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# VELASCØ - VELOCITY FIELD IN ASYMMETRIC ROD CONFIGURATIONS

by

W. EIFLER and R. NIJSING

1973


Joint Nuclear Research Centre
Ispra Establishment - Italy

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**ABSTRACT**

The present report provides a description of VELASCØ, a computer programme for the calculation of the isothermal and fully developed turbulent velocity distribution in fuel bundles with asymmetric rod configurations. A description is given of the physical and topographic model underlying the programme. A complete listing of the programme and the output for a thirty-seven rod bundle as reference case are given as appendix.

**KEYWORDS**

V CODES
PROGRAMMING
FLOW MODELS
VELOCITY
DISTRIBUTION
TURBULENT FLOW
FUEL ELEMENT CLUSTERS
CONFIGURATION
ASYMMETRY

CONTENTS

## 1. GENERAL

The computer programme VELASCØ provides the possibility to calculate the isothermal and fully developed turbulent velocity field and friction factor for parallel flow in the following types of rod arrays:

- infinite rod arrays, e.g. triangular, rectangular, mixed triangular-rectangular arrays (examples A, B and C respectively in Fig. 1);
- semi-infinite rod arrays, e.g. the configurations D and E in Fig. 1;
- finite rod arrays.

The finite arrays may have the following characteristics.

a) They may be bounded by curved and/or straight channel walls as shown in the examples F, G and H respectively of Fig. 2. Worth noting is that the channel corner edges have to be rounded off as shown in Fig. 3, since the physical model does not apply to corners with sharp edges.

b) They may be made up of rods of identical diameters and of rods of different diameters (example J in Fig. 4).

c) They may be characterized by a number of identical subarrays (see the examples F, G and H in Fig. 2 with 12, 2 and 6 subarrays respectively) or they may be completely asymmetric as is the case for the example K of Fig. 4.

Account can be taken of wall roughness effects. The characteristic roughness function employed is that pertaining to uniform geometries.

## 2. PHYSICAL MODEL

In the following, only a brief outline of the physical model is given. More details are to be found in references [1, 2] .

The physical model involves the assumption, that a flow section can be divided into "momentum-balanced" zones around the wetted walls, bounded in the liquid by "zero shear"-lines, i.e. lines perpendicular to which the momentum flux is zero. These zones, in principle closed around

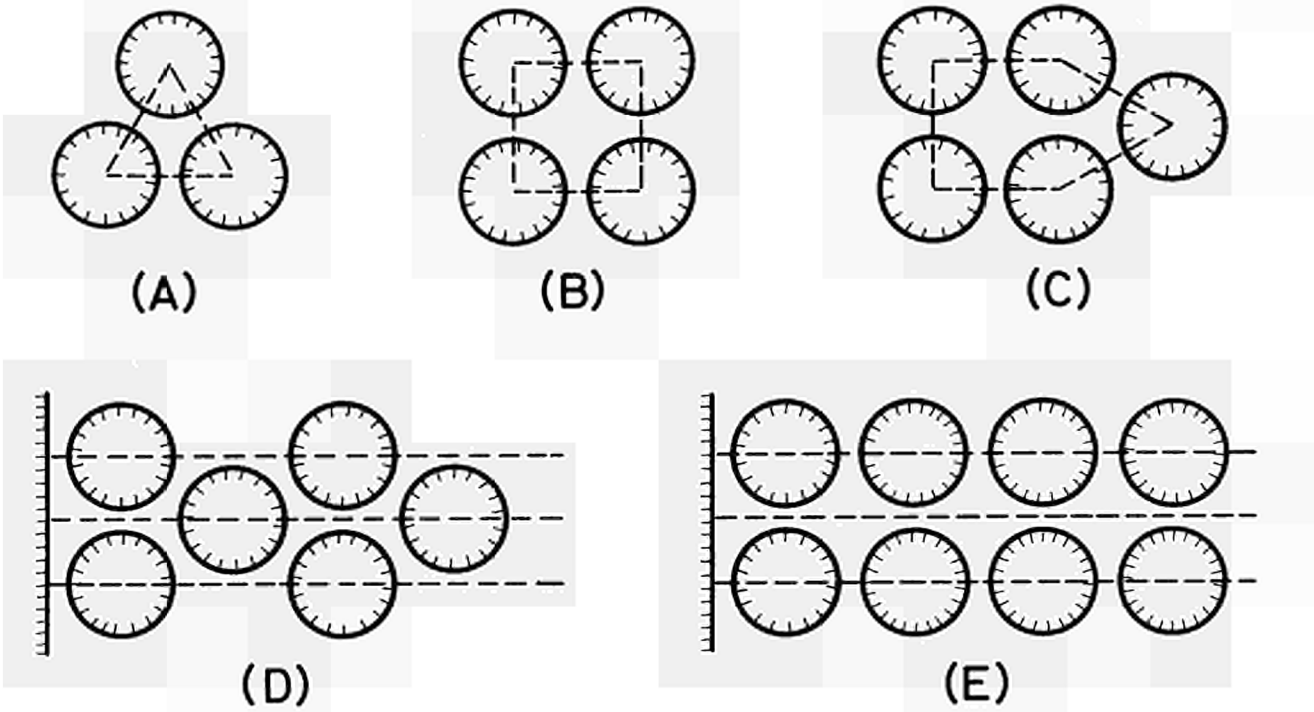



Fig.1 : Infinite (A,B,C) and semi-infinite (D,E) rod arrays

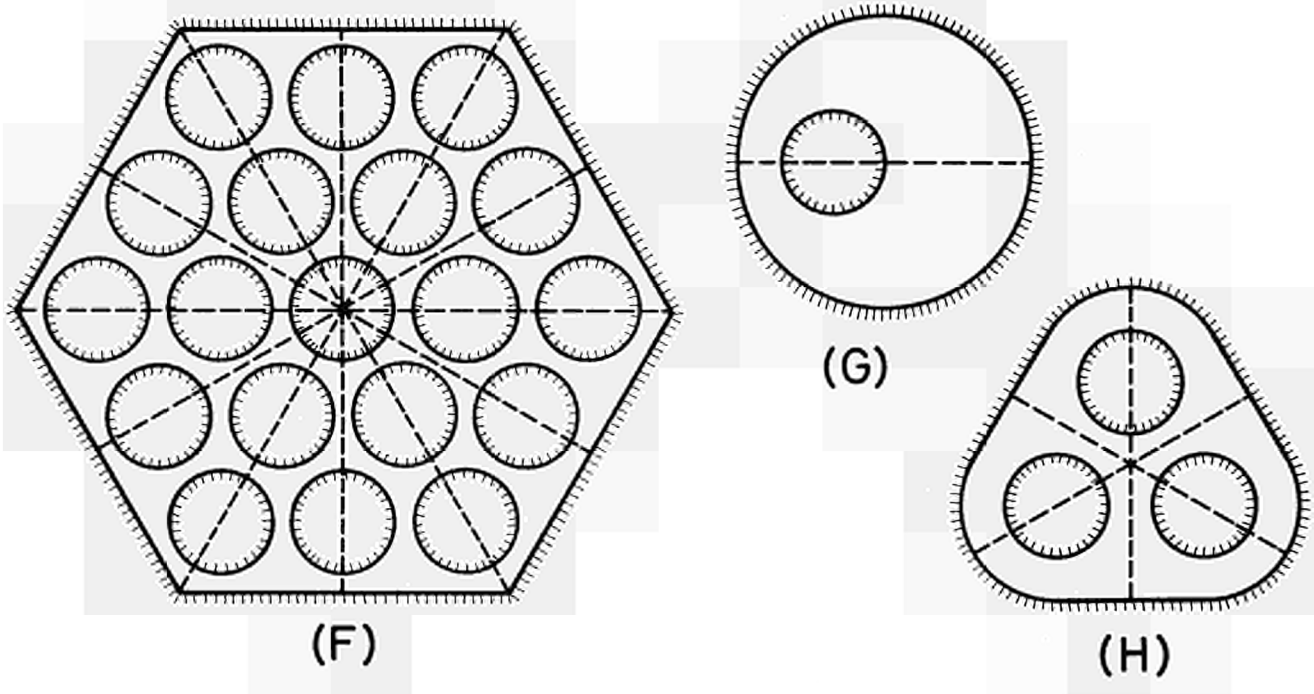



Fig. 2–Finite rod arrays (I)

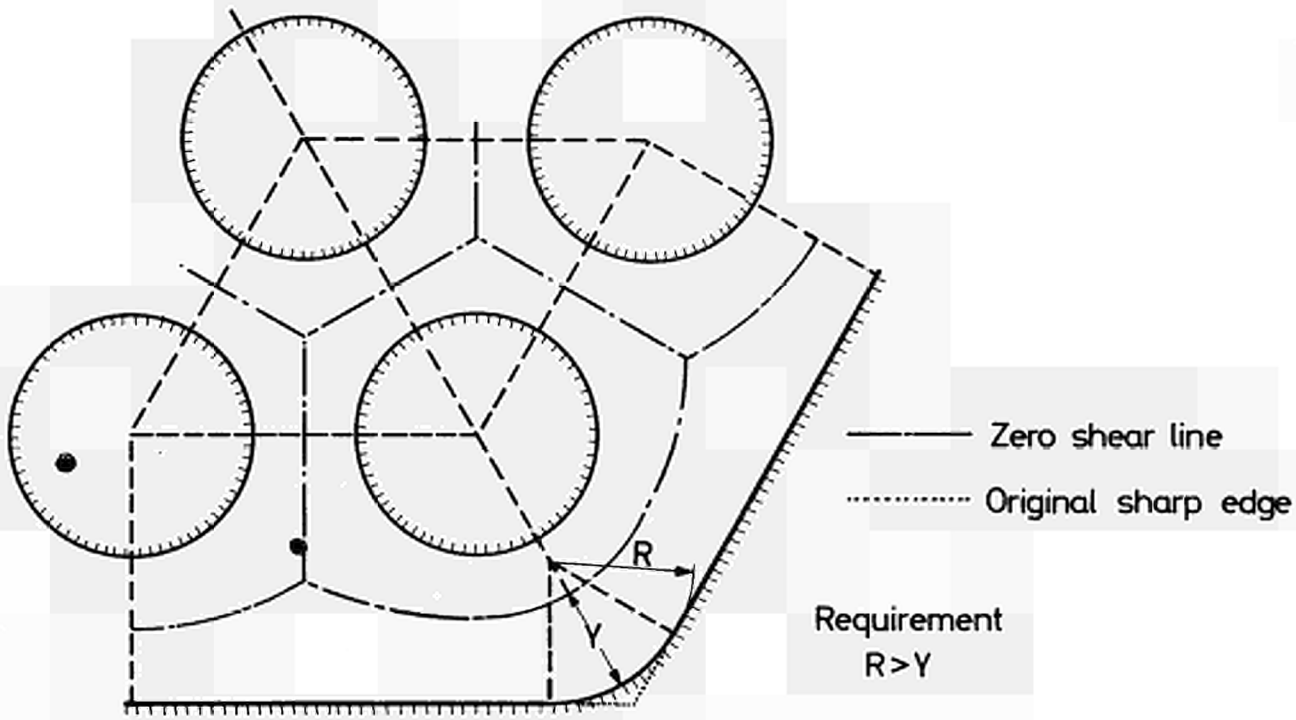



Fig. 3 - Rounding of sharp edges in the channel wall

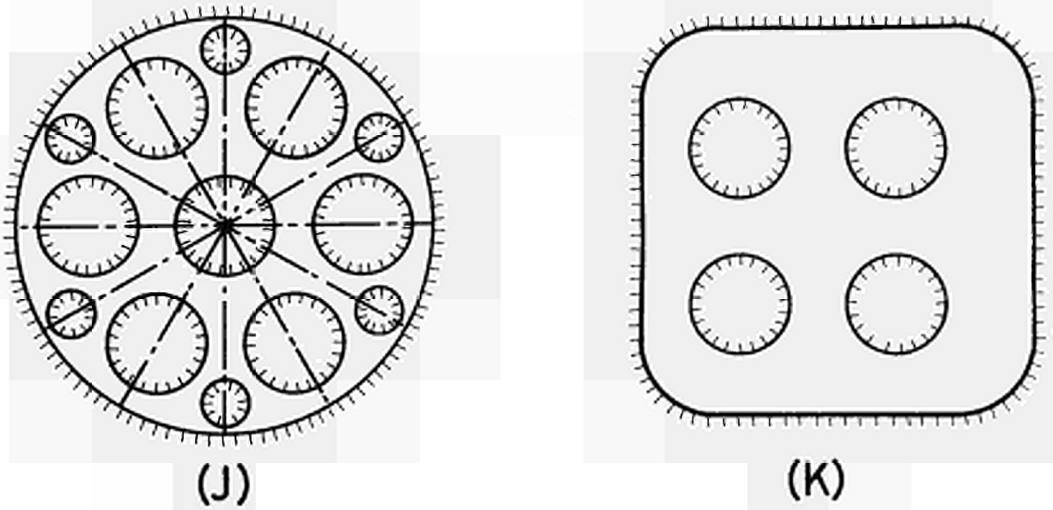



Fig. 4 - Finite rod arrays (II)

a wetted wall, may be divided in two or more identical parts by radial symmetry lines. The radial extent of the momentum-balanced zones is a priori only known for the particular case where the zero shear line coincides with a symmetry line.

Fig. 5 shows as an example the case of a thirty-seven rod array in a hexagonal channel. Because of symmetry one twelfth of the flow section is representative for the whole array. It is emphasized that the division into momentum balanced zones by zero-shear lines in Fig. 5 is only a qualitative one. Only on the lines $\overline{AB}$ and $\overline{A'B'}$ the position of zero shear is determined by symmetry.

Within one zone a momentum balance for a differential volume element $r d\varphi dr\, dz$ yields under conditions of steady flow

$$\frac{\partial(\tau_r \cdot r)}{\partial r} + \frac{\partial(\tau_\varphi)}{\partial \varphi} = - \frac{\partial P}{\partial z} \cdot r \qquad (1)$$

r, $\varphi$ and z are the radial, peripheral and axial coordinate respectively, $\tau_r$ and $\tau_\varphi$ represent the momentum fluxes in the r and $\varphi$ direction respectively. With the assumption of fully developed flow, the pressure gradient $\partial P/\partial z$ becomes constant and can be determined from a momentum balance applied to the entire flow section:

$$- \frac{\partial P}{\partial z} = \frac{4 \cdot \tau_{R.av}}{d_h} \qquad (2)$$

$\tau_{R.av}$ is the average wall shear stress, $d_h$ the hydraulic diameter of the rod array considered.

The solution of eq. (1) has to satisfy the following boundary conditions:

$$0 \leq \varphi \leq \varphi_{end}, \quad r = R, \quad \tau_r = \tau_R \qquad (3)$$

$$r = r_m \quad \tau_n = 0$$

$$\text{or } (\tau_r)_{r_m} = \frac{1}{r_m} \cdot \frac{dr_m}{d\varphi} \cdot (\tau_\varphi)_{r_m} \qquad (4)$$

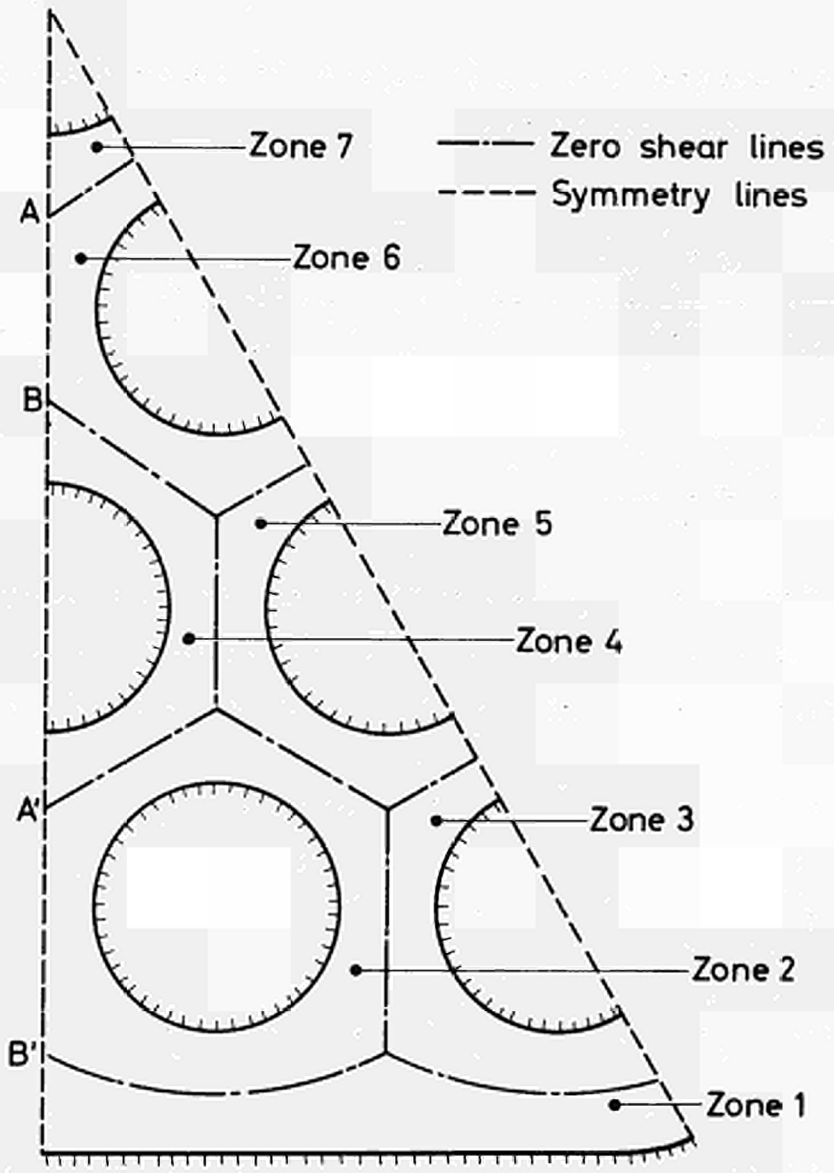



Fig. 5-Qualitative picture of the zero shear lines in a subarray representative for a thirty-seven rod array

$\tau_n$ is the momentum flux perpendicular to the zero shear line, $\tau_R$ is the radial momentum flux at the wall, i.e. the wall shear stress.

Radial integration of eq. (1) between the limits R and $r_m$, taking account of eqs. (2) - (4), yields:

$$\frac{\tau_R}{\tau_{R.av}} = \frac{2(r_m^2 - R^2)}{R.d_h} + \frac{d}{d\varphi}\left\{ \int_R^{r_m} \frac{\tau_\varphi}{\tau_{R.av}} d\frac{r}{R} \right\} \qquad (5)$$

The term

$$d_{h.l} = \frac{2(r_m^2 - R^2)}{R} \qquad (6)$$

has the significance of a local hydraulic diameter. Consequently the relative wall shear stress variation is in first approximation proportional to the variation of the relative local hydraulic diameter $d_{h.l}/d_h$.

Using the computer programme notations

$$T = \frac{\tau_R}{\tau_{R.av}} \quad , \quad X = \frac{S}{Pe} \quad , \quad Y = \frac{r - R}{r_m - R}$$

$$YM = \frac{r_m - R}{R} \quad , \quad DHI = \int_0^X \frac{d_{h.l}}{d_h} dX \quad , \quad DU = \frac{Pe}{R.\pi}$$

and integrating eq. (5) in peripheral direction, one obtains

$$\int_0^X T dX = DHI + \frac{YM}{DU.\pi}\left\{ \int_0^1 \frac{\tau_\varphi}{\tau_{R.av}} dY - \left[ \int_0^1 \frac{\tau_\varphi}{\tau_{R.av}} dY \right]_{X=0} \right\} \qquad (7)$$

S is the length on the wetted wall between zero and the position considered, Pe is the total length of the wetted wall in the zone considered.

The second integral on the right hand side of eq. (7) is only different from zero for the case of peripherally closed zones. In the case of zones which are divided because of symmetry, the flux component $\tau_\varphi$ is zero at the symmetric positions.

For the evaluation of the integral terms between the brackets, the following assumptions are made.

The momentum flux $\tau_\varphi$ is assumed to be made up of a turbulent diffusion and of a convective transport term, as expressed by

$$\tau_\varphi = \rho . \varepsilon_\varphi . \frac{\partial U}{r\, d\varphi} + \rho . U . v \qquad (8)$$

$\tau_\varphi$ is the eddy diffusivity for momentum transport in the peripheral direction, $\rho$ is the density of the fluid, U is the axial velocity and v the peripheral secondary flow component.

