I,IK)=TZAE*(0.13*TRT+0.132)
10 CONTINUE
20 CONTINUE
NXOR=NCOR(L3)
FZMIN=0.2*(XE(L3,NXOR)-PXL(LL))*TT
IF (ZE(L3,NXOR).LT.FZMIN) ZE(L3,NXOR)=FZMIN
RETURN
END

```

AZC 10
AZC 20
AZC 30
AZC 40
AZC 50
AZC 60
AZC 70
AZC 80
AZC 90
AZC 100
AZC 110
AZC 120
AZC 130
AZC 140
AZC 150
AZC 160
AZC 170
AZC 180
AZC 190
AZC 200
AZC 210
AZC 220
AZC 230
AZC 240
AZC 250-

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SUBROUTINE APFXC (NELM,NCOR,M1)
DIMENSION M1(1),NCOR(1),NELM(1)
COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)
COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC
COMMON /LOC/ FU1,FU2,XEND,PXL(5),PXT(5),PYL(5)
LL=1
IM=1
L1=M1(1)-1

```

APX 10
APX 20
APX 30
APX 40
APX 50
APX 60
APX 70
APX 80

	L3=IM	APX 90
	GO TO 20	APX 100
10	IM=M1(1)	APX 110
	LL=2	APX 120
	L1=MAXL	APX 130
	L3=IM	APX 140
20	CONTINUE	APX 150
	NELM(IM)=NELM(IM+1)+1	APX 160
	NCOR(IM)=NCOR(IM+1)	APX 170
	K=NCOR(IM)	APX 180
	DO 30 IJ=5,K	APX 190
	XE(IM,IJ)=XE(IM,4)	APX 200
	YE(IM,IJ)=YE(IM,4)	APX 210
	ZF(IM,IJ)=ZE(IM,4)	APX 220
30	CONTINUE	APX 230
	NSW8=NELM(IM)-NCOR(IM)	APX 240
	DO 40 I=1,NSW8	APX 250
	J=NCOR(IM)+I	APX 260
	XE(IM,J)=XE(IM+1,J-1)	APX 270
	YE(IM,J)=YE(IM+1,J-1)	APX 280
	ZE(IM,J)=ZE(IM+1,J-1)	APX 290
40	CONTINUE	APX 300
	CALL AYCORE (PXL,PXT,PYL,NCOR,NELM,L1,L3,LL)	APX 310
	IF (ITPAKE.NE.1.AND.LL.EQ.1) GO TO 10	APX 320
	RETURN	APX 330
	END	APX 340-

	SUBROUTINE AYCORE (PXL,PXT,PYL,NCOR,NELM,L1,L3,LL)	AYC 10
	DIMENSION PXL(1),PXT(1),PYL(1),NELM(1),NCOR(1)	AYC 20
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	AYC 30
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	AYC 40
	COMMON /ALLPA/ TTL(16),ALPHA	AYC 50
	TANG=(PYL(LL+1)-PYL(LL))/(PXL(LL+1)-PXL(LL))	AYC 60
	PAV=0.5*(PXT(LL)+PXT(LL+1))	AYC 70
	DO 10 I=L3,L1	AYC 80
	K=NELM(I)	AYC 90
	NN=NCOR(I)	AYC 100
	DO 10 IK=NN,K	AYC 110
	TZAE=TANG*(XE(I,IK)-PXL(LL))	AYC 120

	IF (XF(I,IK).GT.PAV) TZAF=PYL(LL+1)-PYL(LL)	AYC 130
	FYE=0.6*TZAF	AYC 140
	IF (YF(I,IK).GT.FYE.AND.XE(I,IK).LT.PAV) GO TO 10	AYC 150
	IF (XE(I,IK).GE.PAV.AND.YF(I,IK).GT.FYE) GO TO 10	AYC 160
	YE(I,IK)=0.62*TZAF+PYL(LL)	AYC 170
10	CONTINUE	AYC 180
C	SET UP THE GOOD SHAPE OF THE STRAKE CORE ON THE X-Y PLANE	AYC 190
	IF (ITRAKE.EQ.1.OR.LL.NE.1) GO TO 60	AYC 200
	KK=NCOR(L1)	AYC 210
	JJ=NELM(L1)-1	AYC 220
	DXX=XE(L1,KK)-XE(L1-1,KK)	AYC 230
	DYY=YE(L1,KK)-YE(L1-1,KK)	AYC 240
	DZZ=ZE(L1,KK)-ZE(L1-1,KK)	AYC 250
	DYDX=DYY/DXX	AYC 260
	DZDX=DZZ/DXX	AYC 270
	DO 20 I=KK,JJ	AYC 280
	Dx=XE(L1,I+1)-XE(L1,I)	AYC 290
	YE(L1,I+1)=YE(L1,I)+DX*DYDX	AYC 300
	ZE(L1,I+1)=ZE(L1,I)+DX*DZDX	AYC 310
20	CONTINUE	AYC 320
C	REGROUP THE NODE POINTS ALONG THE CORE ON THE STRAKE SECTION	AYC 330
	KK=L1-1	AYC 340
30	LA=NELM(KK)-NCOR(KK)	AYC 350
	DO 40 I=1,LA	AYC 360
	J=NCOR(KK)+I	AYC 370
	XE(KK,J)=XE(KK+1,J-1)	AYC 380
	YE(KK,J)=YE(KK+1,J-1)	AYC 390
	ZE(KK,J)=ZE(KK+1,J-1)	AYC 400
40	CONTINUE	AYC 410
	KK=KK-1	AYC 420
	IF (KK.LT.2) GO TO 50	AYC 430
	GO TO 30	AYC 440
50	CONTINUE	AYC 450
60	CONTINUE	AYC 460
C	TO SET UP THE INITIAL FREE SHEET AND CORE IN STANDARD FORM	AYC 470
	IF (ITRAKE.NE.1) RETURN	AYC 480
	NXOR=NCOR(L3)	AYC 490
	NXOR1=NXOR+1	AYC 500
	NXOR2=NXOR+2	AYC 510
	RY=(YE(L3,NXOR2)-PYL(LL))/(XE(L3,NXOR2)-PXL(LL))	AYC 520
	RZ=(ZF(L3,NXOR2)-0.)/(XE(L3,NXOR2)-PXL(LL))	AYC 530

	YE(L3,NXOR1)=RY*(XE(L3,NXOR1)-PXL(LL))+PYL(LL)	AYC 540
	ZE(L3,NXOR1)=RZ*(XE(L3,NXOR1)-PXL(LL))	AYC 550
	ZE(L3,NXOR1)=0.5*(ZE(L3,NXOR1)+ZE(L3,NXOR2))	AYC 560
C	MODIFY THE FREE SHEET PORTION NEAR APEX REGION	AYC 570
	XE(L3+1,NXOR)=XF(L3,NXOR1)	AYC 580
	YE(L3+1,NXOR)=YF(L3,NXOR1)	AYC 590
	ZE(L3+1,NXOR)=ZF(L3,NXOR1)	AYC 600
C	*****	AYC 610
	XE(L3+1,NXOR-1)=XE(L3+1,NXOR)	AYC 620
	YE(L3+1,NXOR-1)=YE(L3+1,NXOR)	AYC 630
	ZE(L3+1,NXOR-1)=ZE(L3+1,NXOR)	AYC 640
C	*****	AYC 650
	XE(L3+1,NXOR-2)=XE(L3+1,NXOR)	AYC 660
	YE(L3+1,NXOR-2)=YE(L3+1,NXOR)	AYC 670
	RETURN	AYC 680
	END	AYC 690-

	SUBROUTINE LEADLM (NOC,BXE,BYE,BZE,NIT,I)	LAD 10
	DIMENSION PNT(20,3),FLEN(20),COEF(20,4,3),	LAD 20
	IBXE(5),PYE(5),BZE(5),SP(20)	LAD 30
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	LAD 40
C	LEADING-EDGE VORTEX SEGMENT STARTS FROM FIFTH POINT OF LEADING	LAD 50
C	EDGE FREE ELEMENT ON FREE SHEET	LAD 60
	NOC1=NOC-1	LAD 70
	DO 10 J=1,NOC	LAD 80
	JJ=J+4	LAD 90
	PNT(J,1)=XE(I,JJ)	LAD 100
	PNT(J,2)=YE(I,JJ)	LAD 110
	PNT(J,3)=ZE(I,JJ)	LAD 120
10	CONTINUE	LAD 130
	EPS=0.	LAD 140
	N=0	LAD 150
	MAXN=20	LAD 160
	MAXSP=20	LAD 170
	IX=NOC	LAD 180
	IPT=-1	LAD 190
	CALL CSIPAR (MAXN,IX,PNT,N,MAXSP,EPS,K1,IPT,ELEN,COEF,CPT,IERR)	LAD 200
	SP(1)=0.	LAD 210
	ST=0.	LAD 220

	DO 20 K=2,NOC	LAD 230
	SP(K)=SP(K-1)+ELEN(K-1)	LAD 240
20	ST=ST+FLEN(K-1)	LAD 250
	DO 50 L=1,NIT	LAD 260
	FL=L	LAD 270
	DS=ST*FL/NIT	LAD 280
	LL=1	LAD 290
30	IF (DS.GT.SP(LL).AND.DS.LE.SP(LL+1)) GO TO 40	LAD 300
	LL=LL+1	LAD 310
	GO TO 30	LAD 320
40	DT=(DS-SP(LL))/(SP(LL+1)-SP(LL))	LAD 330
	BXE(L)=COEF(LL,1,1)*(DT**3)+COEF(LL,2,1)*(DT**2)+COEF(LL,3,1)*DT+CLAD	LAD 340
	10EF(LL,4,1)	LAD 350
	BYE(L)=COEF(LL,1,2)*(DT**3)+COEF(LL,2,2)*(DT**2)+COEF(LL,3,2)*DT+CLAD	LAD 360
	10EF(LL,4,2)	LAD 370
	BZE(L)=COEF(LL,1,3)*(DT**3)+COEF(LL,2,3)*(DT**2)+COEF(LL,3,3)*DT+CLAD	LAD 380
	10EF(LL,4,3)	LAD 390
50	CONTINUE	LAD 400
	RETURN	LAD 410
	END	LAD 420-