$\varepsilon_\varphi$ was found [3] to be represented well by the relation

$$\varepsilon_\varphi = 0.154 . \sqrt{\frac{\tau_R}{\rho}} (r_m - R) \qquad (9)$$

For the peripheral secondary flow component v the previously [4, 1, 2] given expression

$$v = 2 . C_{sec} . \frac{Pe_{sec}}{Pe} . \frac{d\sqrt{\frac{\tau_R}{\rho}}}{dX} . \cos(\pi Y) \qquad (10)$$

is used with

$$C_{sec} = 0.573$$

$Pe_{sec}$ is the peripheral extent along the wall of a closed secondary flow vortex. By definition it is equal to the distance between two adjacent extreme values of the wall shear stress curve. Only in the special case that the wall shear stress curve has only two extreme values, i.e. that the peripheral extent of the vortex is equal to the perimeter of the zone, the parameter $Pe_{sec}/Pe$ is known and has the value 1. In the general case first an estimation has to be made of $Pe_{sec}/Pe$ which is corrected during the iteration procedure described below.

General expressions are used for the radial velocity distribution. For the wall region the following relation [5] is adopted:

$$y^+ \leq y_o^+ : \; u^+ = y^+\left(1-0,34\,\frac{y^+}{U_o^+} + 0.039\left(\frac{y^+}{U_o^+}\right)^2\right) \qquad (11)$$

For the center region of smooth channels the following expression was derived [6]:

$$y^+ > y_o^+ : \; u^+ = \frac{1}{\varkappa}\ln y^+ + C + \frac{1}{\varkappa}\ln\frac{Te(2-Y)}{2\,[1+(Te-1)(1-Y)^2]} \qquad (12)$$

The parameters $u^+$ and $y^+$ are defined as

$$u^+ = \frac{U}{\sqrt{\frac{\tau_R}{\rho}}} \quad , \quad y^+ = \frac{(r-R)\sqrt{\frac{\tau_R}{\rho}}}{\nu}$$

$U_o^+$ is a constant and has the value 14.7. $y_o^+$ is a measure for the thickness of the viscous wall region, which is assumed to have the value 21. $\varkappa$ and Te are parameters depending primarily on the local geometry. They are tabulated in [6]. For VELASCØ the following expressions for $\varkappa$ and Te, derived from the tabulated values, are used:

$$0 \leq \frac{r_m}{R} \leq 1 : \quad \varkappa = 0.407$$

$$Te = 3.87 - 1.8\left|\frac{r_m}{R} - 0.32\right|^{1.4}$$

$$1 < \frac{r_m}{R} : \quad \varkappa = 0.387\left(1+\frac{1}{20}\cdot\frac{r_m}{R}\right)$$

$$Te = 10.\,e^{-1.26\sqrt{\frac{r_m}{R}}}$$

The integration constant C in eq. (12) is determined in such a manner that $u^+$ predicted by eq. (12) under neglectance of the second logarithmic expression is equal to that from eq. (11) at the position $y_o^+$.

For rough channels use is made of the known effect of shifting of the velocity profile $u^+ = f(y^+)$ to lower values of $u^+$. This behaviour is governed by the roughness parameter $k^+$, defined as

$$k^+ = \frac{k.\sqrt{\frac{\tau_R}{\rho}}}{\nu}$$

where k is the height of the roughness.

The increment $\Delta u^+_{rough}$, which is added to the right hand side of eq. (12), is a function of the type of roughness. VELASCØ contains the following expression applicable for sand roughness, based on NIKURADSE's data [7]:

$\ln k^+ \leq 1$ : $\quad \Delta u^+_{rough} = 0$

$1 < \ln k^+ \leq 5$ : $\quad \Delta u^+_{rough} = \frac{1}{\varkappa}(1-\ln k^+) - 5 +$

$$+ 7.4275 \ln k^+ - 2.80708(\ln k^+)^2 +$$

$$+ 0.3975(\ln k^+)^3 - 0.01792(\ln k^+)^4$$

$5 < \ln k^+$ : $\quad \Delta u^+_{rough} = \frac{1}{\varkappa}(1-\ln k^+) + 0.45$

In the case of rough walls the velocity profile in the wall region is matched to the center region profile lowered by $\Delta u^+_{rough}$ at the radial position corresponding to $y^+ = 21$.

With the eq. (8) - (12) it follows from (7)

$$\int_0^X T dX = DHI + C\text{Ø}EF\frac{dT}{dX} - C\text{Ø}EF_o \cdot \left(\frac{dT}{dX}\right)_o \qquad (13)$$

CØEF is essentially a function of the radial extent YM at the peripheral position X. It depends only weakly on the local wall shear stress. Consequently the local wall shear stress for the calculation of CØEF can be put in first approximation equal to the average wall shear stress. The necessary corrections have to be made in subsequent iteration steps.

For the solution of the integro-differential equation (13) a Fourier series is introduced for the relative wall shear stress distribution T. For zones bounded in peripheral direction by radial symmetry lines, the Fourier series contains only consinus terms:

$$T = BT_o + \sum_{n=1}^{\infty} BT(n) \cdot \cos(n\pi X) \qquad (14)$$

For peripherally closed zones the Fourier series contains cosinus terms as well as sinus terms. Additionally the continuity of T and all its derivates has to be guaranteed at the coinciding peripheral positions X = 0 and X = 1. These continuity conditions are fulfilled by the series

$$T = BT_o + \sum_{n=1}^{\infty} BT_n(n) \cdot \sin(2n\pi X) + \sum_{m=1}^{\infty} BT_m(m) \cdot \cos(2m\pi X) \qquad (15)$$

The first coefficient $BT_o$ in the series (13) and (15) respectively represents the relative average wall shear stress TAUM within the zone considered. From a momentum balance over an entire momentum-balanced zone follows with eq. (2)

$$TAUM = \frac{(d_h)_{zone}}{d_h}$$

The right hand side of this equation equals to DHI at the position X =1, i.e.

$$BT_o = TAUM = (DHI)_{X=1} \qquad (16)$$

The solutions (14) or (15), depending on the type of zone considered, are introduced in eq. (13). Applying the resultant expression at a finite number N peripheral positions X result in N equations used to evaluate the coefficients BT, if the Fourier series (14) or (15) are truncated after N terms.

For a rod array divided into NZ momentum-balanced zones, we dispose of a system of NZ integro-differential equations of the type of eq. (13). Relations between integro-differential equations pertaining to adjacent zones are established by the condition of continuity of the velocity at common zero shear lines. For the calculation of the velocity at a zero-shear line, use is made of equation (12). This procedure involves the assumption that the zero-shear line coincides with the position of maximum velocity.

The solution for the complete system is found using an iteration procedure. In a first step the radial extent YM of the zones is prescribed applying the rule that zero shear lines have equal perpendicular distances to neighbouring wetted walls. The integro-differential equation system can then be solved in the above described manner. With the knowledge of the local values of T and YM the velocity ratio VU on the zero shear line, which because of continuity has to be equal to unity, can be calculated. If this velocity ratio differs by more than a prescribed percentage from unity, it can be used to compute a new value for YM and the whole procedure is repeated. This iteration procedure requires a special topographic description of the rod array which is outlined in the following chapter.

## 3. TOPOGRAPHIC MODEL

The first step in the topographic description of a rod array is to identify the smallest subarray representative for the whole rod assembly. This is for the case of a thirty-seven rod array one twelfth of the bundle section. The second step is to draw the qualitatively known zero-shear lines. The resulting momentum-balanced zones are numbered in an arbitrary manner. These two steps are illustrated in Fig. 5 for the thirty-seven rod array.

In a next step the zones are divided into subzones by lines perpendicular to the wetted wall. Subzone boundaries have to be established at each position, at which

A - a line perpendicular to the wall crosses the point of intersection of zero shear lines;
B - two opposite zone walls have parallel tangents;
C - there is a change in curvature of the zone wall.

Boundary positions of type A move during the iteration calculations, positions of type B and C remain fixed. In the case of peripherally closed zones the origin of the coordinate X along the wetted wall is made to coincide with a subzone boundary position of type B or C. In the other cases

the natural origin of X is one of the points of intersection of the symmetry lines with the wetted wall. The boundary positions are numbered starting with the position X = 0.

For illustration the case of the thirty-seven rod array is considered (Fig. 6):

| | number of subzone boundary position | type |
|---|---|---|
| zone 1: | 1 (X = 0) | A |
| | 2 | B |
| | 3 | A |
| | 4 | B |
| | 5 | C |
| | 6 (X = 1) | B |
| zone 2: | 1 (X = 0) | B |
| | 2 | A |
| | 3 | B |
| | 4 | A |
| | etc. | etc. |

Each boundary position XG is related by the radial extent YG at this position to one or more corresponding positions in neighbouring zones. A number IXGACT is defined characterizing the manner the boundary positions have to be determined.

IXGACT = 1

For IXGACT = 1 a boundary position is identified which is already included in a previously defined set of boundary positions.

IXGACT = 2

For IXGACT = 2 the special case is treated, in which a boundary position has as corresponding partner an identical position in an adjacent and, because of symmetry, identical subarray. Examples in Fig. 6 for the thirty-seven rod array and in Fig. 7 for a sixteen rod array are the following boundary positions (the first number in the brackets represents the zone

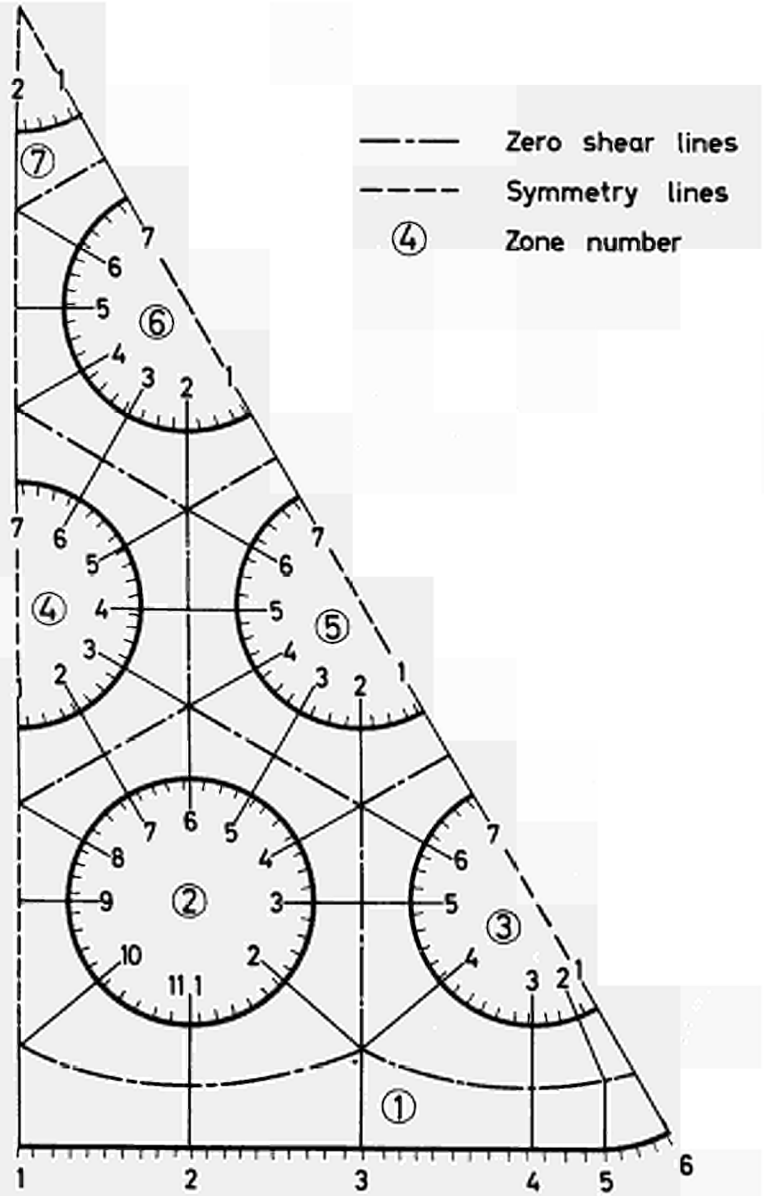



Fig.6 - Subzone boundary positions in a subarray representative for a thirty - seven rod array

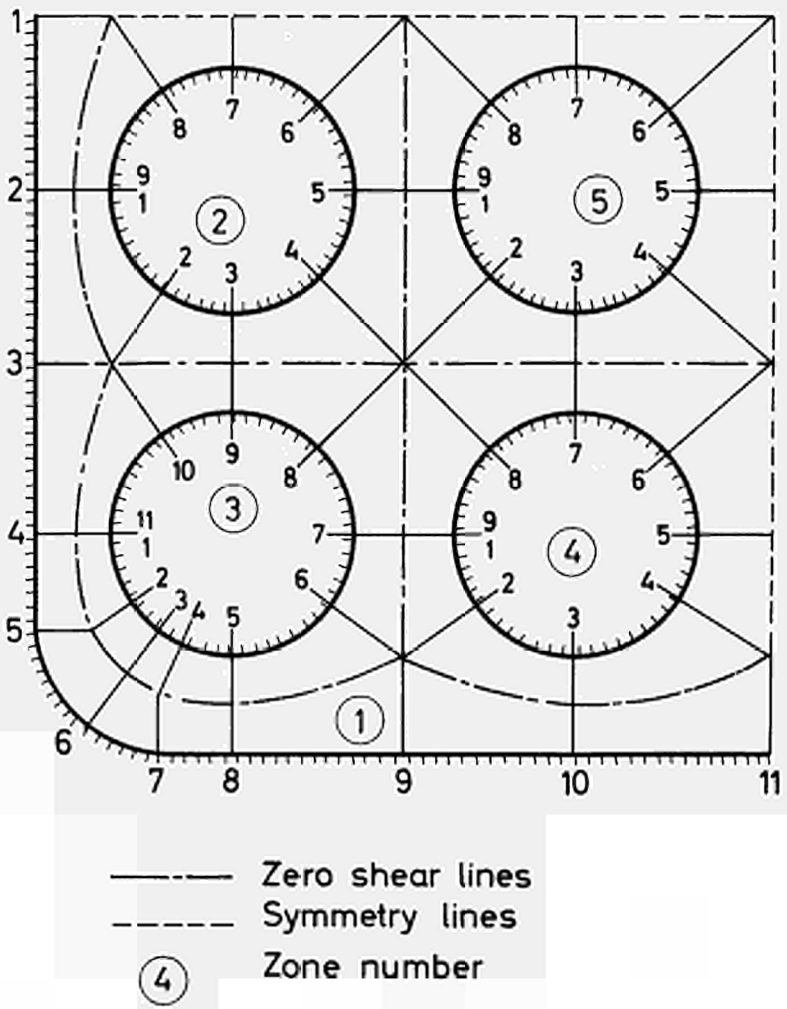



Fig.7-Subzone boundary positions in a subarray representative for a sixteen rod array

number, the second one the boundary position number):

Fig. 6: (2, 9), (6, 5)

Fig. 7: (4, 5), (5, 5), (5, 6), (5, 7), (2, 7).

XG and YG have to be specified as input data.

IXGACT = 3

IXGACT = 3 characterizes the simplest two-point set of boundary positions, i.e. that occurring in the case of parallel tangents. The exception is the symmetry situation already described under IXGACT = 2. The two boundary positions are fixed positions and have to be specified as input data. In the N'th iteration cycle the corresponding YG's are determined by a two-point iteration as follows:

$$\frac{YG_{IZ1,N}}{YG_{IZ1,N-1}} = \frac{UMX_{IZ2,N-1}}{UMX_{IZ1,N-1}} \qquad (17)$$

UMX is the velocity on the zero-shear line, IZ1 and IZ2 are the numbers of the zone considered and of the zone of the partner respectively. The value of $YG_{IZ2,N}$ then follows from the geometrical situation. Examples in Fig. 6 and Fig. 7 are the sets:

Fig. 6: [(1, 2), (2, 1)], [(1, 4), (3, 3)], [(2, 3), (3, 5)] etc.

Fig. 7: [(1, 2), (2, 1)], [(1, 4), (3, 1)], [(1, 8), (3, 5)] etc.

IXGACT = 4

IXGACT = 4 concerns a two-point set where only one of the two boundary positions is a fixed position. This situation occurs:

1. - if triangular or, generally, three-partner subchannels are halved by symmetry lines; examples in Fig. 6 and Fig. 7 are the sets:

   Fig. 6: [(1, 1), (2, 10)], [(2, 8), (4, 1)], [(4, 7), (6, 4)], [(6, 6), (7, 2)]

   Fig. 7: [(1, 1), (2, 8)], [(1, 11), (4, 4)]

2. - if there is a change in wall curvature; examples in Fig. 6 and Fig. 7 are the sets:

Fig. 6: [(1, 5), (2, 2)]

Fig. 7: [(1, 5), (3, 2)], [(1, 7), (3, 4)].

$YG_{IZ1,N}$ corresponding to the fixed boundary position $XG_{IZ1}$ is calculated from eq. (17).

$YG_{IZ2,N}$ and $XG_{IZ2,N}$ follow then from the geometrical situation.

IXGACT = 5

IXGACT = 5 characterizes a two-point set without any fixed boundary position. This situation occurs if a quadrangular subchannel is halved by a symmetry line. Examples in Fig. 7 are the sets [(4, 6), (5, 4)] and [(5, 8), (2, 6)]. $YG_{IZ1,N}$ is calculated from eq. (17); $XG_{IZ1,N}$, $YG_{IZ2,N}$ and $XG_{IZ2,N}$ follow then from the geometrical situation.

IXGACT = 6

IXGACT = 6 characterizes a three-point set of subzone boundary positions. The corresponding situation occurs in three-partner subchannels. Examples in Fig. 6 and Fig. 7 are the sets:

Fig. 6: [(1, 3), (2, 2), (3, 4)], [(2, 4), (3, 6), (5, 3)],
[(2, 6), (4, 3), (5, 4)], [(4, 5), (5, 6), (6, 2)]

Fig. 7: [(1, 3), (2, 2), (3,10)], [(1, 9), (3, 6), (4, 2)]

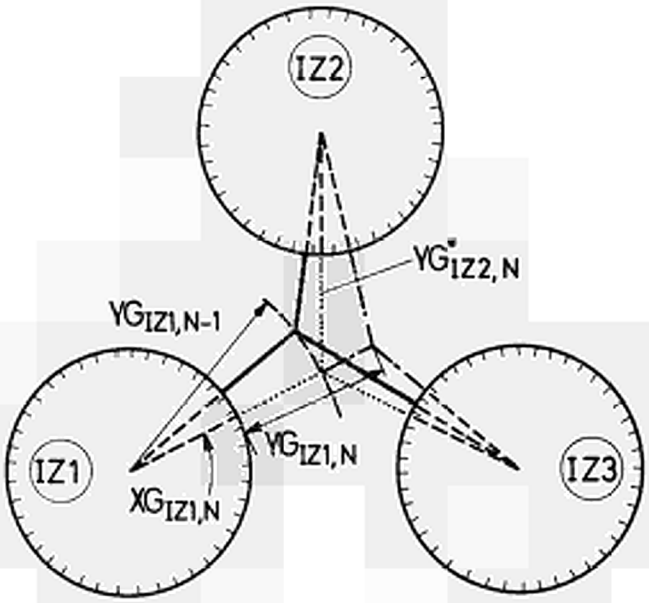
In the N'th iteration cycle the set of XG- and YG-values is determined applying a three-point iteration explained below (for the geometrical representation of the single steps, see Fig. 8):

- keeping constant in a first step $YG_{IZ1,N-1}$ a new (but not yet definitive) value $YG_{IZ2}$ is calculated using the two-point relation

$$\frac{YG^{*}_{IZ2,N}}{YG_{IZ2,N-1}} = \frac{UMX_{IZ3,N-1}}{UMX_{IZ2,N-1}} \; ; \qquad (18)$$

with $YG_{IZ1,N-1}$ and $YG^{*}_{IZ2,N}$ the definitive value $XG_{IZ1,N}$ is calculated;

- in a second step $YG_{IZ1,N}$ is defined by the relation




——— Situation after the (N-1)' th iteration cycle

..... First step in the N'th iteration cycle

—·— Second step in the N'th iteration cycle, situation after the N'th iteration cycle

(IZ3) Zone number

Fig.8-Graphic representation of a "three-point" iteration for the determination of the corrisponding subzone boundary positions

$$\frac{YG_{IZ1,N}}{YG_{IZ1,N-1}} = \frac{2}{\frac{UMX_{IZ1,N-1}}{UMX_{IZ2,N-1}} + \frac{UMX_{IZ1,N-1}}{UMX_{IZ3,N-1}}} \quad ; \tag{19}$$

with $XG_{IZ1,N}$ and $YG_{IZ1,N}$ all other data, i.e. $XG_{IZ2,N}$, $YG_{IZ2,N}$, $XG_{IZ3,N}$ and $YG_{IZ3,N}$, can then be calculated.

IXGACT = 7

IXGACT = 7 concerns the four-point set of subzone boundary positions occurring in quadrangular subchannels. An example in Fig. 7 is the set $[(2,4), (3,8), (4,8), (5,2)]$. The procedure described for IXGACT = 6 is adopted also for this case, adapting the relations (18) and (19) as follows:

$$\frac{YG^{*}_{IZ2,N}}{YG_{IZ2,N-1}} = \frac{2}{\frac{UMX_{IZ2,N-1}}{UMX_{IZ3,N-1}} + \frac{UMX_{IZ2,N-1}}{UMX_{IZ4,N-1}}} \tag{20}$$

$$\frac{YG_{IZ1,N}}{YG_{IZ1,N-1}} = \frac{3}{\frac{UMX_{IZ1,N-1}}{UMX_{IZ2,N-1}} + \frac{UMX_{IZ1,N-1}}{UMX_{IZ3,N-1}} + \frac{UMX_{IZ1,N-1}}{UMX_{IZ4,N-1}}} \tag{21}$$

To the NXG subzone boundary positions within one zone correspond NUZ = NXG-1 subzones numbered consecutively beginning with the subzone near X = 0. Each subzone has one boundary position of the type B. This simplifies the standardization of the description of the subzones. Three types of subzones can be distinguished according to the manner in which the radial extent YM is determined. They are characterized by the number IUZACT.

IUZACT = 1

IUZACT = 1 denotes a subzone within which the position of the zero shear line is known because of symmetry. The radial extent YM at the peripheral position X can be calculated using a simple geometrical relation.

IUZACT = 2 and IUZACT = 3

IUZACT = 2 characterizes "passive" iteration subzones, IUZACT = 3 "active" iteration subzones. An active iteration subzone constitutes, together with a passive iteration subzone an "iteration unit". All iteration units of a subarray are consecutively numbered, as is shown in Fig. 9 for the thirty-seven rod array. The numbering can be carried out in any sequence; care should be taken however, that the subzone of an iteration unit, which is reached first with increasing zone number, is denoted as the active iteration subzone of the unit. Within such a unit a two-point iteration relation similar to eq. (17) is used to calculate in the N'th iteration cycle the radial extent $YM_{IZ1}$ of the active subzone at a given peripheral position X:

$$\frac{YM_{IZ1,N}}{YM_{IZ1,N-1}} = \frac{UMX_{IZ2,N-1}}{UMX_{IZ1,N-1}} \qquad (22)$$

To $YM_{IZ1}$ at the position X in the active subzone corresponds a radial extent $YMD_{IZ2}$ at the position XD in the passive iteration subzone, which can be determined after application of eq. (22). The positions XD are however different from the equidistance positions X within the zone IZ2, as shown for example in Fig. 10. The radial extents $YM_{IZ2}$ in passive subzones at these positions are determined by interpolation of the previously calculated function YMD(XD), assuming a linear variation of the zero shear line between two peripheral positions XD.

The principal steps for the topographic description of rod arrays for calculations with the VELASCØ programme may be summarized as follows.

1) The smallest subarray representative for the whole rod array is identified.
2) The zero-shear lines are drawn in a qualitative manner and the resulting momentum-balanced zones are numbered in arbitrary sequence.
3) These zones are divided into subzones, applying the 3 rules previously outlined. The resulting boundary positions within one zone are numbered starting with the position X = 0.
4) The subzones within one zone are numbered starting with the subzone

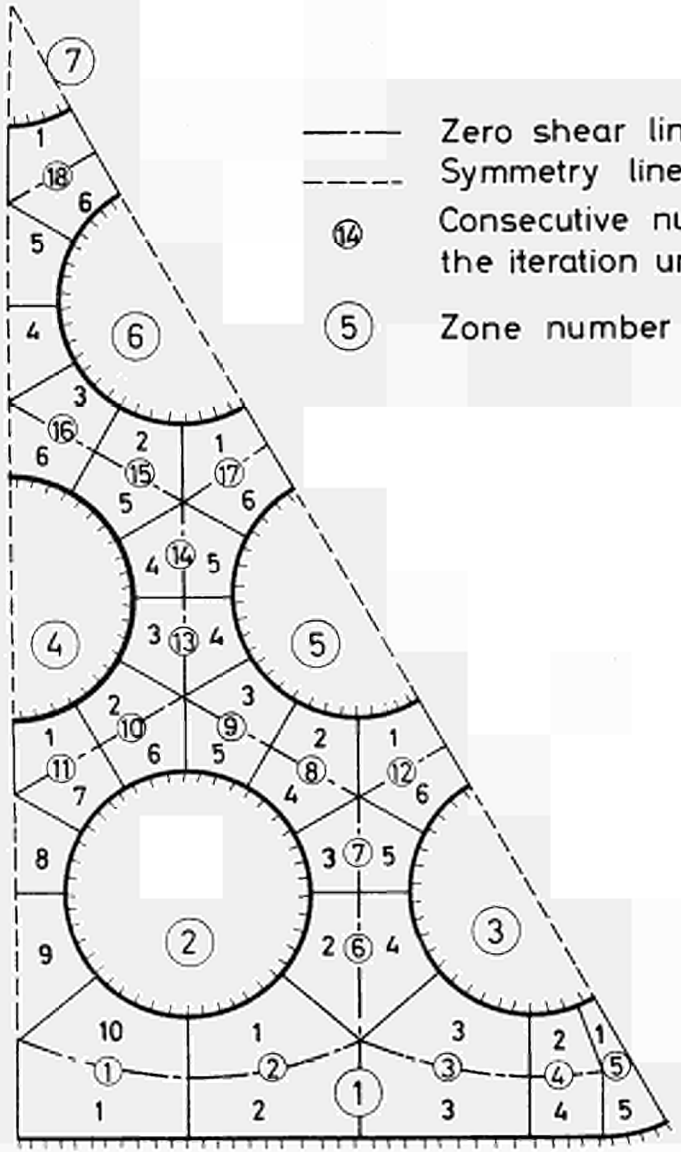



Fig. 9 - Subzones and iteration units in a subarray representative for a thirty-seven rod array

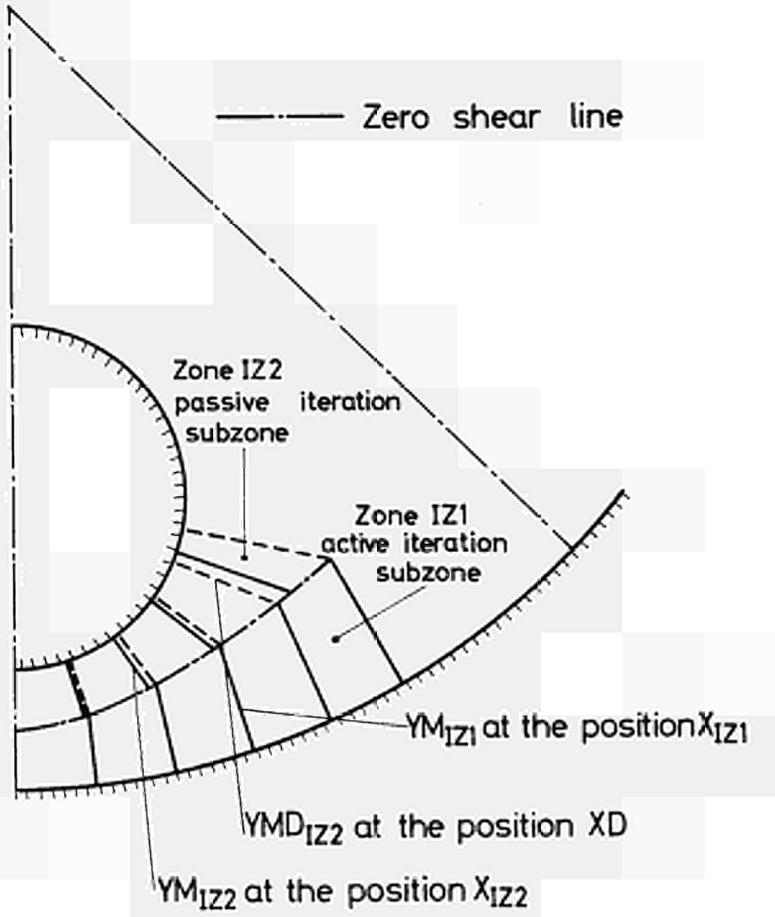



Fig. 10 - Illustration of the significance of the parameter XD and YMD

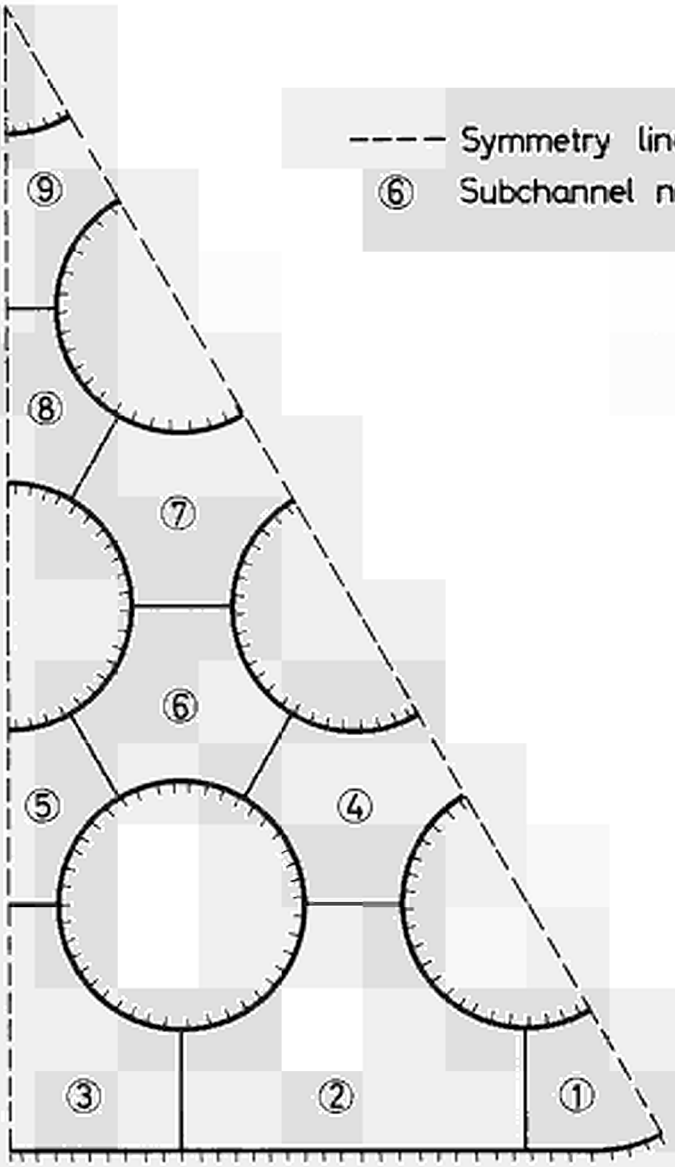



Fig.11 - Subchannels in a subarray representative for a thirty-seven rod array

near X = 0. The iteration units made up of an active and a passive iteration subzone are numbered over the whole subarray.

For the example of a thirty-seven rod array the different steps are represented in Fig. 5 (step 1 and 2), Fig. 6 (step 3) and Fig. 9 (step 4), respectively. The further subdivision in subchannels (Fig. 11) is not related to the physical and topographic model and has only the scope to provide as supplementary final information the bulk velocities in these subchannels.

## 4. OUTLINE OF PROGRAMME STRUCTURE

The simplified flow diagram in Fig. 12 gives an approximate idea of the VELASCØ programme structure. The single parts of the programme are subdivided as follows:

1. Input-data
   - 1.1 Reading
   - 1.2 Writing
   - 1.3 Control
2. Iteration Cycle
   - 2.1 Calculation of the geometrical zone characteristics
   - 2.1.1 The subzone boundary positions XG
   - 2.1.2 The radial extent YM of the zones
   - 2.2 Solution of the integro-differential equations for the wall shear stress distributions
   - 2.2.1 The geometrical term DHI
   - 2.2.2 The coefficient CØEF pertaining to the wall shear stress gradient
   - 2.2.3 The Fourier coefficients BT
   - 2.2.4 The wall shear stress T and its gradient DT; the distances VZUV between two adjacent positions DT = 0
   - 2.2.5 The friction factor F
   - 2.3 Calculation and control of the velocity ratios on the zero shear line

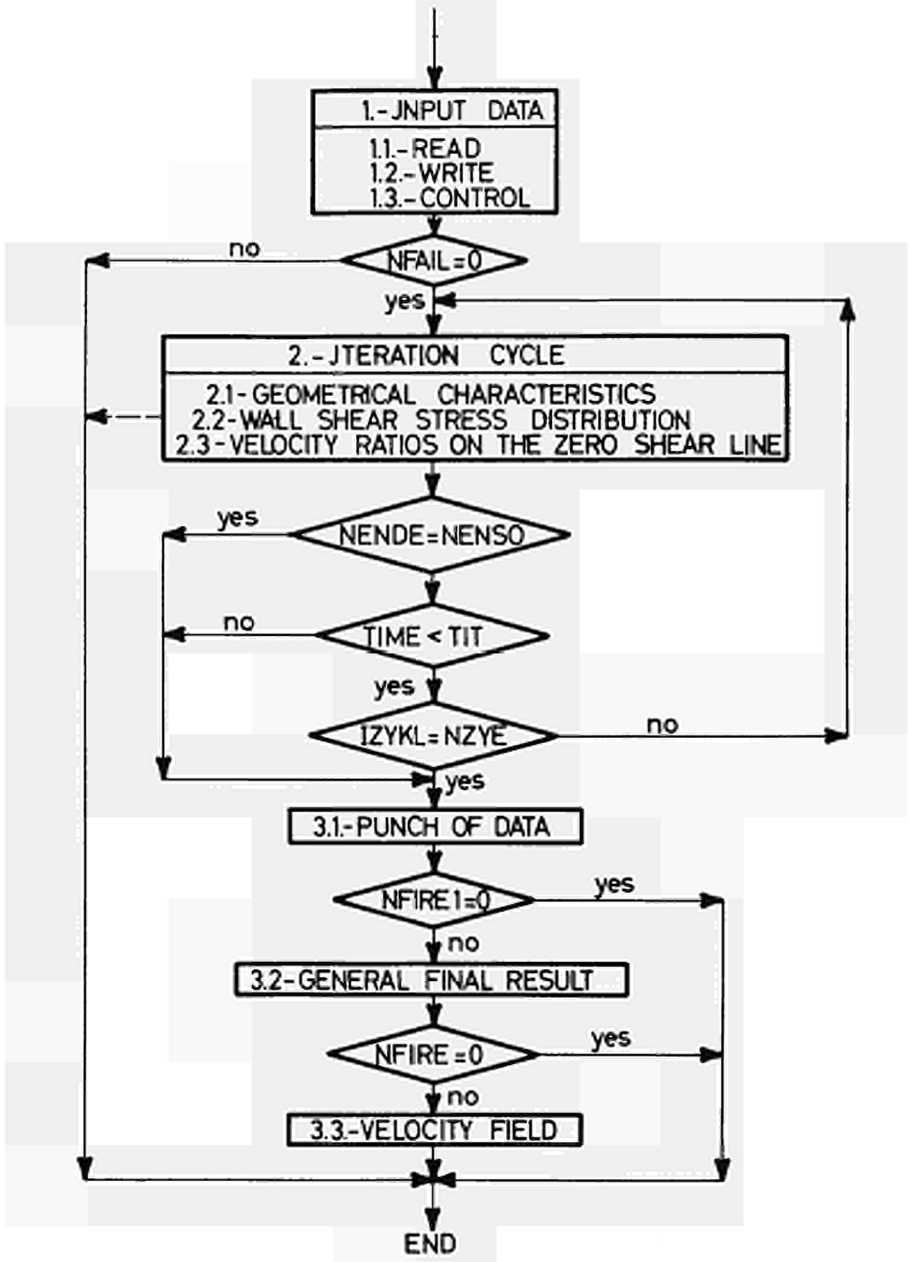



Fig.12 - Simplified flow diagramme of the VELASCO programme

2.3.1 The velocity ratios VUMX at the positions XG

2.3.2 The velocity ratios VUMAX at the positions X

2.3.3 Decision on the continuation of the iteration

3. Output-data

3.1 Punch of data needed for an eventual continuation of the iteration calculations

3.2 Preparation and writing of final results

3.2.1 General results

3.2.2 The velocity field U/UB

The following remarks pertain to the single sections.

1. A separate chapter is dedicated to the preparation of the input data.

1.3 A special control is provided primarily for variables determining the size of DØ-loops. Similar controls are executed in the iteration loop for variables of this type determined during the iterations. This guarantees that the dimensions specified in the programme are not exceeded.

2. The iteration cycle is represented by the loop 2000.
Before initiating the calculations, it is decided whether - according to the corresponding input data - the principal variables and functions calculated during this iteration cycle shall be written out (NWRITE = 1) or not (NWRITE = 0). In any case an additional cycle with this output is made after the cycle in which the final condition was fulfilled, if in the latter cycle NWRITE had the value zero and if the time available is still sufficient.

2.1.1 In the double loop 800 (the outer one with the zone number IZ, the inner one with the subzone boundary position number IXG as variable) the subzone boundary positions XG(IZ, IXG) and the corresponding radial extents YG(IZ,IXG) are calculated. According to the value of the characteristic number IXGACT, either no calculations are needed (IXGACT = 1 and 2) or new approxi-

mative values have to be computed for the corresponding set of subzone boundary positions (IXGACT = 3 to 7). To each value of IXGACT corresponds a special geometrical formulation, each departing in the first iteration cycle (IZYKL = 1) with the condition of equal perpendicular distances from the zero shear line to the neighbouring wetted walls. In this section also a consecutive numbering of all subzone boundary positions involved in the iteration is executed resulting in a total number of NGG.

2.1.2 In the double loop 1200 (the outer one with the zone number IZ, the inner one with the consecutive number IC of the peripheral position X(IZ,IC) as variable), the radial extent YM(IZ,IC) is calculated. In the inner loop first the consecutive number IUZ of the subzone, in which the position X is situated, has to be determined. For the calculation of YM the formulation specific to the type of the subzone considered, is used, which is specified with the characteristic number IUZACT. In the first iteration cycle (IZYKL = 1) these formulations start with the assumption of equal perpendicular distances of the zero shear line to the neighbouring wetted walls.

2.2.1, 2.2.2, 2.2.3 These three sections are parts of the outer loop 1700 with the zone number IZ as variable. In the inner loop 1590 with the position number IC as variable (section 2.2.1), the geometrical term DHI(IC) is calculated. For this purpose the zero shear line between two adjacent positions X or between a position X and the neighbouring boundary position XG (in the case that this boundary position is crossed in the corresponding calculation step) is approximated by a straight line. In the first iteration cycle (IZYKL= 1) the loop 1700 is passed twice. The first time the sections 2.2.2 and 2.2.3 are bypassed and the still unknown relative hydraulic diameter DHTØT is put equal to unity in order to determine this parameter, using the results of the loop 1590. In terms of DHI for DHTØT then can be written:

$$\frac{dh}{2.R_{Ref}} = DHT\emptyset T = \frac{\sum_{IZ=1}^{NZ} DU(IZ).DHI(X=1,IZ)}{\sum_{IZ=1}^{NZ} DU(IZ)} \qquad (23)$$

The second time the loop 1700 is completed with the final aim to determine the Fourier coefficients BT. CØEF(IC) (section 2.2.2, inner loop 1635) represents a radial integral containing the velocity relations (11) and (12), their derivates with respect to X, the expressions (9) and (10) for the transport properties and the velocity profile parameters $\varkappa$, Te, C and $\Delta u^+_{rough}$ (in computer notation CA, TE, CE and DUR respectively). The latter are determined in the subroutine PRØPA as a function of the parameters $G = r_m/R$ and $RLN = \ln(k^+)$. The radial integration is carried out using a numerical five-point integration formula represented by the function FSUM. The third part of the loop 1700 (section 2.2.3) starts with the alternatively used inner loops 1670 and 1685. These loops calculate the matrix of the coefficients of the linear equation system which results from the application of the integro-differential equation (13) at a number NCØF(IZ) peripheral positions, using as solution the Fourier-series expressions (14) (loop 1670) and (15) (loop 1685) respectively. According to the specifications given later on in chapter 5 NCØF(IZ) is not necessarily equal to the number NC(IZ) of peripheral positions used for geometrical calculations. The coefficients BT are determined using a matrix inversion technique (subroutine INMAT). If the Fourier series contains sinus as well as cosinus terms, the first half of the coefficients BT pertain to the sinus terms and the second half to the cosinus terms.