	SUBROUTINE CFSFT (XX1,YY1,ZZ1,IC,XB,YB,ZB,LL)	SET 10
	DIMENSION XB(40,2),YB(40,2),ZB(40,2)	SET 20
	D1=XX1-XB(IC,LL)	SET 30
	D2=XB(IC+1,LL)-XB(IC,LL)	SET 40
	D3=YB(IC+1,LL)-YB(IC,LL)	SET 50
	YY1=YB(IC,LL)+(D3*D1)/D2	SET 60
	D4=ZB(IC+1,LL)-ZB(IC,LL)	SET 70
	ZZ1=ZB(IC,LL)+(D4*D1)/D2	SET 80
	RETURN	SET 90
	END	SET 100-

	SUBROUTINE MINMAX (X1,X2,XMN,XXM)	MAX 10
	XXM=AMIN1(X1,X2)	MAX 20
	XXM=AMAX1(X1,X2)	MAX 30
	RETURN	MAX 40
	END	MAX 50-

	SUBROUTINE CENTRD (XSTN,YSTN,ZSTN,NMAX,NSW1,NELM,ISECT)	CEN 10
	DIMENSION YSTN(1),ZSTN(1),NELM(1)	CEN 20
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	CEN 30
	COMMON /GENCF/ M1(5)	CEN 40
	COMMON /AERO/ NAERO,MAXL,MAXW,ISPAN,ISF,ITRAKE,ISC	CEN 50
	I=2	CEN 60
	IF (ITRAKE.NE.1.AND.ISECT.FO.2) I=M1(1)+1	CEN 70
	NSUB=5	CEN 80
	K=NSUB	CEN 90
10	KMAX=NELM(I)	CEN 100
	IF (XE(I,K).GE.XSTN) GO TO 60	CEN 110
20	IF (XE(I,K).LE.XSTN.AND.XE(I,K+1).GE.XSTN) GO TO 30	CEN 120
	K=K+1	CEN 130
	IF (K.EQ.KMAX) GO TO 50	CEN 140
	GO TO 20	CEN 150
30	CALL COORD (XSTN,I,K,YSTN(I),ZSTN(I))	CEN 160
40	I=I+1	CEN 170
	K=NSUB	CEN 180
	IF (I.GT.NSW1) GO TO 70	CEN 190
	GO TO 10	CEN 200
50	YSTN(I)=YE(I,K)	CEN 210
	ZSTN(I)=ZE(I,K)	CEN 220
	GO TO 40	CEN 230
60	NMAX=I-1	CEN 240
	RETURN	CEN 250
70	NMAX=NSW1	CEN 260
	RETURN	CEN 270
	END	CEN 280-

	SUBROUTINE COORD (XS,I,K,YS,ZS)	C00 10
	COMMON /ABC/ XE(10,40),YE(10,40),ZE(10,40)	C00 20
	DX=XE(I,K+1)-XE(I,K)	C00 30
	DY=YE(I,K+1)-YE(I,K)	C00 40
	DZ=ZE(I,K+1)-ZE(I,K)	C00 50
	YS=YE(I,K)+DY*(XS-XE(I,K))/DX	C00 60
	ZS=ZE(I,K)+DZ*(XS-XE(I,K))/DX	C00 70