2.2.4 Using the previously determined Fourier coefficients in the series (14) and (15) respectively, the wall shear stress distribu-

tion T(IZ,IC), its gradient DT(IZ,IC) and the positions of zero gradient are determined in the double loop 1800 (with the loop variable IZ)/1770 (with the loop variable IC). To determine the position XDT(IZ,IDT) at which the wall shear stress gradient is zero, the variation of the latter is assumed to be linear near XDT. At the end of the loop 1800 the relative distances VZUV between neighbouring extreme values are calculated, which correspond to the parameter $Pe_{sec}/Pe$ in eq. (10).

2.2.5 Using the computer notation the general expression for the friction factor[2] becomes

$$\left(\frac{1}{\sqrt{\frac{f}{8}}}\right) = RF = \frac{2}{DHT\emptyset T} \frac{\sum_{IZ=1}^{NZ} DU(IZ) \int_0^1 T^{1/2} \cdot YM \int_0^1 u^+ [1+Y(G-1)]\, dY dX}{\sum_{IZ=1}^{NZ} DU(IZ)} \qquad (24)$$

For $u^+$ the relations (11) and (12) in their respective region of validity have to be used. RF is calculated in the triple loop 1850/1835/1820 adopting for the evaluation of the two integrals the numerical five-point integration formula (function FSUM). The radial integral of eq. (24) is proportional to the local mean velocity ETA. For this reason ETA, which has no significance for the iteration procedure, is calculated in this section.

2.3.1 First the NGG velocity values UMX on the zero shear line are determined in the loop 1870. Then the velocity ratios within the boundary position sets are calculated in the triple loop 1920/1920/1915 and it is verified whether they fulfill the end condition. In order to avoid excessively sharp differences between the radial extents in two subsequent iteration cycles the values of the velocity ratios VUMX to use in the iteration relations are limited to a maximum value of 1.2 and to a minimum value of 0.8. These limitations are applied also to the velocity ratios

calculated in the following section.

2.3.2 In the double loop 1993/1990 after the identification of an iteration unit, the velocities UMX on the zero shear line within this unit are calculated, first using the data pertaining to the active iteration subzone (loop 1950), then using the data pertaining to the passive iteration subzone. In a third step (loop 1980) the velocity ratios VUMAX are calculated and it is verified whether they fulfill the end condition.

2.3.3 The iteration calculations are discontinued when:

1) the maximum number NZYZUS of cycles, which is specified as input, is reached;

2) the time TIT, which is specified as input and which is estimated to be needed for the total number of NZYZUS cycles, is not sufficient;

3) the end condition (NENDE = NENSØ) is fulfilled (NENSØ is the total number of calculated velocity ratios, which does not differ more than a prescribed percentage - GRENZ - from unity).

3.1 All data are punched which are needed for an eventual continuation of the iteration calculations in a next step.

3.2 The preparation and writing of the final results can be bypassed, specifying in the input for the selection number NFIRE 1 the value zero.

3.2.1 In a first loop (2380) the bulk velocities UB in the subchannels of the rod array, made dimensionless with the bulk velocity in the whole array, are calculated.

Employing the notation of the computer programme, the bulk velocity in a subchannel may be written as

$$UB = \frac{\sum_{I=1}^{NIZ} \int_{XG(i)}^{XG(o)} ETA.YM.DU\,[1+(G-1)/2]\,dX}{\sum_{I=1}^{NIZ} \int_{XG(i)}^{XG(o)} YM.DU\,[1+(G-1)/2]\,dX} \qquad (25)$$

NIZ is the number of zones in the subchannel, which may not exceed the number of 4; XG(i) and XG(o) are the lowest and highest subzone boundary positions respectively coinciding with the subchannel limits. The two integrals in eq. (25) are determined numerically using the function FSUM. In a second loop (2460) the peripheral distributions of various parameters are calculated. In the final output for each zone, the following results are presented:

- the coefficients BT of the Fourier series for the wall shear stress distribution;
- the coordinates X of the peripheral positions, at which the following parameters are specified;
- the radial extent YM(X);
- the wall shear stress T(X);
- the local mean velocity ETA(X);
- the local Reynolds number RELØC(X);
- the wall shear stress gradient DT(X);
- the radial amplitude AMPSEC(X) of the peripheral secondary flow component;
- the parameter DUPR(X)($= \Delta u^+_{rough}$) characterizing the local roughness effect.

3.2.2 The calculation and writing of the velocity field U/UB can be bypassed specifying in the input for the selection number NFIRE2 the value zero.

## 5. SPECIAL FEATURES

In this chapter five particular points are discussed. The first point concerns the possibility to reduce the amount of calculation in the case of very large but regular rod arrays. In the second point it is illustrated how to reduce the number of Fourier coefficients in cases, in which a great number of peripheral positions is needed only for the geometrical calculations.

The third point deals with the definition of the wall curvature used in VELASCØ. The fourth point deals with the question in which manner quadrangular rod configurations have to be handled. In the last point it is shown, for which cases convergence of the Fourier series for the wall shear stress distribution is not to be expected.

1) In the case of very large rod arrays like a 169-rod triangular array in a hexagonal channel, the amount of calculation would be considerable. Fig. 13 a and b represent a one twelfth section as the smallest representative subarray of a hexagonal 169-rod bundle. The correct application of the procedure described results in 21 zones related to each other (Fig. 13 a), of which 9 are closed, which give rise to a great number of Fourier coefficients and hence lead to large computer times. Applying the below simplified procedure, this amount of calculation can be significantly reduced. Theoretically in the subarray represented in Fig. 13, there would not be zones with an identical velocity distribution. In practice, the disturbing effect of the channel wall will not extend into the central region (region I in Fig. 13 b). Therefore this region can be characterized by only one zone (zone 1 in Fig. 13 b). Assuming that the influence of the corners is restricted to the corner region III, the wall influenced region II may be reduced to one that is characterized by 4 zones (zones 2 to 5 in Fig. 13 b). The corner region III itself has to be divided into 5 zones (zones 6 to 10 in Fig. 13 b). In consequence of these simplifications only three non-related groups of 1, 4, and 5 zones respectively have to be considered. As additional input data in the case of the simplified procedure only the frequency of occurrence NNZ of the representative zones has to be specified.

2) Generally the number of peripheral positions is chosen with the criterion of a good convergence of the Fourier series for the wall shear stress distribution. In some cases this may not result in a sufficient number of peripheral positions to justify the assumption, that between two adjacent peripheral positions the zero shear line is a straight line (see sections 2.1.2 and 2.2.1 of the programme).

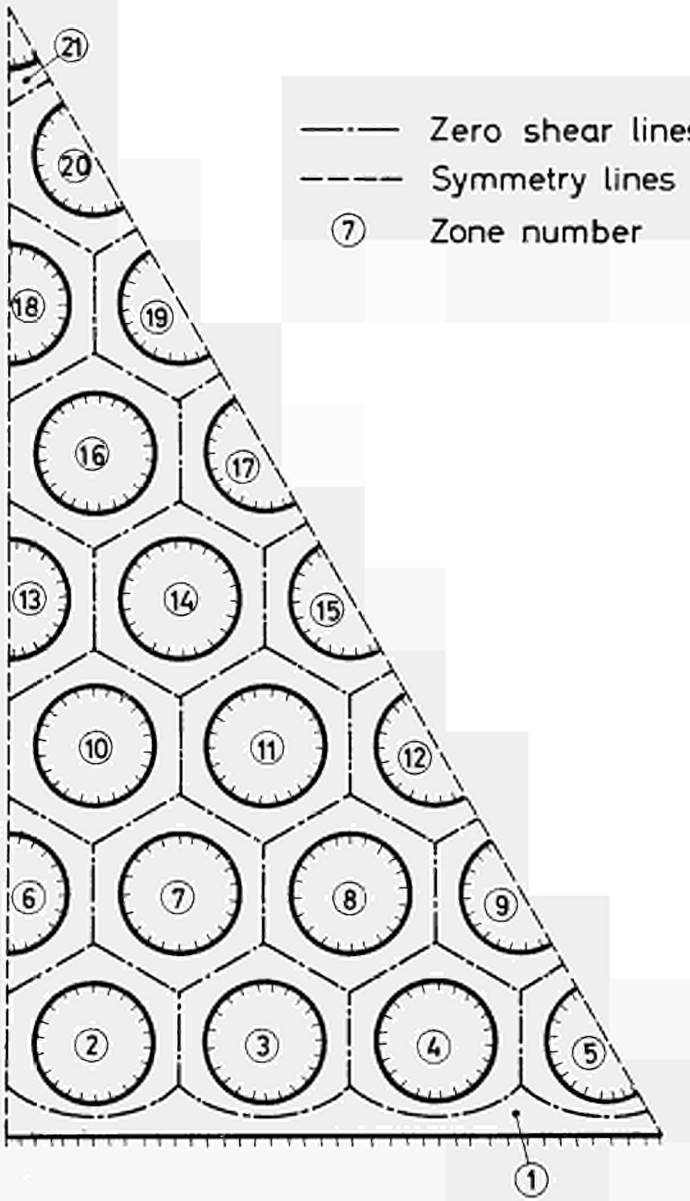



Fig. 13 a - Application of the correct model in a subarray representative for a 169-rod array

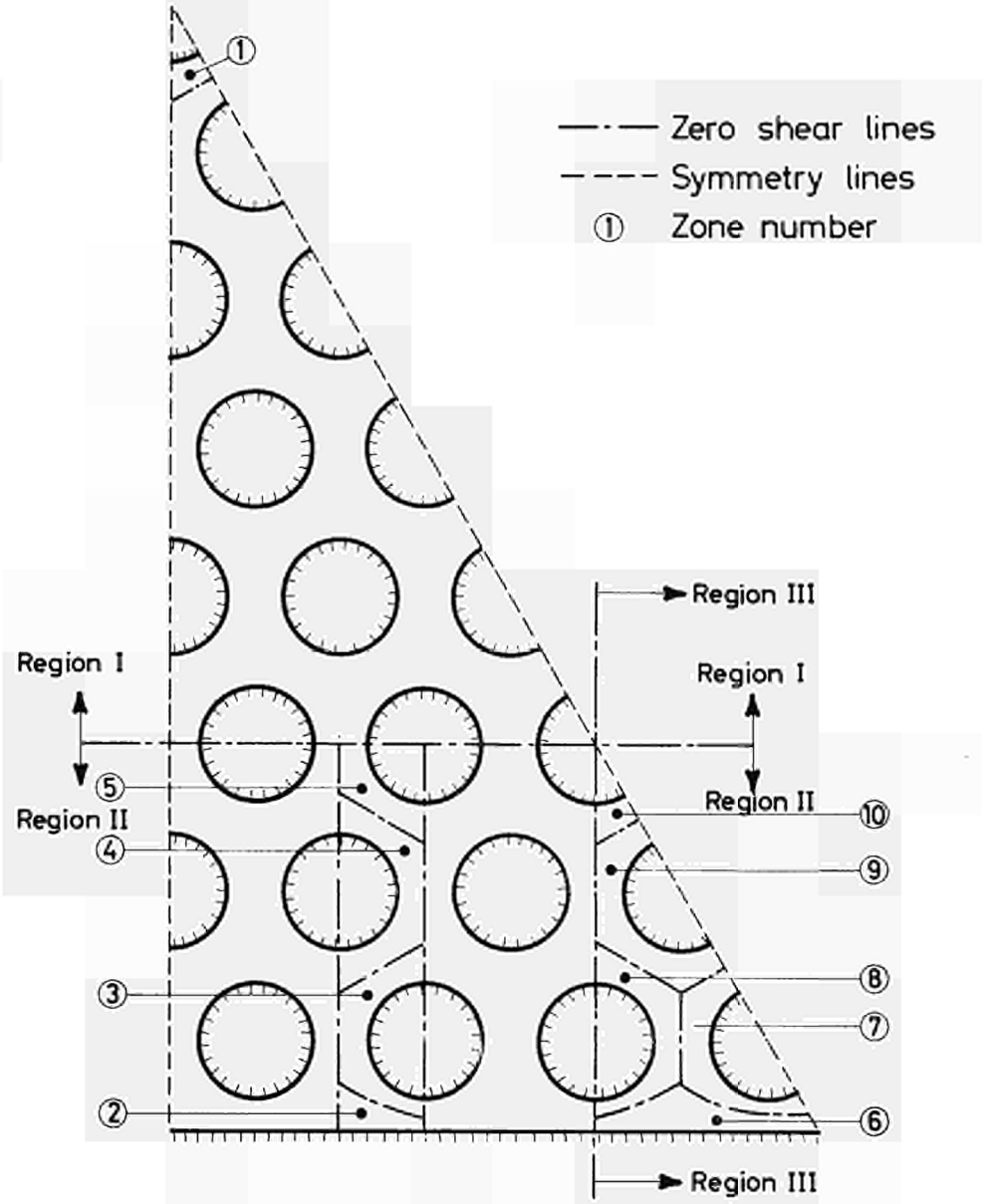



Fig. 13 b - Application of the simplified model in a subarray representative for a 169-rod array

In such cases the number NC of peripheral positions is chosen high enough to justify the above assumption on the zero shear line, whereas for the determination of the Fourier coefficients only a reduced number NCØF of these positions is used according to the relation

$$NC\emptyset F = \frac{NC - 1}{NPASC} + 1$$

The number NC then has to fulfill the condition

$$\frac{NC-1}{NPASC} = \text{integer.}$$

NPASC has in normal cases the value 1 and it has to be specified as input data in each case.

3) For each zone one has to specify a "principal" curvature, and for each subzone the real curvature (see chapter 6 on the input data). The curvature of a wetted wall is defined as the ratio of the reference length or reference radius to the radius of the wetted wall. Consequently a flat wall has a curvature of 0. A curved wall, of which the convex side is wetted by the fluid, has by definition a curvature greater than 0; a wall, of which the concave side is wetted, has by definition a curvature less than 0. The "principal"curvature of a wall is the dominant curvature in this zone. The principal curvature for example of the wall of a rectangular channel with rounded corners is the curvature of the flat wall, i.e. zero.

4) In the case that a configuration of 4 rods is not arranged in a square, it will be sometimes difficult to decide, how the set of subzone boundary positions within the 4 rods has to be described. The following rules may help in such a situation:

- each configuration of 4 rods can in principle be divided in two configurations of 3 rods; within a configuration of 3 rods a "three-point" set of boundary positions (IXGACT = 6) has to be assumed;
- within a configuration of 4 rods a "four-point" set of boundary positions

(IXGACT = 7) can only be assumed in the case that all four rods are tangent to the inscribed circle;

- in the case that during the iteration calculations not all 6 velocity ratios of a "four-point" set converge towards unity, this configuration of 4 rods has to be divided into two configurations of 3 rods.

In Fig. 14 a few examples of 4-rod configurations are represented. If the subzone boundary positions within a configuration of 4 rods are described with IXGACT = 6 as shown in Fig. 14, example (b), the subzone boundary positions corresponding to the positions (1, 2) and (3, 2) in Fig. 14 have to be denoted as the no. 1 of the corresponding sets (see chapter 6 on the input data).

5) In some extreme cases the coefficients of the Fourier series describing the wall shear stress distribution imposed by the geometrical boundary conditions does not converge. Examples are eccentric annuli with a small ratio of the inner to the outer radius and with an eccentricity of 100% as shown in Fig. 15. In general also in the case of contacting walls, the Fourier series describing the corresponding wall shear stress distributions may converge well. But in the case represented in Fig. 15 the variation of the wall shear stress in the outer zone is too abrupt to be represented well by a Fourier series. An approximate solution in these cases can be obtained by a parameter study initiating with a less extreme case and approximating as closely as possible the extreme case. For the example in Fig. 15 this would mean that the parameter study is to be started with a smaller value of the eccentricity.

## 6. INPUT DATA

Each zone, each subzone, each peripheral subzone boundary position and each subchannel is described on a separate data card. The following data have to be specified on these cards.

Card type I, Zone characteristics
(Format: 5I5, 3D 10.6)

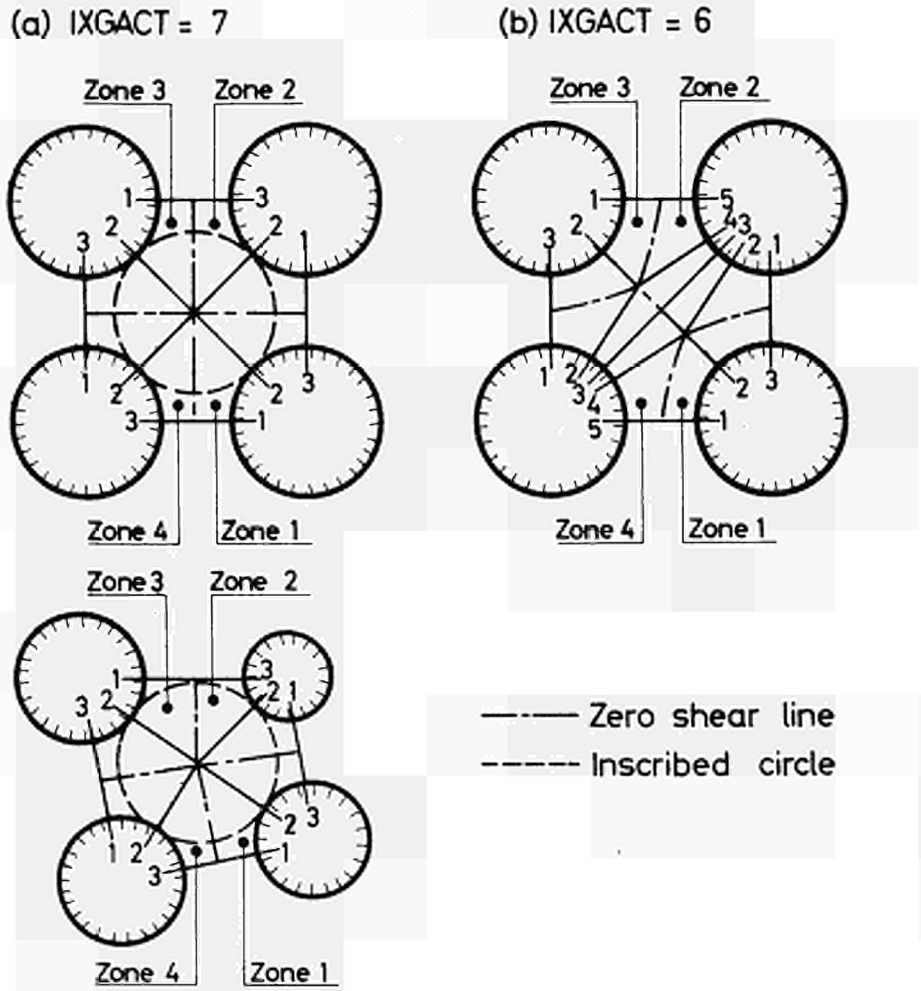
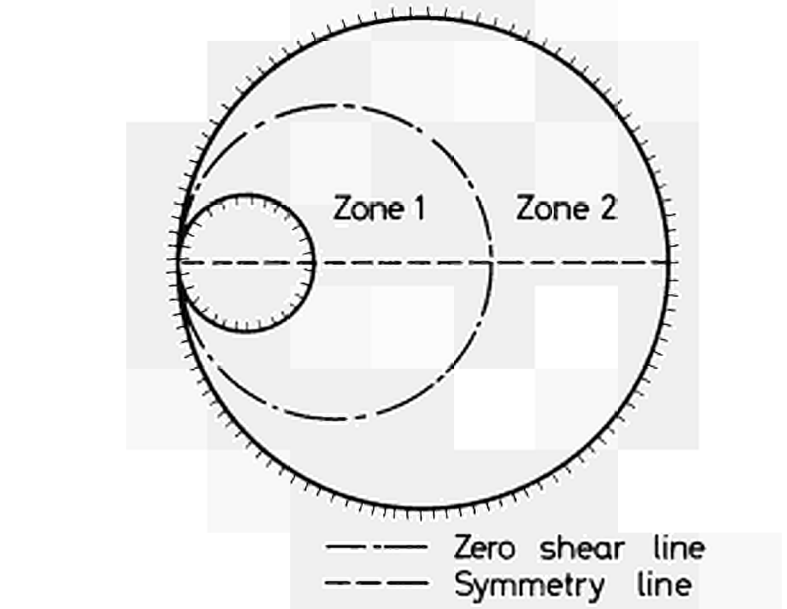



Fig. 14 - Description of the subzone boundary positions within 4-rod configurations



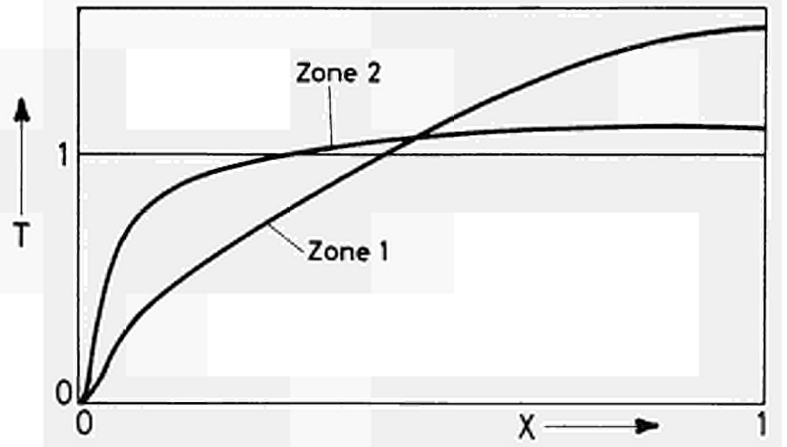




Fig. 15 - Situation in an eccentric annulus having an inner rod of an extremely small diameter in contact with the channel wall.

| Symbol | Meaning |
|---|---|
| NC | number of peripheral positions X used for geometrical calculations; NC has to fulfill the conditions (NC-1)/NPASC = integer and (NC-1)/4 = integer |
| NUZ | number of subzones |
| NSIN | selection number<br>NSIN = 1(0): peripherally closed (open) zones |
| NNZ | frequency of occurrence of the zone (see chapter 5, point 1) |
| NPASC | factor determining the number of Fourier coefficients (see chapter 5, point 2) |
| ACH | = 1/DU; DU is the perimeter of the zone divided by the reference length and $\pi$ |
| RAU | roughness height divided by the reference length |
| ØK | principal curvature of the zone (see chapter 5, point 3) |

Card type II, Subzone characteristics
(Format 6I5, 3D 10.6)

| Symbol | Meaning |
|---|---|
| MCH1 | number characterizing the type of the subzone (=IUZACT, see chapter 3) |
| MCH2 | IUZACT = 1; no significance<br>IUZACT = 2, 3 ; consecutive number of the iteration unit |
| MCH3 | IUZACT = 1; no significance<br>IUZACT = 2, 3 ; zone number of the partner subzone |
| MCH4 | IUZACT = 1; no significance<br>IUZACT = 2, 3; consecutive number of the partner subzone |
| MCH5 | consecutive number of the subzone boundary position of parallel tangents minus the consecutive number of the subzone |
| MCH6 | IUZACT = 1 ; no significance<br>IUZACT = 2, 3 ; same significance for the partner subzone as MCH5 has for the subzone described |
| ACH1 | distance between the zone wall and that of the partner zone |

| Symbol | Meaning |
|---|---|
| | at the position of parallel tangents divided by the reference length |
| ACH2 | wall curvature in the subzone |
| ACH3 | wall curvature in the partner subzone |

Card type III, Characteristics of the peripheral subzone boundaries
(Format IZ, 10 I3, 4D 10.6)

| Symbol | Meaning |
|---|---|
| LCH1 | number characterizing the type of the subzone boundary position (= IXGACT, see chapter 3) |

The following variables are specified as a function of IXGACT.

IXGACT = 1

no other information is needed

IXGACT = 2

| | |
|---|---|
| LCH2-LCH11 | no significance |
| BCH1 | peripheral coordinate of the boundary position divided by the zone perimeter |
| BCH2 | radial extent at this position divided by the reference length |
| BCH3-BCH4 | no significance |

IXGACT = 3

| | |
|---|---|
| LCH2 | zone number of the partner boundary position |
| LCH3 | consecutive number of the partner boundary position |
| LCH4-LCH11 | no significance |
| BCH1 | peripheral coordinate of the boundary position divided by the zone perimeter |
| BCH2 | peripheral coordinate of the partner boundary position divided by the perimeter of the partner zone |
| BCH3 | distance between the zone wall and that of the partner zone divided by the reference length |
| BCH4 | no significance |

IXGACT = 4

| | |
|---|---|
| LCH2 | zone number of the fixed boundary position |
| LCH3 | zone number of the partner boundary position |
| LCH4 | consecutive number of the fixed boundary position |
| LCH5 | consecutive number of the partner boundary position |
| LCH6 | consecutive number of one of the neighbouring positions of parallel tangents minus LCH4 |
| LCH7 | consecutive number of the partner to this position of parallel tangents minus LCH5 |
| LCH8-LCH11 | no significance |
| BCH1 | peripheral coordinate of the fixed boundary position divided by the zone perimeter |
| BCH2 | distance between the zone wall and that of the partner zone at the position of parallel tangents used in the definition of LCH6 divided by the reference length |
| BCH3 | wall curvature in the subzone bounded by the fixed position and the position of parallel tangents used in the definition of LCH6 |
| BCH4 | wall curvature in the corresponding partner subzone |

IXGACT = 5

| | |
|---|---|
| LCH2 | zone number of the partner boundary position |
| LCH3 | consecutive number of the partner boundary position |
| LCH4 | consecutive number of the position of parallel tangents with the partner zone minus the consecutive number of the boundary position |
| LCH5 | consecutive number of the position of parallel tangents of the partner zone with its image in the neighbouring symmetrical subarray minus the consecutive number of the partner position (consequently LCH4 and LCH5 may assume the values 1 or -1) |
| LCH6-LCH11 | no significance |
| BCH1 | distance between the zone wall and that of the partner zone |

at the position of parallel tangents divided by the reference length

BCH2 distance between the partner zone wall and its image in the neighbouring subarray at the position of parallel tangents divided by the reference length

BCH3 distance between the zone wall and its image in the neighbouring subarray at the position of parallel tangents divided by the reference length

BCH4 no significance

IXGACT = 6

LCH2, LCH3, LCH4 zone number of the first, second and third partner position respectively; in the case that the wall of one partner zone has a curvature less or equal to zero, this partner has to be quoted as the first

LCH5, LCH6, LCH7 consecutive number of the first, second and third partner respectively

LCH8, LCH9, LCH10 consecutive number of the position of parallel tangents to the walls of the first (second, third) and of the third (first, second) partner zone minus the consecutive number of the first (second, third)partner position. (consequently LCH8, LCH9 and LCH10 may assume the values 1 or -1)

LCH11 no significance

BCH1, BCH2, BCH3 distance between the wall of the first (second, third) partner position and the wall of the second (third, first) partner position of the position of parallel tangents divided by the reference length

BCH4 no significance

IXGACT = 1

LCH2, LCH3, LCH4 zone number of the second, third and fourth partner position respectively

| | |
|---|---|
| LCH5, LCH6, LCH7 | consecutive number of the second, third and fourth partner position respectively |
| LCH8, LCH9, LCH10, LCH11 | consecutive number of the position of parallel tangents to the walls of the first (second, third, fourth) and of the fourth (first, second, third) partner zone minus the consecutive number of the first (second, third, fourth) partner position. (consequently, LCH8-LCH11 may assume the values 1 or -1) |
| BCH1, BCH2, BCH3, BCH4 | distance between the wall of the first (second, third, fourth) partner position and the wall of the second (third, fourth, first) partner position at the position of parallel tangents divided by the reference length |

Card type IV, Subchannel characteristics
(Format 14I5)

| Symbol | Meaning |
|---|---|
| NCH1 | number of zones in the subchannel (the maximum value is limited to 4) |
| NCH2, NCH3, NCH4, NCH5 | consecutive numbers of the zones in the subchannel |
| NCH6, NCH7, NCH8, NCH9 | lower consecutive number of the boundary positions at the limits of the subchannel pertaining to the zones NCH2, NCH3 NCH4 and NCH5 respectively |
| NCH10, NCH11, NCH12, NCH13 | higher consecutive number of the boundary positions at the limits of the subchannel pertaining to the zones NCH2, NCH3 NCH4 and NCH5 respectively |
| NCH14 | number of peripheral positions between the boundary positions NCH6 and NCH10, NCH7 and NCH11, NCH8 and NCH12, NCH9 and NCH13 (including these positions);for the numeri- |

cal integration NCH14 has to fulfill the condition
(NCH14-1)/4 = integer

Additionally to the data on card types I to IV the following general and global data have to be specified.

Card 1 (Format 14I5)

| Symbol | Meaning |
|---|---|
| NWRIZY | selection number<br>NWRIZY = 1(0) signifies writing (or not) of intermediate results in the iteration cycles determined by the value of NDIFWR |
| NDIFWR | if NWRIZY = 0 : no significance<br>if NWRIZY = 1 : intermediate results are written if the cycle number IZYKL is equal to<br>1, 1+NDIFWR, 1+2.NDIFWR, 1+3.NDIFWR, ... |
| NFIRE1 | selection number<br>NFIRE1 = 1(0) signifies calculating and writing (or not) of the final results |
| NFIRE2 | selection number, no significance for NFIRE1 = 0; if NFIRE1 = 1 :<br>NFIRE2 = 1(0) signifies calculating and writing of all final results (or only the first part of the final results, section 3.2.1 in the programme) |

Card 2 (Format 7D10.6)

| Symbol | Meaning |
|---|---|
| TIT | time in seconds which is estimated to be needed for the iteration calculations |

Card 3 (Format 14I5)

| Symbol | Meaning |
|---|---|
| NZYZUS | maximum number of iteration cycles to be executed in this |

step

Card 4 (Format 7D10.6)

| Symbol | Meaning |
|---|---|
| GRENZ | maximum allowed relative velocity difference on the zero shear line |

Card 5 (Format 7D10.6)

| Symbol | Meaning |
|---|---|
| RE | Reynolds number for which the velocity field has to be calculated |

Card 6 (Format 14I5)

| Symbol | Meaning |
|---|---|
| NZ | total number of zones |
| NØRDN | total number of iteration units |
| NUK | total number of subchannels |

Card 7 (Format 14I5)

| Symbol | Meaning |
|---|---|
| NZYKL | number of iteration cycles passed in preceding calculation steps |

The following input cards give the possibility of an individual description of each case in the output.

Card A (Format 14I5)

| Symbol | Meaning |
|---|---|
| NTEST1 | numbers limited to the range 0 to 9 for establishing the case number ranging from 0000 up to 9999 |
| NTEST2 | |
| NTEST3 | |
| NTEST4 | |

Card B (Format 14I5)

| Symbol | Meaning |
|---|---|
| NTITLE | number of title cards C (limited to 5 by the dimensions foreseen) |

Card C (Format 18A4)

| Symbol | Meaning |
|---|---|
| TITLE | text description of the case considered |

The whole package of input cards is composed as follows:

Card A

Card B

NTITLE ± Card C

Card 1

Card 2

Card 3

Card 4

Card 5

Card 6

NZ ± { Card I
NUZ ± Card II
(NUZ+1) ± Card III

NUK ± Card IV

Card 7

If NZYKL equals zero, card 7 concludes the package; if NZYKL is greater than zero, card 7 has to be substituted by the data card punch of the preceding calculation step.