RETURN
END

C00 80
C00 90-

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      SUBROUTINE CSIPAR(MAXN,IX,PNT,N,MAXSP,EPS,K1,IPT,ELEN,COEF,CPT, CSIP0010
1      I      IEPR)      CSIP0020
C*****CSIP0030
C*      CSIP0040
C*      PURPOSE:      CSIP0050
C*      SUBROUTINE CSIPAR COMPUTES PARAMETRIC CUBIC SPLINE      CSIP0060
C*      COEFFICIENTS TO APPROXIMATE A SMOOTH CURVE THROUGH A      CSIP0070
C*      3D SET OF INPUT POINTS AND OPTIONALLY COMPUTES AN      CSIP0080
C*      ENRICHED CURVE.      CSIP0090
C*      CSIP0100
C*      USE:      CSIP0110
C*      CALL CSIPAR(MAXN,IX,PNT,N,MAXSP,EPS,K1,IPT,ELEN,      CSIP0120
C*      COEF,CPT,IEPR)      CSIP0130
C*      CSIP0140
C*      MAXN      AN INPUT INTEGER SPECIFYING THE MAXIMUM NUMBER OF      CSIP0150
C*      NODE POINTS AS GIVEN IN THE DIMENSION STATEMENT OF      CSIP0160
C*      THE CALLING PROGRAM.      CSIP0170
C*      CSIP0180
C*      IX      AN INPUT INTEGER SPECIFYING THE ACTUAL NUMBER OF      CSIP0190
C*      NODE POINTS DEFINING THE CURVE.  IX @ MAXN.      CSIP0200
C*      CSIP0210
C*      PNT      A TWO-DIMENSIONAL INPUT ARRAY DIMENSIONED (MAXN,3)      CSIP0220
C*      IN THE CALLING PROGRAM.  ON ENTRY TO CSIPAR,      CSIP0230
C*      PNT(K,1), PNT(K,2), PNT(K,3) CONTAIN THE X,Y, AND Z      CSIP0240
C*      COORDINATES RESPECTIVELY OF THE K-TH NODE POINT TO      CSIP0250
C*      BE FITTED.      CSIP0260
C*      CSIP0270
C*      N      AN INPUT INTEGER SPECIFYING THE NUMBER OF      CSIP0280
C*      INTERPOLATED POINTS TO BE COMPUTED BETWEEN EACH PAIR      CSIP0290
C*      OF NODE POINTS.  IF N=0, COMPUTATION OF THE      CSIP0300
C*      ENRICHED CURVE IS OMITTED.      CSIP0310
C*      CSIP0320
C*      MAXSP      AN INPUT INTEGER SPECIFYING THE MAXIMUM NUMBER OF      CSIP0330
C*      POINTS ALLOWED IN THE ENRICHED CURVE, AS GIVEN IN      CSIP0340
C*      THE DIMENSION STATEMENT OF THE CALLING PROGRAM.      CSIP0350
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C*           MAXSP SHOULD BE AT LEAST (IX-1) * (N+1) + 1 TO          *CSIP0360
C*           PROVIDE FOR ALL INTERPOLATED POINTS.  IF AN ENRICHED    *CSIP0370
C*           CURVE IS NOT CALCULATED, A DUMMY ARGUMENT SHOULD       *CSIP0380
C*           BE SPECIFIED FOR MAXSP.                                *CSIP0390
C*                                                                 *CSIP0400
C*           EPS           AN INPUT PARAMETER USED TO TEST CURVATURE  *CSIP0410
C*           OF THE        ENRICHED CURVE.  IF THE ABSOLUTE VALUE OF  *CSIP0420
C*           THE SECOND    DERIVATIVE AT AN INTERPOLATED POINT IS    *CSIP0430
C*           LESS THAN     EPS, THE POINT WILL BE OMITTED FROM THE   *CSIP0440
C*           ENRICHED     CURVE.  IF EPS=0, ALL INTERPOLATED POINTS  *CSIP0450
C*           WILL BE      RETAINED.  IF AN ENRICHED CURVE IS NOT    *CSIP0460
C*           CALCULATED,  A DUMMY ARGUMENT SHOULD BE SPECIFIED FOR   *CSIP0470
C*           EPS.                                                *CSIP0480
C*           K1           AN INPUT INTEGER SPECIFYING WHETHER A NODE  *CSIP0490
C*           POINT IS     TO BE RETAINED IN THE ENRICHED CURVE WHEN  *CSIP0500
C*           THE SECOND    DERIVATIVE AT THE POINT IS LESS THAN EPS. *CSIP0510
C*           K1=1        ALL NODE POINTS WILL BE RETAINED.          *CSIP0520
C*           K1=2        NODE POINTS WILL BE OMITTED IF SECOND      *CSIP0530
C*           DERIVATIVE   IS LESS THAN EPS.                          *CSIP0540
C*           IF AN ENRICHED CURVE IS NOT CALCULATED, A DUMMY       *CSIP0550
C*           ARGUMENT    SHOULD BE SPECIFIED FOR K1.                 *CSIP0560
C*                                                                 *CSIP0570
C*           IPT         AN INPUT/OUTPUT INTEGER HAVING THE FOLLOWING *CSIP0580
C*           FUNCTIONS:                                           *CSIP0590
C*                                                                 *CSIP0600
C*           INPUT:                                              *CSIP0610
C*                                                                 *CSIP0620
C*           =-1        WHENEVER A NEW PNT ARRAY IS SPECIFIED, IPT   *CSIP0630
C*           MUST       BE INPUT AS -1 SO THAT THE ROUTINE WILL BE  *CSIP0640
C*           INITIALIZED.                                         *CSIP0650
C*                                                                 *CSIP0660
C*           OUTPUT:                                             *CSIP0670
C*                                                                 *CSIP0680
C*           =N         THERE ARE A TOTAL OF N POINTS IN THE        *CSIP0690
C*           ENRICHED   CURVE.                                       *CSIP0700
C*                                                                 *CSIP0710
C*           ELEN        A ONE-DIMENSIONAL OUTPUT ARRAY DIMENSIONED  *CSIP0720
C*           AT LEAST   IX IN THE CALLING PROGRAM.  ON RETURN FROM   *CSIP0730
C*           CSIPAR,    ELEN(K) CONTAINS THE CHORD LENGTH BETWEEN    *CSIP0740
C*           NODE      POINTS K AND K+1.                             *CSIP0750
C*                                                                 *CSIP0760