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# APPENDIX I

## LISTING OF VELASCØ

```
      C     W.EIFLER,R.NIJSING                                                MAIN  10
      C                                                                       MAIN  20
      C     FULLY DEVELOPED AND ISOTHERMAL TURBULENT VELOCITY DISTRIBUTION    MAIN  30
      C                                                                       MAIN  40
      C     IN ASYMMETRIC ROD CONFIGURATIONS                                  MAIN  50
      C                                                                       MAIN  60
      C                                                                       MAIN  70
      C     V E L A S C O                                                     MAIN  80
      C                                                                       MAIN  90
      C                                                                       MAIN 100
      C                                                                       MAIN 110
      C     ****************************************************************MAIN 120
      C     DOUBLE PRECISION VERSION                                          MAIN 130
0001  C     IMPLICIT REAL*8(A-H,O-Z)                                          MAIN 140
      C     ****************************************************************MAIN 150
      C                                                                       MAIN 160
      C                                                                       MAIN 170
      C     ****************************************************************MAIN 180
      C                                                                       MAIN 190
      C     DIMENSION-STATEMENTS                                              MAIN 200
      C                                                                       MAIN 210
      C     ****************************************************************MAIN 220
      C                                                                       MAIN 230
      C                                                                       MAIN 240
      C     DIMENSIONS IN COMMON BLOCK /MATRIX/ VARYING WITH NC(MAX),NC(MAX)  MAIN 250
      C                                                                       MAIN 260
0002  C     COMMON /MATRIX/ AA(81,81)                                         MAIN 270
      C                                                                       MAIN 280
      C     UNVARYING DIMENSIONS                                              MAIN 290
      C                                                                       MAIN 300
0003  C     DIMENSION                                                         MAIN 310
     1UMX(400),TITLE(90),FINTA(101),FINTB(101),U(8,25),Y(8,25),IZB(8),XT     MAIN 320
     2(8),NRAD(6)                                                           MAIN 330
      C                                                                       MAIN 340
      C     DIMENSIONS VARYING WITH NZ                                        MAIN 350
      C                                                                       MAIN 360
0004  C     DIMENSION                                                         MAIN 370
     1ACH( 7),TAUM( 7),DU( 7),DX( 7),NUZ( 7),NC( 7),NSIN( 7),NNZ( 7),NPA     MAIN 380
     2SC( 7),NCOF( 7),NUV( 7),NDT( 7),RAD( 7),DK( 7)                        MAIN 390
      C                                                                       MAIN 400
      C     DIMENSIONS VARYING WITH NZ,NUZ(MAX)                               MAIN 410
      C                                                                       MAIN 420
0005  C     DIMENSION                                                         MAIN 430
     1MCH1( 7,24),MCH2( 7,24),MCH3( 7,24),MCH4( 7,24),MCH5( 7,24),MCH6(      MAIN 440
     27,24),ACH1( 7,24),ACH2( 7,24),ACH3( 7,24),PITCH( 7,24),DKR( 7,24)     MAIN 450
      C                                                                       MAIN 460
      C     DIMENSIONS VARYING WITH NZ,NXG(MAX)                               MAIN 470
      C                                                                       MAIN 480
0006  C     DIMENSION                                                         MAIN 490
     1LCH1( 7,25),LCH2( 7,25),LCH3( 7,25),LCH4( 7,25),LCH5( 7,25),LCH6(      MAIN 500
     27,25),LCH7( 7,25),LCH8( 7,25),LCH9( 7,25),LCH10( 7,25),LCH11( 7,25     MAIN 510
     3),BCH1( 7,25),BCH2( 7,25),BCH3( 7,25),BCH4( 7,25),XG( 7,25),YG( 7,     MAIN 520
     425)                                                                   MAIN 530
```

```
C
C     DIMENSIONS VARYING WITH NZ,NC(MAX) (OR ONLY WITH NC(MAX))                 MAIN 540
C                                                                               MAIN 550
      DIMENSION                                                                 MAIN 560
0007 1X( 7,81),YM( 7,81),BT( 7,81),T( 7,51),DT( 7,81),VUMAX( 7,81),G( 7,MAIN 570
     281),CTA( 7,81),DHI(81),COEF(81),RELOC(81),AMPSEC(81),DUPR(81)             MAIN 580
C                                                                               MAIN 590
C     DIMENSIONS VARYING WITH NZ,NDT(MAX)                                       MAIN 600
C                                                                               MAIN 610
      DIMENSION                                                                 MAIN 620
0008 1XDT( 7,25),VZUV( 7,25)                                                    MAIN 630
C                                                                               MAIN 640
C     DIMENSIONS VARYING WITH NORDN,ND(MAX) (OR ONLY WITH ONE OF THESE)         MAIN 650
C                                                                               MAIN 660
      DIMENSION                                                                 MAIN 670
0009 1XD(34,83),YMD(34,83),ND(34),NUM(34),IZRR(34),XDR(83),YMDR(83)             MAIN 680
C                                                                               MAIN 690
C     DIMENSIONS VARYING WITH THE SUM OF XG'S                                   MAIN 700
C                                                                               MAIN 710
      DIMENSION                                                                 MAIN 720
0010 1VGMX(99),IZR(99),IXGR(99)                                                 MAIN 730
C                                                                               MAIN 740
C     DIMENSIONS VARYING WITH NUK (OR WITH 4*NUK)                               MAIN 750
C                                                                               MAIN 760
      DIMENSION                                                                 MAIN 770
0011 1NCH1(10),NCH2(10),NCH3(10),NCH4(10),NCH5(10),NCH6(10),NCH7(10),NCHMAIN 780
     28(10),NCH9(10),NCH10(10),NCH11(10),NCH12(10),NCH13(10),NCH14(10),UMAIN 790
     3B(10),FUMA(40),FUM3(40)                                                   MAIN 800
C                                                                               MAIN 810
C     ATTENTION  ADAPTING THE DIMENSIONS FOR YOUR CASE GIVE THE ADEQUATE        MAIN 820
C     VALUES ALSO TO THE FOLLOWING VARIABLES SERVING FOR CONTROL                MAIN 830
C                                                                               MAIN 840
      NZDIM=7                                                                   MAIN 850
0012  NCDIM=81                                                                  MAIN 860
0013  NUZDIM=24                                                                 MAIN 870
0014  NXGDIM=25                                                                 MAIN 880
0015  NDTDIM=25                                                                 MAIN 890
0016  NORDIM=34                                                                 MAIN 900
0017  NDDIM=83                                                                  MAIN 910
0018  NSXDIM=99                                                                 MAIN 920
0019  NUKDIM=10                                                                 MAIN 930
0020                                                                            MAIN 940
C                                                                               MAIN 950
      CALL STCLOK                                                               MAIN 960
C                                                                               MAIN 970
C                                                                               MAIN 980
C     ******************************************************************        MAIN 990
C     ******************************************************************        MAIN1000
C                                                                               MAIN1010
C     1.- I N P U T  -  D A T A                                                 MAIN1020
C                                                                               MAIN1030
C     ******************************************************************        MAIN1040
C     ******************************************************************        MAIN1050
C                                                                               MAIN1060
```

```
                C      1.1.- READING                                                    MAIN1070
                C      ---------------------------------------------------------------MAIN1080
                C                                                                       MAIN1090
0022                 1 READ (5,9010) NTEST1,NTEST2,NTEST3,NTEST4                       MAIN1100
0023                   IF (NTEST1.LT.0) GO TO 9999                                     MAIN1110
0024                   READ (5,9010) NTITLE                                            MAIN1120
0025                   LA=1                                                            MAIN1130
0026                   LE=18                                                           MAIN1140
0027                   DO 2 IN=1,NTITLE                                                MAIN1150
0028                   READ (5,9005) (TITLE(L),L=LA,LE)                                MAIN1160
0029                   LA=LA+18                                                        MAIN1170
0030                 2 LE=LE+18                                                        MAIN1180
0031                   READ (5,9010) NWRIZY,NDIFWR,NFIRE1,NFIRE2                       MAIN1190
0032                   READ (5,9000) TIT                                               MAIN1200
0033                   READ (5,9010) NZYZUS                                            MAIN1210
0034                   READ (5,9000) GRENZ                                             MAIN1220
0035                   READ (5,9000) RE                                                MAIN1230
0036                   READ (5,9010) NZ,NORDN,NUK                                      MAIN1240
0037                   DO 50 IZ=1,NZ                                                   MAIN1250
0038                   READ (5,9015) NC(IZ),NUZ(IZ),NSIN(IZ),NNZ(IZ),NPASC(IZ),ACH(IZ),RAMAIN1260
                      1U(IZ),UK(IZ)                                                    MAIN1270
0039                   DU(IZ)=1.D0/ACH(IZ)                                             MAIN1280
0040                   NCOF(IZ)=(NC(IZ)-1)/NPASC(IZ)+1-NSIN(IZ)                        MAIN1290
0041                   IF (NSIN(IZ).EQ.1) NSIN(IZ)=NCOF(IZ)/2                          MAIN1300
0042                   NUZR=NUZ(IZ)                                                    MAIN1310
0043                   READ (5,9030) (MCH1(IZ,L),MCH2(IZ,L),MCH3(IZ,L),MCH4(IZ,L),MCH5(IZMAIN1320
                      1,L),MCH6(IZ,L),ACH1(IZ,L),ACH2(IZ,L),ACH3(IZ,L),L=1,NUZR)       MAIN1330
0044                   NXG=NUZR+1                                                      MAIN1340
0045                   DO 50 IXG=1,NXG                                                 MAIN1350
0046                   READ (5,9035) LCH1(IZ,IXG),LCH2(IZ,IXG),LCH3(IZ,IXG),LCH4(IZ,IXG),MAIN1360
                      1LCH5(IZ,IXG),LCH6(IZ,IXG),LCH7(IZ,IXG),LCH8(IZ,IXG),LCH9(IZ,IXG),LMAIN1370
                      2CH10(IZ,IXG),LCH11(IZ,IXG),BCH1(IZ,IXG),BCH2(IZ,IXG),BCH3(IZ,IXG),MAIN1380
                      3BCH4(IZ,IXG)                                                   MAIN1390
0047                   IF(LCH1(IZ,IXG)-2) 50,20,25                                     MAIN1400
0048                20 XG(IZ,IXG)=BCH1(IZ,IXG)                                         MAIN1410
0049                   YG(IZ,IXG)=BCH2(IZ,IXG)                                         MAIN1420
0050                   GO TO 50                                                        MAIN1430
0051                25 IF(LCH1(IZ,IXG)-4) 30,40,50                                     MAIN1440
0052                30 XG(IZ,IXG)=BCH1(IZ,IXG)                                         MAIN1450
0053                   IZ2=LCH2(IZ,IXG)                                                MAIN1460
0054                   IXG2=LCH5(IZ,IXG)                                               MAIN1470
0055                   XG(IZ2,IXG2)=BCH2(IZ,IXG)                                       MAIN1480
0056                   GO TO 50                                                        MAIN1490
0057                40 IZ1=LCH2(IZ,IXG)                                                MAIN1500
0058                   IXG1=LCH4(IZ,IXG)                                               MAIN1510
0059                   XG(IZ1,IXG1)=BCH1(IZ,IXG)                                       MAIN1520
0060                50 CONTINUE                                                        MAIN1530
0061                   READ (5,9010) (NCH1(L),NCH2(L),NCH3(L),NCH4(L),NCH5(L),NCH6(L),NCHMAIN1540
                      17(L),NCH8(L),NCH9(L),NCH10(L),NCH11(L),NCH12(L),NCH13(L),NCH14(L),MAIN1550
                      1L=1,NUK)                                                        MAIN1560
                C                                                                      MAIN1570
0062                   READ (5,9010) NZYKL                                             MAIN1580
0063                   IF (NZYKL.EQ.0) GO TO 100                                       MAIN1590
```

```
                C
0064                 READ (5,9040) RET,DHTOT                                                MAIN1600
0065                 DO 60 IZ=1,NZ                                                          MAIN1610
0066                 NCR=NC(IZ)                                                             MAIN1620
0067                 NXG=NUZ(IZ)+1                                                          MAIN1630
0068                 READ (5,9040) (YM(IZ,L),L=1,NCR)                                       MAIN1640
0069                 READ (5,9040) (T(IZ,L),L=1,NCR)                                        MAIN1650
0070                 READ (5,9040) (XG(IZ,L),L=1,NXG)                                       MAIN1660
0071                 READ (5,9040) (YG(IZ,L),L=1,NXG)                                       MAIN1670
0072                 READ (5,9010) NDT(IZ)                                                  MAIN1680
0073                 NDTR=NDT(IZ)                                                           MAIN1690
0074                 NDTR1=NDTR-1                                                           MAIN1700
0075                 READ (5,9040) (XDT(IZ,L),L=1,NDTR)                                     MAIN1710
0076                 READ (5,9040) (VZUV(IZ,L),L=1,NDTR1)                                   MAIN1720
0077              60 CONTINUE                                                               MAIN1730
                C                                                                          MAIN1740
0078                 IF (NZ.EQ.1) GO TO 100                                                 MAIN1750
                C                                                                          MAIN1760
0079                 READ (5,9010) NUVG                                                     MAIN1770
0080                 READ (5,9040) (VUMX(L),L=1,NUVG)                                       MAIN1780
0081                 DO 70 IZ=1,NZ                                                          MAIN1790
0082                 READ (5,9010) NUV(IZ)                                                  MAIN1800
0083                 NUVR=NUV(IZ)                                                           MAIN1810
0084                 IF (NUVR.EQ.0) GO TO 70                                                MAIN1820
0085                 READ (5,9040) (VUMAX(IZ,L),L=1,NUVR)                                   MAIN1830
0086              70 CONTINUE                                                               MAIN1840
                C                                                                          MAIN1850
                C    1.2.- WRITING                                                         MAIN1860
                C    ------------------------------------------------------------------    MAIN1870
                C                                                                          MAIN1880
0087             100 WRITE (6,9073) NTEST1,NTEST2,NTEST3,NTEST4                            MAIN1890
0088                 LA=1                                                                  MAIN1900
0089                 LE=18                                                                 MAIN1910
0090                 DO 102 IN=1,NTITLE                                                    MAIN1920
0091                 WRITE (6,9077) (TITLE(L),L=LA,LE)                                     MAIN1930
0092                 LA=LA+18                                                              MAIN1940
0093              102 LE=LE+18                                                             MAIN1950
0094                 WRITE (6,9078)                                                        MAIN1960
0095                 WRITE (6,9080)                                                        MAIN1970
0096                 WRITE (6,9085) RE,GRENZ,NZ,NORDN,NUK                                  MAIN1980
0097                 DO 148 IZ=1,NZ                                                        MAIN1990
0098                 WRITE (6,9209)                                                        MAIN2000
0099                 WRITE (6,9210) IZ                                                     MAIN2005
0100                 WRITE (6,9090) NC(IZ),NUZ(IZ),NSIN(IZ),NNZ(IZ),NPASC(IZ), DU(IZ),RMAIN2010
                    1AU(IZ),UK(IZ)                                                         MAIN2020
0101                 WRITE (6,9095)                                                        MAIN2030
0102                 NUZR=NUZ(IZ)                                                          MAIN2040
0103                 WRITE (6,9120) (L,MCH1(IZ,L),MCH2(IZ,L),MCH3(IZ,L),MCH4(IZ,L),MCH5MAIN2050
                    1(IZ,L),MCH6(IZ,L),ACH1(IZ,L),ACH2(IZ,L),ACH3(IZ,L),L=1,NUZR)          MAIN2060
0104                 WRITE (6,9125)                                                        MAIN2070
0105                 NXG=1+NUZR                                                            MAIN2080
0106                 WRITE (6,9180) (L,LCH1(IZ,L),LCH2(IZ,L),LCH3(IZ,L),LCH4(IZ,L),LCH5MAIN2090
                    1(IZ,L),LCH6(IZ,L),LCH7(IZ,L),LCH8(IZ,L),LCH9(IZ,L),LCH10(IZ,L),LCHMAIN2100
                                                                                           MAIN2110
```

```
     211(IZ,L),BCH1(IZ,L),BCH2(IZ,L),BCH3(IZ,L),BCH4(IZ,L),L=1,NXG)                MAIN2120
0107   148 CONTINUE                                                                 MAIN2130
0108       WRITE (6,9204)                                                           MAIN2140
0109       WRITE (6,9208) (L,NCH1(L),NCH2(L),NCH3(L),NCH4(L),NCH5(L),NCH6(L),      MAIN2150
     1NCH7(L),NCH8(L),NCH9(L),NCH10(L),NCH11(L),NCH12(L),NCH13(L),NCH14(          MAIN2160
     2L),L=1,NUK)                                                                 MAIN2170
C                                                                                 MAIN2180
0110       IF (NZYKL.EQ.0) GO TO 180                                              MAIN2190
C                                                                                 MAIN2200
0111       WRITE (6,9200) NZYKL                                                   MAIN2210
0112       WRITE (6,9202) RET, DHTOT                                              MAIN2220
0113       DO 150 IZ=1,NZ                                                         MAIN2230
0114       NCR=NC(IZ)                                                             MAIN2240
0115       NXG=NUZ(IZ)+1                                                          MAIN2250
0116       NDTR=NDT(IZ)                                                           MAIN2260
0117       NDTR1=NDTR-1                                                           MAIN2270
0118       WRITE (6,9210) IZ                                                      MAIN2280
0119       WRITE (6,9230)                                                         MAIN2290
0120       WRITE (6,9290) (YM(IZ,L),L=1,NCR)                                      MAIN2300
0121       WRITE (6,9240)                                                         MAIN2310
0122       WRITE (6,9290) (T(IZ,L),L=1,NCR)                                       MAIN2320
0123       WRITE (6,9250)                                                         MAIN2330
0124       WRITE (6,9290) (XG(IZ,L),L=1,NXG)                                      MAIN2340
0125       WRITE (6,9260)                                                         MAIN2350
0126       WRITE (6,9290) (YG(IZ,L),L=1,NXG)                                      MAIN2360
0127       WRITE (6,9270)                                                         MAIN2370
0128       WRITE (6,9290) (XDT(IZ,L),L=1,NDTR)                                    MAIN2380
0129       WRITE (6,9280)                                                         MAIN2390
0130       WRITE (6,9290) (VZDV(IZ,L),L=1,NDTR1)                                  MAIN2400
0131       WRITE (6,9078)                                                         MAIN2410
0132   150 CONTINUE                                                               MAIN2420
C                                                                                 MAIN2430
0133       IF (NZ.EQ.1) GO TO 180                                                 MAIN2440
C                                                                                 MAIN2450
0134       WRITE (6,9300)                                                         MAIN2460
0135       WRITE (6,9290) (VUMX(L),L=1,NUVG)                                      MAIN2470
0136       WRITE (6,9078)                                                         MAIN2480
0137       WRITE (6,9320)                                                         MAIN2490
0138       DO 160 IZ=1,NZ                                                         MAIN2500
0139       WRITE (6,9210) IZ                                                      MAIN2510
0140       NUVR=NUV(IZ)                                                           MAIN2520
0141       IF (NUVR.EQ.0) GO TO 160                                               MAIN2530
0142       WRITE (6,9290) (VUMAX(IZ,L),L=1,NUVR)                                  MAIN2540
0143       WRITE (6,9078)                                                         MAIN2550
0144   160 CONTINUE                                                               MAIN2560
C                                                                                 MAIN2570
C      1.3.- CONTROL                                                              MAIN2580
C      ------------------------------------------------------------------------   MAIN2590
C                                                                                 MAIN2600
0145   180 NFAIL=0                                                                MAIN2610
0146       WRITE (6,9720)                                                         MAIN2620
0147       IF (NZ.GT.NZDIM.OR.NZ.LT.1) NFAIL=NFAIL+1                              MAIN2630
0148       IF (NORDN.GT.NORDIM.OR.NORDN.LT.0) NFAIL=NFAIL+1                       MAIN2640
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0149              IF (NUK.GT.NUKDIM.OR.NUK.LT.1) NFAIL=NFAIL+1                                  MAIN2650
0150              WRITE (6,9730) NFAIL                                                          MAIN2660
0151              DO 270 IZ=1,NZ                                                                MAIN2670
0152              WRITE (6,9210) IZ                                                             MAIN2680
0153              IF (NC(IZ).GT.NCDIM.OR.NC(IZ).LT.5) NFAIL=NFAIL+1                             MAIN2690