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C*      COEF      A THREE-DIMENSIONAL OUTPUT ARRAY DIMENSIONED      *CSIP0770
C*      (MAXN,4,3) IN THE CALLING PROGRAM. ON RETURN FROM          *CSIP0780
C*      CSIPAR, COEF(K,M,N) CONTAINS THE M-TH CURIC COEFFIC-      *CSIP0790
C*      IFNT FOR THE N-TH COORDINATE IN THE INTERVAL BETWEEN      *CSIP0800
C*      NODE POINTS K AND K+1.                                     *CSIP0810
C*      ORDER OF CURIC COEFFICIENTS IS:                            *CSIP0820
C*      COEF(K,1,1)=AX      COEF(K,1,2)=AY      COEF(K,1,3)=AZ      *CSIP0830
C*      COEF(K,2,1)=RX      COEF(K,2,2)=RY      COEF(K,2,3)=BZ      *CSIP0840
C*      COEF(K,3,1)=CX      COEF(K,3,2)=CY      COEF(K,3,3)=CZ      *CSIP0850
C*      COEF(K,4,1)=DX      COEF(K,4,2)=DY      COEF(K,4,3)=DZ      *CSIP0860
C*      WHERE:                                                    *CSIP0870
C*      FX = AX*T**3 + RX*T**2 + CX*T + DX                       *CSIP0880
C*      FY = AY*T**3 + RY*T**2 + CY*T + DY                       *CSIP0890
C*      FZ = AZ*T**3 + RZ*T**2 + CZ*T + DZ                       *CSIP0900
C*      AND:                                                      *CSIP0910
C*      T = CHORDAL DISTANCE PARAMETER.                          *CSIP0920
C*                                                                *CSIP0930
C*      CPT      A TWO-DIMENSIONAL OUTPUT ARRAY DIMENSIONED (MAXSP,3) *CSIP0940
C*      IN THE CALLING PROGRAM. ON RETURN FROM CSIPAR,           *CSIP0950
C*      CPT(K,1), CPT(K,2), CPT(K,3) CONTAIN THE X,Y,Z          *CSIP0960
C*      COORDINATES RESPECTIVELY OF THE K-TH POINT ON THE      *CSIP0970
C*      ENRICHED CURVE. IF AN ENRICHED CURVE IS NOT            *CSIP0980
C*      CALCULATED, A DUMMY ARGUMENT SHOULD BE SPECIFIED      *CSIP0990
C*      FOR CPT.                                                *CSIP1000
C*                                                                *CSIP1010
C*      IERR     AN OUTPUT INTEGER ERROR CODE.                  *CSIP1020
C*      =0      NORMAL RETURN NO ERROR IN CALCULATION          *CSIP1030
C*      =-1     INCOMPLETE FAIRED CURVE                        *CSIP1040
C*      =-2     LESS THAN FOUR NODE POINTS WERE SPECIFIED.    *CSIP1050
C*      ROUTINE TERMINATES.                                     *CSIP1060
C*                                                                *CSIP1070
C*                                                                *CSIP1080
C*                                                                *CSIP1090
C*      REQUIRED ROUTINES                                         NONE *CSIP1100
C*                                                                *CSIP1110
C*      SOURCE      SUBROUTINE SPFIT WRITTEN BY                *CSIP1120
C*                  CMPB, MODIFIED BY COMPUTER                 *CSIP1130
C*                  SCIENCES CORPORATION                      *CSIP1140
C*                                                                *CSIP1150
C*      LANGUAGE    FORTRAN                                     *CSIP1160
C*                                                                *CSIP1170

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C*   DATE RELEASED           OCTOBER 3, 1973           *CSIP1180
C*                                     *CSIP1190
C*   LATEST REVISION        OCTOBER 3, 1973           *CSIP1200
C*                                     *CSIP1210
C*                                     *CSIP1220
C*****CSIP1230
DIMENSION PNT(MAXN,3),ELEN(1),COEF(MAXN,4,3),CPT(MAXSP,3) CSIP1240
DIST(X1,Y1,Z1,X2,Y2,Z2)=SQRT((X2-X1)**2+(Y2-Y1)**2+(Z2-Z1)**2) CSIP1250
IF (IPT .NE. -1) GO TO 92 CSIP1260
IF (IX .LT. 4) GO TO 140 CSIP1270
IEPR = 0 CSIP1280
N1=IX-1 CSIP1290
C CSIP1300
C   COMPUTES CHORD LENGTHS CSIP1310
C CSIP1320
DO 30 NN=2,IX CSIP1330
  ELEN(NN-1)=DIST(PNT(NN-1,1),PNT(NN-1,2),PNT(NN-1,3),
1 PNT(NN,1),PNT(NN,2),PNT(NN,3)) CSIP1340
  CONTINUE CSIP1350
30 CSIP1360
C CSIP1370
C   SFTUP COEFFICIENT MATRIX WITH UNCLAMPED END POINTS CSIP1380
C   SETS 2ND DER=0. AT P1 AND PN CSIP1390
C CSIP1400
COEF(1,1,1)=0. CSIP1410
COEF(1,1,2)=2. CSIP1420
COEF(1,1,3)=1. CSIP1430
COEF (IX,1,1)=1. CSIP1440
COEF (IX,1,2)=2. CSIP1450
COEF (IX,1,3)=0. CSIP1460
DO 40 NN=2,N1 CSIP1470
  COFF(NN,1,1)=ELEN(NN) CSIP1480
  COFF(NN,1,2)=2.*(ELEN(NN-1)+ELEN(NN)) CSIP1490
  COFF(NN,1,3)=ELEN(NN-1) CSIP1500
  CONTINUE CSIP1510
40 CSIP1520
C CSIP1530
C   SOLVE FOR SLOPES CSIP1540
C CSIP1550
DO 70 I=1,3 CSIP1560
  COEF(1,4,I)=(3./ELEN(1))*(PNT(2,I)-PNT(1,I)) CSIP1570
  COEF (IX,4,I)=(3./ELEN (IX-1))*(PNT(IX,I)-PNT(IX-1,I)) CSIP1580
  DO 60 NN=2,N1