0154              IF (NUZ(IZ).GT.NUZDIM.OR.NUZ(IZ).LT.1) NFAIL=NFAIL+1                          MAIN2700
0155              IF ((NUZ(IZ)+1).GT.NXGDIM) NFAIL=NFAIL+1                                      MAIN2710
0156              IF (NSIN(IZ).GT.(NCOF(IZ)/2).OR.NSIN(IZ).LT.0) NFAIL=NFAIL+1                  MAIN2720
0157              NUZR=NUZ(IZ)                                                                  MAIN2730
0158              DO 190 IUZ=1,NUZR                                                             MAIN2740
0159              IF (MCH1(IZ,IUZ).GT.3.OR.MCH1(IZ,IUZ).LT.1) NFAIL=NFAIL+1                     MAIN2750
0160              IF (MCH1(IZ,IUZ).EQ.1) GO TO 190                                              MAIN2760
0161              IF (MCH2(IZ,IUZ).GT.NORDN.OR.MCH2(IZ,IUZ).LT.1) NFAIL=NFAIL+1                 MAIN2770
0162              IF (MCH3(IZ,IUZ).GT.NZ.OR.MCH3(IZ,IUZ).LT.1) NFAIL=NFAIL+1                    MAIN2780
0163              IZT=MCH3(IZ,IUZ)                                                              MAIN2790
0164              IF (MCH4(IZ,IUZ).GT.NUZ(IZT).OR.MCH4(IZ,IUZ).LT.1) NFAIL=NFAIL+1              MAIN2800
0165          190 CONTINUE                                                                      MAIN2810
0166              NXG=NUZR+1                                                                    MAIN2820
0167              DO 260 IXG=1,NXG                                                              MAIN2830
0168              IXGACT=LCH1(IZ,IXG)                                                           MAIN2840
0169              IF(IXGACT.GT.7.OR.IXGACT.LT.1) NFAIL=NFAIL+1                                  MAIN2850
0170              GO TO (260,260,210,220,210,240,240), IXGACT                                   MAIN2860
0171          210 IF (LCH2(IZ,IXG).GT.NZ.OR.LCH2(IZ,IXG).LT.1) NFAIL=NFAIL+1                    MAIN2870
0172              IZT=LCH2(IZ,IXG)                                                              MAIN2880
0173              NXGS=NUZ(IZT)+1                                                               MAIN2890
0174              IF (LCH3(IZ,IXG).GT.NXGS.OR.LCH3(IZ,IXG).LT.1) NFAIL=NFAIL+1                  MAIN2900
0175              GO TO 260                                                                     MAIN2910
0176          220 IF (LCH2(IZ,IXG).GT.NZ.OR.LCH2(IZ,IXG).LT.1) NFAIL=NFAIL+1                    MAIN2920
0177              IF (LCH3(IZ,IXG).GT.NZ.OR.LCH3(IZ,IXG).LT.1) NFAIL=NFAIL+1                    MAIN2930
0178              IZT=LCH2(IZ,IXG)                                                              MAIN2940
0179              NXGS=NUZ(IZT)+1                                                               MAIN2950
0180              IF (LCH4(IZ,IXG).GT.NXGS.OR.LCH4(IZ,IXG).LT.1) NFAIL=NFAIL+1                  MAIN2960
0181              IZT=LCH3(IZ,IXG)                                                              MAIN2970
0182              NXGS=NUZ(IZT)+1                                                               MAIN2980
0183              IF (LCH5(IZ,IXG).GT.NXGS.OR.LCH5(IZ,IXG).LT.1) NFAIL=NFAIL+1                  MAIN2990
0184              GO TO 260                                                                     MAIN3000
0185          240 IF (LCH2(IZ,IXG).GT.NZ.OR.LCH2(IZ,IXG).LT.1) NFAIL=NFAIL+1                    MAIN3010
0186              IF (LCH3(IZ,IXG).GT.NZ.OR.LCH3(IZ,IXG).LT.1) NFAIL=NFAIL+1                    MAIN3020
0187              IF (LCH4(IZ,IXG).GT.NZ.OR.LCH4(IZ,IXG).LT.1) NFAIL=NFAIL+1                    MAIN3030
0188              IZT=LCH2(IZ,IXG)                                                              MAIN3040
0189              NXGS=NUZ(IZT)+1                                                               MAIN3050
0190              IF (LCH5(IZ,IXG).GT.NXGS.OR.LCH5(IZ,IXG).LT.1) NFAIL=NFAIL+1                  MAIN3060
0191              IZT=LCH3(IZ,IXG)                                                              MAIN3070
0192              NXGS=NUZ(IZT)+1                                                               MAIN3080
0193              IF (LCH6(IZ,IXG).GT.NXGS.OR.LCH6(IZ,IXG).LT.1) NFAIL=NFAIL+1                  MAIN3090
0194              IZT=LCH4(IZ,IXG)                                                              MAIN3100
0195              NXGS=NUZ(IZT)+1                                                               MAIN3110
0196              IF (LCH7(IZ,IXG).GT.NXGS.OR.LCH7(IZ,IXG).LT.1) NFAIL=NFAIL+1                  MAIN3120
0197          260 CONTINUE                                                                      MAIN3130
0198              WRITE (6,9730) NFAIL                                                          MAIN3140
0199          270 CONTINUE                                                                      MAIN3150
0200              DO 273 IUK=1,NUK                                                              MAIN3160
0201              IF (NCH1(IUK).GT.NZ.OR.NCH1(IUK).GT.4.OR.NCH1(IUK).LT.1) NFAIL=NFAMAIN3170
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                1IL+1                                                                  MAIN3180
0202                IF (NCH2(IUK).GT.NZ.OR.NCH2(IUK).LT.1) NFAIL=NFAIL+1               MAIN3190
0203                IF (NCH3(IUK).GT.NZ.OR.NCH3(IUK).LT.0) NFAIL=NFAIL+1               MAIN3200
0204                IF (NCH4(IUK).GT.NZ.OR.NCH4(IUK).LT.0) NFAIL=NFAIL+1               MAIN3210
0205                IF (NCH5(IUK).GT.NZ.OR.NCH5(IUK).LT.0) NFAIL=NFAIL+1               MAIN3220
0206                IZT=NCH2(IUK)                                                      MAIN3230
0207                IF (NCH6(IUK).GT.(NUZ(IZT)+1).OR.NCH6(IUK).LT.1) NFAIL=NFAIL+1     MAIN3240
0208                IF (NCH10(IUK).GT.(NUZ(IZT)+1).OR.NCH10(IUK).LT.1) NFAIL=NFAIL+1   MAIN3250
0209                IZT=NCH3(IUK)                                                      MAIN3260
0210                IF (IZT.EQ.0) GO TO 272                                            MAIN3270
0211                IF (NCH7(IUK).GT.(NUZ(IZT)+1).OR.NCH7(IUK).LT.1) NFAIL=NFAIL+1     MAIN3280
0212                IF (NCH11(IUK).GT.(NUZ(IZT)+1).OR.NCH11(IUK).LT.1) NFAIL=NFAIL+1   MAIN3290
0213                IZT=NCH4(IUK)                                                      MAIN3300
0214                IF (IZT.EQ.0) GO TO 272                                            MAIN3310
0215                IF (NCH8(IUK).GT.(NUZ(IZT)+1).OR.NCH8(IUK).LT.1) NFAIL=NFAIL+1     MAIN3320
0216                IF (NCH12(IUK).GT.(NUZ(IZT)+1).OR.NCH12(IUK).LT.1) NFAIL=NFAIL+1   MAIN3330
0217                IZT=NCH5(IUK)                                                      MAIN3340
0218                IF (IZT.EQ.0) GO TO 272                                            MAIN3350
0219                IF (NCH9(IUK).GT.(NUZ(IZT)+1).OR.NCH9(IUK).LT.1) NFAIL=NFAIL+1     MAIN3360
0220                IF (NCH13(IUK).GT.(NUZ(IZT)+1).OR.NCH13(IUK).LT.1) NFAIL=NFAIL+1   MAIN3370
0221              272 IF (NCH14(IUK).GT.101.OR.NCH14(IUK).LT.5) NFAIL=NFAIL+1          MAIN3380
0222              273 CONTINUE                                                         MAIN3390
0223                  WRITE (6,9730) NFAIL                                             MAIN3400
0224                  IF(NFAIL.GT.0) GO TO 9999                                        MAIN3410
                C                                                                      MAIN3420
                CC    ---------------------------------------------------------------MAIN3430
                C                                                                      MAIN3440
0225                  DO 300 IZ=1,NZ                                                   MAIN3450
0226                  DX(IZ)=1.D0/DFLOAT(NC(IZ)-1)                                     MAIN3460
0227                  NCR=NC(IZ)                                                       MAIN3470
0228                  DO 300 IC=1,NCR                                                  MAIN3480
0229              300 X(IZ,IC)=DFLOAT(IC-1)*DX(IZ)                                     MAIN3490
                C                                                                      MAIN3500
0230                  PI=3.1415926536D0                                                MAIN3510
                CC                                                                     MAIN3520
                CC                                                                     MAIN3530
                CC    ***************************************************************MAIN3540
                CC                                                                     MAIN3550
                CC    2.- I T E R A T I O N  C Y C L E                                 MAIN3560
                CC                                                                     MAIN3570
                CC    ***************************************************************MAIN3580
                C                                                                      MAIN3590
                C                                                                      MAIN3600
0231                  NZYA=1+NZYKL                                                     MAIN3610
0232                  NZYE=NZYZUS+NZYKL                                                MAIN3620
0233                  NZYWR=NZYA                                                       MAIN3630
0234                  CALL TIME (TI1)                                                  MAIN3640
0235                  DO 2000 IZYKL=NZYA,NZYE                                          MAIN3650
0236                  IF (NWRIZY.EQ.0) GO TO 500                                       MAIN3660
0237                  IF (IZYKL.EQ.NZYWR) GO TO 501                                    MAIN3670
0238              500 NWRITE=0                                                         MAIN3680
0239                  GO TO 503                                                        MAIN3690
0240              501 NWRITE=1                                                         MAIN3700
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0241            NZYWR=NZYWR+NDIFWR                                                  MAIN3710
0242          503 WRITE (6,9060) IZYKL                                              MAIN3720
                C                                                                   MAIN3730
                CC                                                                  MAIN3740
                CC    ************************************************************MAIN3750
                CC                                                                  MAIN3760
                CC    2.1.- CALCULATION OF THE GEOMETRICAL ZONE CHARACTERISTICS     MAIN3770
                CC    ************************************************************MAIN3780
                CC                                                                  MAIN3790
                CC                                                                  MAIN3800
                CC    2.1.1.- THE SUBZONE BOUNDARY POSITIONS XG                     MAIN3810
                CC    ************************************************************MAIN3820
                C                                                                   MAIN3830
0243                  IUVG=1                                                        MAIN3840
0244                  IGG=1                                                         MAIN3850
0245                  IF (NWRITE.EQ.1) WRITE (6,9360)                               MAIN3860
0246                  DO 800 IZ=1,NZ                                                MAIN3870
0247                  IF (NWRITE.EQ.0) GO TO 504                                    MAIN3880
0248                  WRITE (6,9210) IZ                                             MAIN3890
0249                  WRITE (6,9340)                                                MAIN3900
0250          504     NXG=NUZ(IZ)+1                                                 MAIN3910
0251                  DO 800 IXG=1,NXG                                              MAIN3920
0252                  IXGACT=LCH1(IZ,IXG)                                           MAIN3930
0253                  GO TO (505,505,515,530,680,660,680),IXGACT                    MAIN3940
                C                                                                   MAIN3950
0254          505     IF (NWRITE.EQ.1) WRITE (6,9350) IXG,IXGACT,XG(IZ,IXG),YG(IZ,IXG)  MAIN3960
0255                  IF (NWRITE.EQ.1) WRITE (6,9078)                               MAIN3970
0256                  GO TO 800                                                     MAIN3980
                C                                                                   MAIN3990
0257          515     IZ2=LCH2(IZ,IXG)                                              MAIN4000
0258                  IXG2=LCH3(IZ,IXG)                                             MAIN4010
0259                  A12=BCH3(IZ,IXG)                                              MAIN4020
0260                  IF(IZYKL.GT.1) GO TO 520                                      MAIN4030
0261                  YG(IZ,IXG)=A12/2.D0                                           MAIN4040
0262                  YG(IZ2,IXG2)=A12/2.D0                                         MAIN4050
0263                  GO TO 525                                                     MAIN4060
0264          520     YG(IZ,IXG)=YG(IZ,IXG)/VUMX(IUVG)                             MAIN4070
0265                  IUVG=IUVG+1                                                   MAIN4080
0266                  YG(IZ2,IXG2)=A12-YG(IZ,IXG)                                   MAIN4090
0267          525     IZR(IGG)=IZ                                                   MAIN4100
0268                  IZR(IGG+1)=IZ2                                                MAIN4110
0269                  IXGR(IGG)=IXG                                                 MAIN4120
0270                  IXGR(IGG+1)=IXG2                                              MAIN4130
0271                  IGG=IGG+2                                                     MAIN4140
0272                  IF (NWRITE.EQ.1) WRITE (6,9350) IXG,IXGACT,XG(IZ,IXG),YG(IZ,IXG),XMAIN4150
                     1G(IZ2,IXG2),YG(IZ2,IXG2)                                    MAIN4160
0273                  IF (NWRITE.EQ.1) WRITE (6,9078)                               MAIN4170
0274                  GO TO 800                                                     MAIN4180
                C                                                                   MAIN4190
0275          530     IZ1=LCH2(IZ,IXG)                                              MAIN4200
0276                  IZ2=LCH3(IZ,IXG)                                              MAIN4210
0277                  IXG1=LCH4(IZ,IXG)                                             MAIN4220
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0278              IXG2=LCH5(IZ,IXG)                                                    MAIN4240
0279              IRI1=LCH6(IZ,IXG)                                                    MAIN4250
0280              IRI2=LCH7(IZ,IXG)                                                    MAIN4260
0281              A12=BCH2(IZ,IXG)                                                     MAIN4270
0282              OK1=BCH3(IZ,IXG)                                                     MAIN4280
0283              OK2=BCH4(IZ,IXG)                                                     MAIN4290
0284              IF (IZYKL.GT.1) GO TO 536                                            MAIN4300
0285              IF (DABS(OK1).GT.0.D0) GO TO 533                                     MAIN4310
0286              YG(IZ1,IXG1)=A12/2.D0+(PI*DU(IZ1)*(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 )MAIN4320
                 1))**2/(2.D0*(2.D0/OK2+A12))                                         MAIN4330
0287              GO TO 539                                                            MAIN4340
0288            533 YG(IZ1,IXG1)=(A12*OK1*(1.D0+A12*OK2/2.D0)+(OK2/OK1+1.D0+A12*OK2)*(MAIN4350
                 11.D0-DCOS(PI*DU(IZ1)*DABS(OK1)*(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 ))))MAIN4360
                 2)/(OK1-OK2+(OK1+OK2+A12*OK1*OK2)*DCOS(PI*DU(IZ1)*DABS(OK1)*(XG(IZ1MAIN4370
                 3,IXG1)-XG(IZ1,IXG1+IRI1 ))))                                        MAIN4380
0289              GO TO 539                                                            MAIN4390
0290            536 YG(IZ1,IXG1)=YG(IZ1,IXG1)/VUMX(IUVG)                               MAIN4400
0291              IUVG=IUVG+1                                                          MAIN4410
0292            539 IF (DABS(OK1).GT.0.D0) GO TO 542                                   MAIN4420
0293              YG(IZ2,IXG2)=DSQRT(((PI*DU(IZ1)*(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 )))*MAIN4430
                 1*2+(1.D0/OK2+A12-YG(IZ1,IXG1))**2)-1.D0/OK2                         MAIN4440
0294              XG(IZ2,IXG2)=XG(IZ2,IXG2+IRI2)-IRI2*DARCOS((1.D0/OK2+A12-YG(IZ1,IXMAIN4450
                 1G1))/(1.D0/OK2+YG(IZ2,IXG2)))/(PI*DU(IZ2)*DABS(OK2))                MAIN4460
0295              GO TO 548                                                            MAIN4470
0296            542 IF (DABS(OK2).GT.0.D0) GO TO 545                                   MAIN4480
0297              YG(IZ2,IXG2)=1.D0/OK1+A12-(1.D0/OK1+YG(IZ1,IXG1))*DCOS(PI*DU(IZ1)*MAIN4490
                 1DABS(OK1)*(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 )))                        MAIN4500
0298              XG(IZ2,IXG2)=XG(IZ2,IXG2+IRI2)-IRI2*(1.D0/OK1+YG(IZ1,IXG1))*DSIN(PMAIN4510
                 11*DU(IZ1)*DABS(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 ))*OK1)/(PI*DU(IZ2)) MAIN4520
0299              GO TO 548                                                            MAIN4530
0300            545 YG(IZ2,IXG2)=(DSQRT(((1.D0/OK1+YG(IZ1,IXG1))*DSIN(PI*DU(IZ1)*DABS(MAIN4540
                 1OK1)*(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 ))))**2+(1.D0/OK1+A12+1.D0/OK2MAIN4550
                 2-DCOS(PI*DU(IZ1)*DABS(OK1)*(XG(IZ1,IXG1)-XG(IZ1,IXG1+IRI1 )))*(1.DMAIN4560
                 30/OK1+YG(IZ1,IXG1)))**2)*DABS(OK2)-1.D0)/OK2                        MAIN4570
0301              XG(IZ2,IXG2)=XG(IZ2,IXG2+IRI2)-IRI2*DARCOS((1.D0/OK1+A12+1.D0/OK2-MAIN4580
                 1(1.D0/OK1+YG(IZ1,IXG1))*DCOS(PI*DU(IZ1)*DABS(OK1)*(XG(IZ1,IXG1)-XGMAIN4590
                 2(IZ1,IXG1+IRI1 ))))/(1.D0/OK2+YG(IZ2,IXG2)))/(PI*DU(IZ2)*DABS(OK2)MAIN4600
                 3)                                                                   MAIN4610
0302            548 IZR(IGG)=IZ1                                                     MAIN4620
0303              IZR(IGG+1)=IZ2                                                     MAIN4630
0304              IXGR(IGG)=IXG1                                                     MAIN4640
0305              IXGR(IGG+1)=IXG2                                                   MAIN4650
0306              IGG=IGG+2                                                          MAIN4660
0307              IF (NWRITE.EQ.1) WRITE (6,9350) IXG,IXGACT,XG(IZ,IXG),YG(IZ,IXG),XMAIN4670
                 1G(IZ1,IXG1),YG(IZ1,IXG1),XG(IZ2,IXG2),YG(IZ2,IXG2)                  MAIN4680
0308              IF (NWRITE.EQ.1) WRITE (6,9078)                                    MAIN4690
0309              GO TO 800                                                          MAIN4700
                C                                                                    MAIN4710
0310            660 IZ1=LCH2(IZ,IXG)                                                 MAIN4720
0311              IZ2=LCH3(IZ,IXG)                                                   MAIN4730
0312              IZ3=LCH4(IZ,IXG)                                                   MAIN4740
0313              IXG1=LCH5(IZ,IXG)                                                  MAIN4750
0314              IXG2=LCH6(IZ,IXG)                                                  MAIN4760
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0315              IXG3=LCH7(IZ,IXG)                                                    MAIN4770
0316              IRI1=LCH8(IZ,IXG)                                                    MAIN4780
0317              IRI2=LCH9(IZ,IXG)                                                    MAIN4790
0318              IRI3=LCH10(IZ,IXG)                                                   MAIN4800
0319              OK1=GK(IZ1)                                                          MAIN4810
0320              OK2=GK(IZ2)                                                          MAIN4820
0321              OK3=GK(IZ3)                                                          MAIN4830
0322              A12=BCH1(IZ,IXG)                                                     MAIN4840
0323              A23=BCH2(IZ,IXG)                                                     MAIN4850
0324              A31=BCH3(IZ,IXG)                                                     MAIN4860
0325              IF(IZYKL.GT.1) GO TO 670                                             MAIN4870
0326              C11=(2.D0+A31*OK1)/(1.D0+(A31+1.D0/OK3)*OK1)                         MAIN4880
0327              C21=(2.D0+A23*OK2)/(1.D0+(A23+1.D0/OK3)*OK2)                         MAIN4890
0328              C12=(1.D0-OK1/OK3)/(1.D0+(A31+1.D0/OK3)*OK1)                         MAIN4900
0329              C22=(1.D0-OK2/OK3)/(1.D0+(A23+1.D0/OK3)*OK2)                         MAIN4910
0330              CSIN1=DSIN(PI*DU(IZ3)*DABS(OK3)*(XG(IZ3,IXG3+1)-XG(IZ3,IXG3-1))/2.MAIN4920
                 1D0)                                                                 MAIN4930
0331              CSIN2=DSIN(PI*DU(IZ3)*DABS(OK3)*(XG(IZ3,IXG3+1)-XG(IZ3,IXG3-1)))   MAIN4940
0332              C31=1/OK3+A31*C11/2.D0                                               MAIN4950
0333              C32=1/OK3+A23*C21/2.D0                                               MAIN4960
0334              C4=(A31*C11-A23*C21)/2.D0                                            MAIN4970
0335              C5=(C12-C22)**2+4.D0*C12*C22*CSIN1**2-CSIN2**2                       MAIN4980
0336              C61=((C12-C22)*C4+2.D0*CSIN1**2*(C12*C32+C22*C31)+CSIN2**2/OK3)      MAIN4990
0337              C62=((CSIN2/OK3)**2-C4**2-4.D0*CSIN1**2*C31*C32)                     MAIN5000
0338              IF (OK1.EQ.0.AND.OK2.EQ.OK3) GO TO 663                               MAIN5010
0339              IF (C5.EQ.0) GO TO 663                                               MAIN5020
0340              IVZ=1                                                                MAIN5030
0341              IF ((OK1*OK2*OK3).LT.1.D-7) IVZ=-1                                   MAIN5040
0342              YG(IZ1,IXG1)=C61/C5+DFLOAT(IVZ)*DSQRT(C61/C5*C61/C5+C62/C5)          MAIN5050
0343              GO TO 664                                                            MAIN5060
0344         663  YG(IZ1,IXG1)=-C62/(2.D0*C61)                                        MAIN5070
0345         664  YG(IZ2,IXG2)=YG(IZ1,IXG1)                                           MAIN5080
0346              YG(IZ3,IXG3)=YG(IZ1,IXG1)                                            MAIN5090
0347              Y31=1/OK3+A31*C11/2.D0-YG(IZ1,IXG1)*C12                              MAIN5100
0348              Y32=1/OK3+A23*C21/2.D0-YG(IZ1,IXG1)*C22                              MAIN5110
0349              Y21=1/OK2+A12*(2.D0+A12*OK1)/(2.D0*(1.D0+(A12+1.D0/OK2)*OK1))-YG(IMAIN5120
                 1Z1,IXG1)*(1.D0-OK1/OK2)/(1.D0+(A12+1.D0/OK2)*OK1)                   MAIN5130
0350              ARG=          (A23+1.D0/OK2+1.D0/OK3-Y32)/(1.D0/OK2+YG(IZ1,IXG1))  MAIN5140
0351              IF (ARG.GE.1.D0) DX23=0.D0                                           MAIN5150
0352              IF (ARG.LT.1.D0) DX23=DARCOS(ARG)/(DU(IZ2)*PI*DABS(OK2))             MAIN5160
0353              ARG=          Y31/(1.D0/OK3+YG(IZ1,IXG1))                          MAIN5170
0354              IF (ARG.GE.1.D0) DX31=0.D0                                           MAIN5180
0355              IF (ARG.LT.1.D0) DX31=DARCOS(ARG)/(DU(IZ3)*PI*DABS(OK3))             MAIN5190
0356              IF(OK1.EQ.0.D0) DX12=DSQRT((YG(IZ1,IXG1)+1.D0/OK2)**2-Y21*Y21)/(DU(MAIN5200
                 1IZ1)*PI)                                                            MAIN5210
0357              IF(DABS(OK1).GT.0.D0) ARG=       (A12+1.D0/OK2+1.D0/OK1-Y21)/(1.D0MAIN5220
                 1/OK1+YG(IZ1,IXG1))                                                  MAIN5230
0358              IF (DABS(OK1).GT.0.D0.AND.ARG.GE.1.D0) DX12=0.D0                     MAIN5240
0359              IF (DABS(OK1).GT.0.D0.AND.ARG.LT.1.D0) DX12=DARCOS(ARG)/(DU(IZ1)*PMAIN5250
                 11*DABS(OK1))                                                        MAIN5260
0360              XG(IZ1,IXG1)=XG(IZ1,IXG1-IRI1)+DFLOAT(IRI1)*DX12                     MAIN5270