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	COFF(NN,4,1)=(3./(ELFN(NN-1)*ELEN(NN)))*	CSIP1590
1	(ELEN(NN-1)**2*(PNT(NN+1,I)-PNT(NN,I))+	CSIP1600
2	ELEN(NN)**2*(PNT(NN,I)-PNT(NN-1,I)))	CSIP1610
60	CONTINUE	CSIP1620
C		CSIP1630
C	SOLVE TPIDIAGONAL MATRIX	CSIP1640
C		CSIP1650
	COFF(1,2,1)=COEF(1,1,3)/COEF(1,1,2)	CSIP1660
	COEF(1,3,I)=COEF(1,4,1)/COEF(1,1,2)	CSIP1670
	DO 63 K=2,IX	CSIP1680
	KM1=K-1	CSIP1690
	TEMP=COEF(K,1,2)-COEF(K,1,1)*COEF(KM1,2,1)	CSIP1700
	COEF(K,2,1)=COEF(K,1,3)/TEMP	CSIP1710
	COEF(K,3,I)=(COEF(K,4,1)-COEF(K,1,1)*COEF(KM1,3,I))/TEMP	CSIP1720
63	CONTINUE	CSIP1730
	DO 67 K=1,N1	CSIP1740
	KK=IX-K	CSIP1750
	COEF(KK,3,I)=COEF(KK,3,I)-COEF(KK,2,1)*COEF(KK+1,3,I)	CSIP1760
67	CONTINUE	CSIP1770
70	CONTINUE	CSIP1780
C		CSIP1790
C	COMPUTE CURIC COEFFICIENTS FOR EACH SEGMENT	CSIP1800
C		CSIP1810
	DO 90 NN=1,N1	CSIP1820
	EL=1./ELEN(NN)	CSIP1830
	EL2=EL*EL	CSIP1840
	EL3=EL*EL2	CSIP1850
	DO 90 I=1,3	CSIP1860
	COEF(NN,4,I)=PNT(NN,I)	CSIP1870
	E=PNT(NN+1,I)-PNT(NN,I)	CSIP1880
	COEF(NN,2,I)=	CSIP1890
1	F*EL2*3.-	CSIP1900
2	EI*(2.*COEF(NN,3,I)+COEF(NN+1,3,I))	CSIP1910
	COEF(NN,1,I)=	CSIP1920
1	-F*EL3*2.+	CSIP1930
2	FL2*(COEF(NN,3,I)+COEF(NN+1,3,I))	CSIP1940
C		CSIP1950
C	REFERENCE LENGTH TO 1.	CSIP1960
C		CSIP1970
	COEF(NN,1,I)=COEF(NN,1,I)/EL3	CSIP1980
	COEF(NN,2,I)=COEF(NN,2,I)/EL2	CSIP1990

	COEF (NN,3,I)=COEF (NN,3,I)/EL	CSIP2000
90	CONTINUE	CSIP2010
	92 IPT = 0	CSIP2020
	IF (N .EQ. 0) RETURN	CSIP2030
	IF (K1 .EQ. 0) K1 =1	CSIP2040
C		CSIP2050
C	COMPUTE ENRICHED POINTS	CSIP2060
C		CSIP2070
	IFIT = N+1	CSIP2080
	XFIT=IFIT	CSIP2090
	DELT=1./XFIT	CSIP2100
	DO 120 NN=1,N1	CSIP2110
	DO 110 NF=1,IFIT	CSIP2120
	F=NF-1	CSIP2130
	T=DELT*F	CSIP2140
	IF (NN.EQ.1.AND.NF.EQ.1)GO TO 95	CSIP2150
	IF (NF.EQ. 1.AND. K1 .EQ. 1) GO TO 95	CSIP2160
	T6=6.*T	CSIP2170
	EX=ABS (T6*COEF (NN,1,1)+2.*COEF (NN,2,1))	CSIP2180
	EY=ABS (T6*COEF (NN,1,2)+2.*COEF (NN,2,2))	CSIP2190
	EZ=ABS (T6*COEF (NN,1,3)+2.*COEF (NN,2,3))	CSIP2200
	EE=(EX+EY+EZ)/(ELFN(NN)*ELEN(NN))	CSIP2210
	IF (EE.LT.EPS)GO TO 110	CSIP2220
95	IF (IPT .GE. MAXSP) GO TO 130	CSIP2230
	IPT=IPT+1	CSIP2240
	DO 100 I=1,3	CSIP2250
100	CPT (IPT,I)=((T*COEF (NN,1,I) + COEF (NN,2,I))*T+ COEF (NN,3,	CSIP2260
1	I))*T+COEF (NN,4,I)	CSIP2270
110	CONTINUE	CSIP2280
120	CONTINUE	CSIP2290
	IF (IPT .GE. MAXSP) GO TO 130	CSIP2300
	IPT=IPT+1	CSIP2310
	DO 125 I=1,3	CSIP2320
125	CPT (IPT,I)=PNT (IX,I)	CSIP2330
	RETURN	CSIP2340
130	IERR=-1	CSIP2350
	RETURN	CSIP2360
140	IERR =-2	CSIP2370
	RETURN	CSIP2380
	END	CSIP2390

*** RUN STREAM ***

LEVSP,T1777,CM177000.
USER,XXXXXX.
CHARGE,YYYYYY,LRC.
FTN.
LGO.
REWIND,TAPE9.
COPY,TAPE9.
REWIND,TAPF10.
COPY,TAPE10.
7/8/9 - CARD

} FILE MANIPULATION FOR BEST SET OF RESULTS

** COMPUTER PROGRAM **

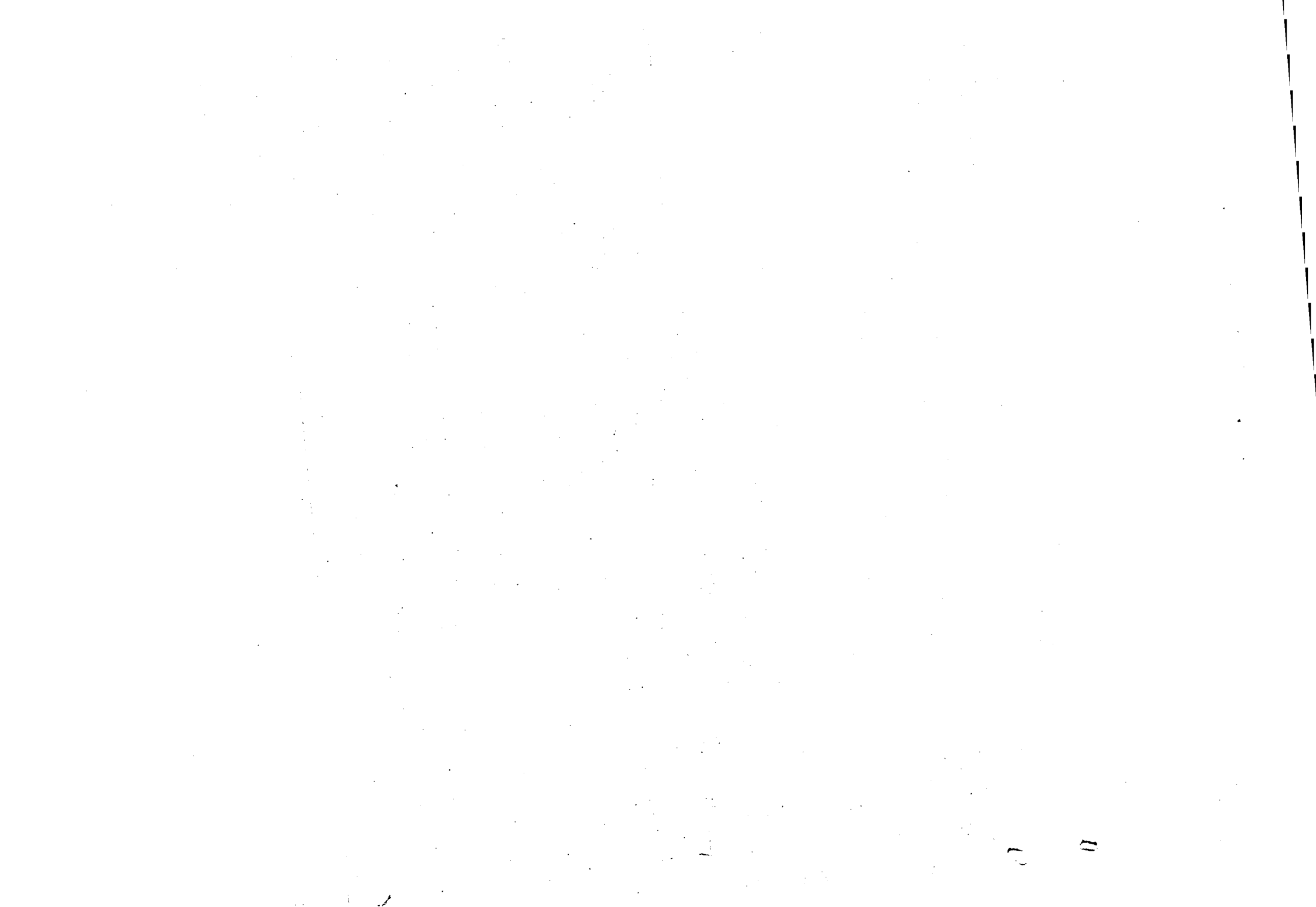
7/8/9 - CARD

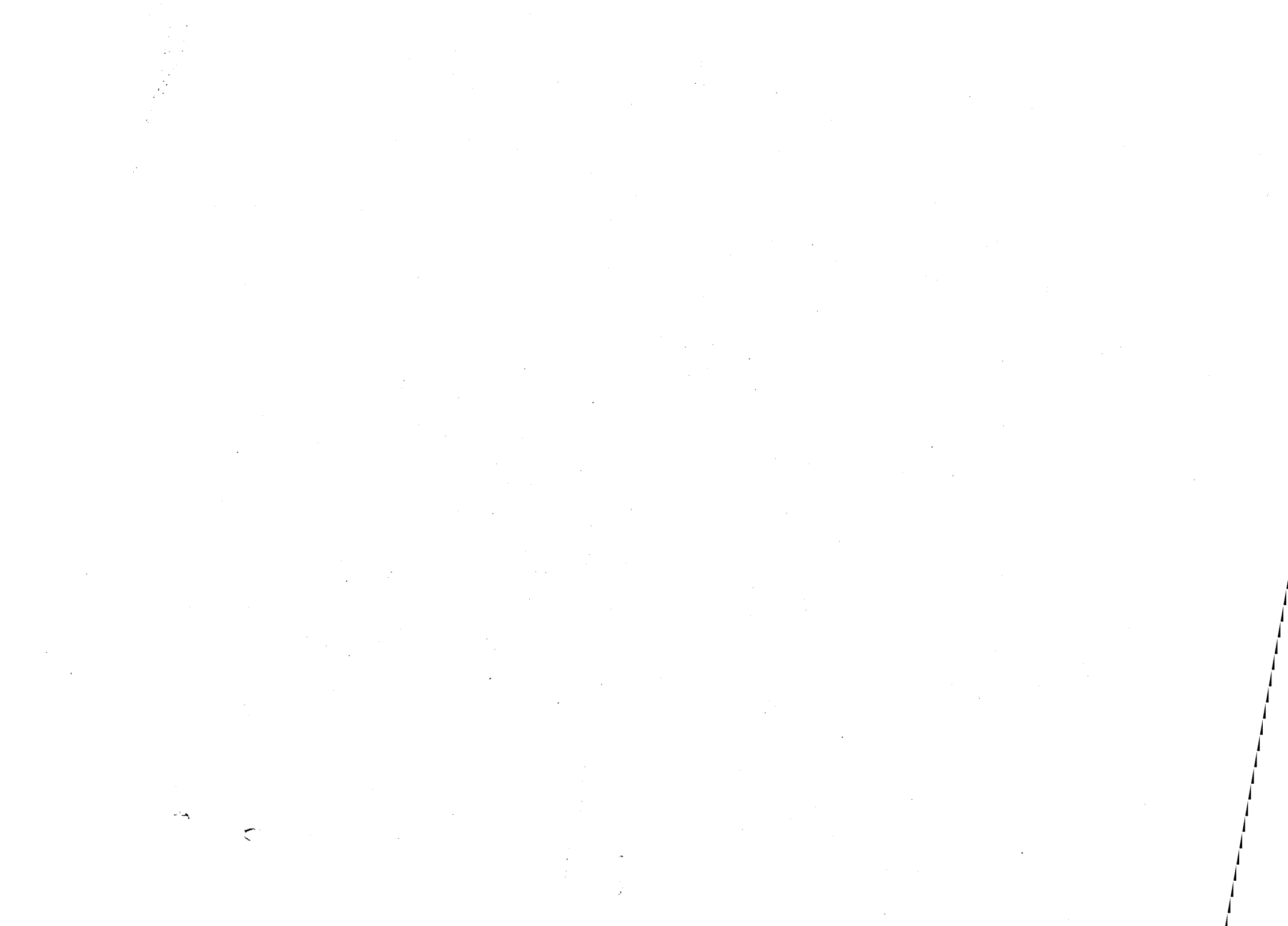
** DATA CARDS **

6/7/8/9 - CARD

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16. Abstract A computer code based on an improved vortex filament - vortex core method for predicting aerodynamic characteristics of slender wings with edge vortex separations has been developed. The code is applicable to camber wings, straked wings or wings with leading-edge vortex flaps at subsonic speeds. The prediction of lifting pressure distribution and the computer time have been improved by using a pair of concentrated vortex cores above the wing surface. The main features of this computer program are: (1) arbitrary camber shape may be defined and option for exactly defining leading-edge flap geometry is also provided; (2) the side-edge vortex system is incorporated.					
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