0361              XG(IZ2,IXG2)=XG(IZ2,IXG2-IRI2)+DFLOAT(IRI2)*DX23                     MAIN5280
0362              XG(IZ3,IXG3)=XG(IZ3,IXG3-IRI3)+DFLOAT(IRI3)*DX31                     MAIN5290
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0363            GO TO 675                                                       MAIN5300
0364        670 IF (OK1.EQ.0.D0) GO TO 673                                      MAIN5310
0365            Y12=((1.D0/OK1+YG(IZ1,IXG1))**2-(1.D0/OK2+YG(IZ2,IXG2)/VUMX(IUVG+2MAIN5320
               1))**2+(A12+1.D0/OK1+1.D0/OK2)**2)/(2.D0*(A12+1.D0/OK1+1.D0/OK2))  MAIN5330
0366            ARG=Y12/(1.D0/OK1+YG(IZ1,IXG1))                                 MAIN5340
0367            IF (ARG.GE.1.D0) DX12=0.D0                                      MAIN5350
0368            IF (ARG.LT.1.D0) DX12=DARCOS(ARG)/(DU(IZ1)*PI*DABS(OK1))        MAIN5360
0369            Y12=Y12*(2.D0*YG(IZ1,IXG1)/(VUMX(IUVG)+VUMX(IUVG+1))+1.D0/OK1)/(YGMAIN5370
               1(IZ1,IXG1)+1.D0/OK1)                                            MAIN5380
0370            XG(IZ1,IXG1)=XG(IZ1,IXG1-IRI1)+DFLOAT(IRI1)*DX12                MAIN5390
0371            YG(IZ1,IXG1)=2.D0*YG(IZ1,IXG1)/(VUMX(IUVG)+VUMX(IUVG+1))       MAIN5400
0372            IUVG=IUVG+3                                                     MAIN5410
0373            ARG=(1.D0/OK1+YG(IZ1,IXG1))**2-Y12*Y12                          MAIN5420
0374            DX21=0.D0                                                       MAIN5430
0375            IF (ARG.LE.0.D0) GO TO 671                                      MAIN5440
0376            ARG=DSQRT(ARG)/(A12+1.D0/OK1+1.D0/OK2-Y12)                      MAIN5450
0377            IF (ARG.GE.0.D0) DX21=DATAN(ARG)/(DU(IZ2)*PI*DABS(OK2))         MAIN5460
0378            IF (ARG.LT.0.D0) DX21=(DATAN(ARG)+PI)/(DU(IZ2)*PI*DABS(OK2))    MAIN5470
0379        671 DX23=XG(IZ2,IXG2+1)-XG(IZ2,IXG2-1)-DX21                         MAIN5480
0380            XG(IZ2,IXG2)=XG(IZ2,IXG2-IRI2)+DFLOAT(IRI2)*DX23                MAIN5490
0381            YG(IZ2,IXG2)=(A12+1.D0/OK1+1.D0/OK2-Y12)/DCOS(DX21*DU(IZ2)*PI*DABSMAIN5500
               1(OK2))-1.D0/OK2                                                 MAIN5510
0382            DX13=XG(IZ1,IXG1+1)-XG(IZ1,IXG1-1)-DX12                         MAIN5520
0383            Y13=(1.D0/OK1+YG(IZ1,IXG1))*DCOS(DX13*DU(IZ1)*PI*DABS(OK1))     MAIN5530
0384            ARG=DABS(1.D0/OK1+YG(IZ1,IXG1)) *DSIN(DX13*DU(IZ1)*PI*DABS(OK1))/(MAIN5540
               1A31+1.D0/OK1+1.D0/OK3-Y13)                                      MAIN5550
0385            IF (ARG.GE.0.D0) DX31=DATAN(ARG)/(DU(IZ3)*PI*DABS(OK3))         MAIN5560
0386            IF (ARG.LT.0.D0) DX31=(DATAN(ARG)+PI)/(DU(IZ3)*PI*DABS(OK3))    MAIN5570
0387            XG(IZ3,IXG3)=XG(IZ3,IXG3-IRI3)+DFLOAT(IRI3)*DX31                MAIN5580
0388            YG(IZ3,IXG3)=(A31+1.D0/OK1+1.D0/OK3-Y13)/DCOS(DX31*DU(IZ3)*PI*DABSMAIN5590
               1(OK3))-1.D0/OK3                                                 MAIN5600
0389            GO TO 675                                                       MAIN5610
0390        673 ARG=(1.D0+YG(IZ2,IXG2)/VUMX(IUVG+2))**2-(A12+1.D0/OK2-YG(IZ1,IXG1)MAIN5620
               1)**2                                                            MAIN5630
0391            IF (ARG.LE.0.D0) DX12=0.D0                                      MAIN5640
0392            IF (ARG.GT.0.D0) DX12=DSQRT(ARG)/(DU(IZ1)*PI)                   MAIN5650
0393            XG(IZ1,IXG1)=XG(IZ1,IXG1-IRI1)+DFLOAT(IRI1)*DX12                MAIN5660
0394            YG(IZ1,IXG1)=2.D0*YG(IZ1,IXG1)/(VUMX(IUVG)+VUMX(IUVG+1))       MAIN5670
0395            IUVG=IUVG+3                                                     MAIN5680
0396            DX21=DATAN(DX12*DU(IZ1)*PI/(A12+1.D0/OK2-YG(IZ1,IXG1)))/(DU(IZ2)*PMAIN5690
               1I*OK2)                                                          MAIN5700
0397            DX23=XG(IZ2,IXG2+1)-XG(IZ2,IXG2-1)-DX21                         MAIN5710
0398            XG(IZ2,IXG2)=XG(IZ2,IXG2-IRI2)+DFLOAT(IRI2)*DX23                MAIN5720
0399            YG(IZ2,IXG2)=(A12+1.D0/OK2-YG(IZ1,IXG1))/DCOS(DX21*DU(IZ2)*PI*OK2)MAIN5730
               1-1.D0/OK2                                                       MAIN5740
0400            DX13=XG(IZ1,IXG1+1)-XG(IZ1,IXG1-1)-DX12                         MAIN5750
0401            DX31=DATAN(DX13*DU(IZ1)*PI/(A31+1.D0/OK3-YG(IZ1,IXG1)))/(DU(IZ3)*PMAIN5760
               1I*OK3)                                                          MAIN5770
0402            XG(IZ3,IXG3)=XG(IZ3,IXG3-IRI3)+DFLOAT(IRI3)*DX31                MAIN5780
0403            YG(IZ3,IXG3)=(A31+1.D0/OK3-YG(IZ1,IXG1))/DCOS(DX31*DU(IZ3)*PI*OK3)MAIN5790
               1-1.D0/OK3                                                       MAIN5800
0404        675 IZR(IGG)=IZ1                                                    MAIN5810
0405            IZR(IGG+1)=IZ2                                                  MAIN5820
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0406              IZR(IGG+2)=IZ3                                                    MAIN5830
0407              IXGR(IGG)=IXG1                                                    MAIN5840
0408              IXGR(IGG+1)=IXG2                                                  MAIN5850
0409              IXGR(IGG+2)=IXG3                                                  MAIN5860
0410              IGG=IGG+3                                                         MAIN5870
0411              IF (NWRITE.EQ.1) WRITE (6,9350) IXG,IXGACT,XG(IZ,IXG),YG(IZ,IXG),XMAIN5880
                 1G(IZ1,IXG1),YG(IZ1,IXG1),XG(IZ2,IXG2),YG(IZ2,IXG2),XG(IZ3,IXG3),YGMAIN5890
                 2(IZ3,IXG3)                                                       MAIN5900
0412              IF (NWRITE.EQ.1) WRITE (6,9078)                                   MAIN5910
0413              GO TO 800                                                         MAIN5920
                C                                                                   MAIN5930
0414          680 IZ2=LCH2(IZ,IXG)                                                  MAIN5940
0415              A12=BCH1(IZ,IXG)                                                  MAIN5950
0416              A23=BCH2(IZ,IXG)                                                  MAIN5960
0417              IF (IXGACT.EQ.7) GO TO 685                                        MAIN5970
0418              IZ3=IZ2                                                           MAIN5980
0419              IZ4=IZ                                                            MAIN5990
0420              IXG2=LCH3(IZ,IXG)                                                 MAIN6000
0421              IXG3=IXG2                                                         MAIN6010
0422              IXG4=IXG                                                          MAIN6020
0423              IRI1=LCH4(IZ,IXG)                                                 MAIN6030
0424              IRI2=LCH5(IZ,IXG)                                                 MAIN6040
0425              IRI3=-IRI2                                                        MAIN6050
0426              IRI4=-IRI1                                                        MAIN6060
0427              A34=A12                                                           MAIN6070
0428              A41=BCH3(IZ,IXG)                                                  MAIN6080
0429              GO TO 688                                                         MAIN6090
0430          685 IZ3=LCH3(IZ,IXG)                                                  MAIN6100
0431              IZ4=LCH4(IZ,IXG)                                                  MAIN6110
0432              IXG2=LCH5(IZ,IXG)                                                 MAIN6120
0433              IXG3=LCH6(IZ,IXG)                                                 MAIN6130
0434              IXG4=LCH7(IZ,IXG)                                                 MAIN6140
0435              IRI1=LCH8(IZ,IXG)                                                 MAIN6150
0436              IRI2=LCH9(IZ,IXG)                                                 MAIN6160
0437              IRI3=LCH10(IZ,IXG)                                                MAIN6170
0438              IRI4=LCH11(IZ,IXG)                                                MAIN6180
0439              A34=BCH3(IZ,IXG)                                                  MAIN6190
0440              A41=BCH4(IZ,IXG)                                                  MAIN6200
0441          688 R1=1.D0/DK(IZ)                                                    MAIN6210
0442              R2=1.D0/DK(IZ2)                                                   MAIN6220
0443              R3=1.D0/DK(IZ3)                                                   MAIN6230
0444              R4=1.D0/DK(IZ4)                                                   MAIN6240
0445              IF (IZYKL.GT.1.AND.IXGACT.EQ.7) GO TO 690                         MAIN6250
0446              IF(IZYKL.GT.1.AND.IXGACT.EQ.5) GO TO 710                          MAIN6260
0447              C11=(2.D0+A12/R2)/(1.D0+(A12+R1)/R2)                              MAIN6270
0448              C21=(2.D0+A41/R4)/(1.D0+(A41+R1)/R4)                              MAIN6280
0449              C12=(1.D0-R1/R2)/(1.D0+(A12+R1)/R2)                               MAIN6290
0450              C22=(1.D0-R1/R4)/(1.D0+(A41+R1)/R4)                               MAIN6300
0451              CSIN1=DSIN(PI*DU(IZ)/DABS(R1)*(XG(IZ,IXG+1)-XG(IZ,IXG-1))/2.D0)   MAIN6310
0452              CSIN2=DSIN(PI*DU(IZ)/DABS(R1)*(XG(IZ,IXG+1)-XG(IZ,IXG-1)))       MAIN6320
0453              C31=R1+A12*C11/2.D0                                               MAIN6330
0454              C32=R1+A41*C21/2.D0                                               MAIN6340
0455              C4=(A12*C11-A41*C21)/2.D0                                         MAIN6350
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0456              C5=(C12-C22)**2+4.D0*C12*C22*CSIN1**2-CSIN2**2                                    MAIN6360
0457              C61=((C12-C22)*C4+2.D0*CSIN1*(C12*C32+C22*C31)+R1*CSIN2**2)/C5                    MAIN6370
0458              C62=((R1*CSIN2)**2-C4*C4-4.D0*CSIN1**2*C31*C32)/C5                                MAIN6380
0459              YG(IZ,IXG)=C61+DSQRT(C61*C61+C62)                                                 MAIN6390
0460              YG(IZ2,IXG2)=YG(IZ,IXG)                                                           MAIN6400
0461              YG(IZ3,IXG3)=YG(IZ,IXG)                                                           MAIN6410
0462              YG(IZ4,IXG4)=YG(IZ,IXG)                                                           MAIN6420
0463              Y12=R1+A12*C11/2.D0-C12*YG(IZ,IXG)                                                MAIN6430
0464              Y23=R2+A23*(2.D0+A23/R3)/(2.D0*(1.D0+(A23+R2)/R3))-YG(IZ,IXG)*(1.DMAIN6440
                 10-R2/R3)/(1.D0+(A23+R2)/R3)                                                       MAIN6450
0465              Y34=R3+A34*(2.D0+A34/R4)/(2.D0*(1.D0+(A34+R3)/R4))-YG(IZ,IXG)*(1.DMAIN6460
                 10-R3/R4)/(1.D0+(A34+R3)/R4)                                                       MAIN6470
0466              Y41=R4+A41*(2.D0+A41/R1)/(2.D0*(1.D0+(A41+R4)/R1))-YG(IZ,IXG)*(1.DMAIN6480
                 10-R4/R1)/(1.D0+(A41+R4)/R1)                                                       MAIN6490
0467              DX12=DARCOS(Y12/(R1+YG(IZ,IXG)))/(DU(IZ)*PI/DABS(R1))                             MAIN6500
0468              DX23=DARCOS(Y23/(R2+YG(IZ,IXG)))/(DU(IZ2)*PI/DABS(R2))                            MAIN6510
0469              DX34=DARCOS(Y34/(R3+YG(IZ,IXG)))/(DU(IZ3)*PI/DABS(R3))                            MAIN6520
0470              DX41=DARCOS(Y41/(R4+YG(IZ,IXG)))/(DU(IZ4)*PI/DABS(R4))                            MAIN6530
0471              XG(IZ,IXG)=XG(IZ,IXG-IRI1)+DFLOAT(IRI1)*DX12                                      MAIN6540
0472              XG(IZ2,IXG2)=XG(IZ2,IXG2-IRI2)+DFLOAT(IRI2)*DX23                                  MAIN6550
0473              XG(IZ3,IXG3)=XG(IZ3,IXG3-IRI3)+DFLOAT(IRI3)*DX34                                  MAIN6560
0474              XG(IZ4,IXG4)=XG(IZ4,IXG4-IRI4)+DFLOAT(IRI4)*DX41                                  MAIN6570
0475              IF (IXGACT.EQ.7) GO TO 700                                                        MAIN6580
0476              IF(IXGACT.EQ.5) GO TO 525                                                         MAIN6590
0477           690 Y12=((R1+YG(IZ,IXG))**2-(R2+2.D0*YG(IZ2,IXG2)/(VUMX(IUVG+3)+VUMX(IMAIN6600
                1UVG+4)))**2+(A12+R1+R2)**2)/(2.D0*(A12+R1+R2))                                    MAIN6610
0478              DX12=DARCOS(Y12/(R1+YG(IZ,IXG)))/(DU(IZ)*PI/DABS(R11)                             MAIN6620
0479              XG(IZ,IXG)=XG(IZ,IXG-IRI1)+DFLOAT(IRI1)*DX12                                      MAIN6630
0480              Y12=Y12*(3.D0*YG(IZ,IXG)/(VUMX(IUVG)+VUMX(IUVG+1)+VUMX(IUVG+2))+R1MAIN6640
                 1)/(R1+YG(IZ,IXG))                                                                 MAIN6650
0481              YG(IZ,IXG)=3.D0*YG(IZ,IXG)/(VUMX(IUVG)+VUMX(IUVG+1)+VUMX(IUVG+2))                MAIN6660
0482              IUVG=IUVG+6                                                                       MAIN6670
0483              DX21=DATAN(DSQRT((R1+YG(IZ,IXG))**2-Y12*Y12)/(A12+R1+R2-Y12))/(DU(MAIN6680
                 1IZ2)*PI/DABS(R2))                                                                 MAIN6690
0484              DX23=XG(IZ2,IXG2+1)-XG(IZ2,IXG2-1)-DX21                                           MAIN6700
0485              XG(IZ2,IXG2)=XG(IZ2,IXG2-IRI2)+DFLOAT(IRI2)*DX23                                  MAIN6710
0486              YG(IZ2,IXG2)=(A12+R1+R2-Y12)/DCOS(DX21*DU(IZ2)*PI/DABS(R2))-R2                    MAIN6720
0487              DX14=XG(IZ,IXG+1)-XG(IZ,IXG-1)-DX12                                               MAIN6730
0488              Y14=(R1+YG(IZ,IXG))*DCOS(DX14*DU(IZ)*PI/DABS(R1))                                 MAIN6740
0489              DX41=DATAN((R1+YG(IZ,IXG))*DSIN(DX14*DU(IZ)*PI/DABS(R1))/(A41+R1+RMAIN6750
                 14-Y14))/(DU(IZ4)*PI/DABS(R4))                                                     MAIN6760
0490              XG(IZ4,IXG4)=XG(IZ4,IXG4-IRI4)+DFLOAT(IRI4)*DX41                                  MAIN6770
0491              YG(IZ4,IXG4)=(A41+R1+R4-Y14)/DCOS(DX41*DU(IZ4)*PI/DABS(R4))-R4                    MAIN6780
0492              DX43=XG(IZ4,IXG4+1)-XG(IZ4,IXG4-1)-DX41                                           MAIN6790
0493              Y43=(R4+YG(IZ4,IXG4))*DCOS(DX43*DU(IZ4)*PI/DABS(R4))                              MAIN6800
0494              DX34=DATAN((R4+YG(IZ4,IXG4))*DSIN(DX43*DU(IZ4)*PI/DABS(R4))/(A34+RMAIN6810
                 13+R4-Y43))/(DU(IZ3)*PI/DABS(R3))                                                  MAIN6820
0495              XG(IZ3,IXG3)=XG(IZ3,IXG3-IRI3)+DFLOAT(IRI3)*DX34                                  MAIN6830
0496              YG(IZ3,IXG3)=(A34+R3+R4-Y43)/DCOS(DX34*DU(IZ3)*PI/DABS(R3))-R3                    MAIN6840
0497           700 IZR(IGG)=IZ                                                                      MAIN6850
0498              IZR(IGG+1)=IZ2                                                                    MAIN6860
0499              IZR(IGG+2)=IZ3                                                                    MAIN6870
0500              IZR(IGG+3)=IZ4                                                                    MAIN6880
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0501                IXGR(IGG)=IXG                                                    MAIN6890
0502                IXGR(IGG+1)=IXG2                                                 MAIN6900
0503                IXGR(IGG+2)=IXG3                                                 MAIN6910
0504                IXGR(IGG+3)=IXG4                                                 MAIN6920
0505                IGG=IGG+4                                                        MAIN6930
0506                IF (NWRITE.EQ.1) WRITE (6,9350) IXG,IXGACT,XG(IZ,IXG),YG(IZ,IXG),XMAIN6940
                   1G(IZ2,IXG2),YG(IZ2,IXG2),XG(IZ3,IXG3),YG(IZ3,IXG3),XG(IZ4,IXG4),YGMAIN6950
                   2(IZ4,IXG4)                                                      MAIN6960
0507                IF (NWRITE.EQ.1) WRITE (6,9078)                                  MAIN6970
0508                GO TO 800                                                        MAIN6980
                C                                                                    MAIN6990
0509              710 YG(IZ,IXG)=YG(IZ,IXG)/VUMX(IUVG)                               MAIN7000
0510                IUVG=IUVG+1                                                      MAIN7010
0511                C11=DSQRT((A12+R1+R2)**2-(R2+A23/2.D0-R1-A41/2.D0)**2)           MAIN7020
0512                C12=DSQRT((R1+YG(IZ,IXG))**2-(R1+A41/2.D0)**2)                   MAIN7030
0513                YG(IZ2,IXG2)=DSQRT((C11-C12)**2+(R2+A23/2.D0)**2)-R2             MAIN7040
0514                DX14=DARCOS((R1+A41/2.D0)/(R1+YG(IZ,IXG)))/(DU(IZ)*PI/DABS(R1))  MAIN7050
0515                XG(IZ,IXG)=XG(IZ,IXG+IRI1)-DFLOAT(IRI1)*DX14                     MAIN7060
0516                DX23=DARCOS((R2+A23/2.D0)/(R2+YG(IZ2,IXG2)))/(DU(IZ2)*PI/DABS(R2))MAIN7070
0517                XG(IZ2,IXG2)=XG(IZ2,IXG2-IRI2)+DFLOAT(IRI2)*DX23                 MAIN7080
0518                GO TO 525                                                        MAIN7090
                C                                                                    MAIN7100
0519              800 CONTINUE                                                       MAIN7110
0520                NGG=IGG-1                                                        MAIN7120
0521                IF (NGG.GT.NSXDIM) WRITE (6,9740) NGG                            MAIN7130
0522                IF (NGG.GT.400) WRITE (6,9745) NGG                               MAIN7140
0523                IF (NGG.GT.NSXDIM.OR.NGG.GT.400) GO TO 9999                      MAIN7150
                C                                                                    MAIN7160
                C     2.1.2.- THE RADIAL EXTENT YM OF THE ZONES                      MAIN7170
                C     ************************************************************MAIN7180
                C                                                                    MAIN7190
0524                WRITE (6,9078)                                                   MAIN7200
0525                IF (NWRITE.EQ.1) WRITE (6,9370)                                  MAIN7210
0526                DO 1200 IZ=1,NZ                                                  MAIN7220
0527                IF (NWRITE.EQ.1) WRITE (6,9210) IZ                               MAIN7230
0528                NCR=NC(IZ)                                                       MAIN7240
0529                IUZ=0                                                            MAIN7250
0530                IUV=1                                                            MAIN7260
0531                DO 1200 IC=1,NCR                                                 MAIN7270
0532                IF(IC.EQ.1) GO TO 1005                                           MAIN7280
0533                IF ((XG(IZ,IUZ+1)-X(IZ,IC)+1.D-5).GT.0.D0) GO TO 1010            MAIN7290
0534             1003 IF (NWRITE.EQ.0) GO TO 1004                                    MAIN7300
0535                IF (IC.EQ.NCR.AND.IUZ.EQ.NUZ(IZ)) ICE=IC                         MAIN7310
0536                IF (IC.LT.NCR.OR.IUZ.LT.NUZ(IZ)) ICE=IC-1                        MAIN7320
0537                WRITE (6,9380) IUZ,IUZACT                                        MAIN7330
0538                WRITE (6,9330)                                                   MAIN7340
0539                WRITE (6,9290) (X(IZ,L),L=ICA,ICE)                               MAIN7350
0540                WRITE (6,9230)                                                   MAIN7360
0541                WRITE (6,9290) (YM(IZ,L),L=ICA,ICE)                              MAIN7370
0542                WRITE (6,9078)                                                   MAIN7380
0543                IF(IUZACT.LT.3) GO TO 1004                                       MAIN7390
0544                NDR=ND(IORDN)                                                    MAIN7400
0545                WRITE (6,9390) IZI,IUZI,IORDN,NDR                                MAIN7410
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0546                WRITE (6,9400)                                                  MAIN7420
0547                WRITE (6,9290) (XD(IORDN,L),L=1,NDR)                            MAIN7430
0548                WRITE (6,9410)                                                  MAIN7440
0549                WRITE (6,9290) (YMD(IORDN,L),L=1,NDR)                           MAIN7450
0550                WRITE (6,9078)                                                  MAIN7460
0551          1004  IF (IC.EQ.NCR.AND.IUZ.EQ.NUZ(IZ)) GO TO 1200                   MAIN7470
0552          1005  IUZ=IUZ+1                                                       MAIN7480
0553                IF (IUZ.GT.NUZ(IZ)) WRITE (6,9750) IUZ                          MAIN7490
0554                IF (IUZ.GT.NUZ(IZ)) GO TO 9999                                  MAIN7500
0555                IUZACT=MCH1(IZ,IUZ)                                             MAIN7510
0556                IORDN=MCH2(IZ,IUZ)                                              MAIN7520
0557                IZI=MCH3(IZ,IUZ)                                                MAIN7530
0558                IUZI=MCH4(IZ,IUZ)                                               MAIN7540
0559                IMIN=MCH5(IZ,IUZ)                                               MAIN7550
0560                IMINI=MCH6(IZ,IUZ)                                              MAIN7560
0561                PITCH(IZ,IUZ)=ACH1(IZ,IUZ)                                      MAIN7570
0562                OKR(IZ,IUZ)=ACH2(IZ,IUZ)                                        MAIN7580
0563                OKR(IZI,IUZI)=ACH3(IZ,IUZ)                                      MAIN7590
0564                IF(IUZACT.EQ.3) ND(IORDN)=0                                     MAIN7600
0565                IF(IUZACT.EQ.3) IZRR(IORDN)=IZI                                 MAIN7610
0566                IF (IUZ.EQ.NUZ(IZ)) GO TO 1006                                  MAIN7620
0567                IF ((X(IZ,IC)+1.D-3).GE.XG(IZ,IUZ+1)) GO TO 1005                MAIN7630
0568                IF ((X(IZ,IC)+1.D-3).GE.XG(IZ,IUZ+2)) GO TO 1005                MAIN7640
0569          1006  ICA=IC                                                          MAIN7650
0570                ID=0                                                            MAIN7660
0571          1010  GO TO (1030,1040,1080),IUZACT                                   MAIN7670
                    C                                                             MAIN7680
0572          1030  YM(IZ,IC)=((1.D0+PITCH(IZ,IUZ)*OKR(IZ,IUZ)/2.D0)/DCOS(PI*DU(IZ)*(XMAIN7690
                   1(IZ,IC)-XG(IZ,IUZ+IMIN))*DABS(OKR(IZ,IUZ)))-1.D0)/OKR(IZ,IUZ)   MAIN7700
0573                GO TO 1195                                                      MAIN7710
                    C                                                             MAIN7720
0574          1040  NDR=ND(IORDN)                                                   MAIN7730
0575                IF (NDR.LE.0) GO TO 1005                                        MAIN7740
0576                IF (NDR.GT.NDDIM) WRITE (6,9760) NDR,IUZACT                     MAIN7750
0577                IF (NDR.GT.NDDIM) GO TO 9999                                    MAIN7760
0578                DO 1050 I=1,NDR                                                 MAIN7770
0579                IR=I                                                            MAIN7780
0580                IF ((X(IZ,IC)+1.D-6).LT.XD(IORDN,I)) GO TO 1060                 MAIN7790
0581          1050  CONTINUE                                                        MAIN7800
0582          1060  IF (DABS(XD(IORDN,IR)-XD(IORDN,IR-1)).LT.1.D-6) IR=IR-1         MAIN7810
0583                IF (DABS(OKR(IZ,IUZ)).GT.0.D0) GO TO 1070                       MAIN7820
0584                YM(IZ,IC)=YMD(IORDN,IR-1)+(YMD(IORDN,IR)-YMD(IORDN,IR-1))*(X(IZ,ICMAIN7830
                   1)-XD(IORDN,IR-1))/(XD(IORDN,IR)-XD(IORDN,IR-1))                 MAIN7840
0585                GO TO 1195                                                      MAIN7850
0586          1070  WIN=YMD(IORDN,IR)+1.D0/OKR(IZ,IUZ)-(YMD(IORDN,IR-1)+1.D0/OKR(IZ,IUMAIN7860
                   1Z))*DCOS(PI*DABS(OKR(IZ,IUZ))*DU(IZ)*(XD(IORDN,IR)-XD(IORDN,IR-1))MAIN7870
                   2)                                                             MAIN7880
0587                IF (DABS(WIN).LT.1.D-6) WI=PI/2.D0                              MAIN7890
0588                IF(DABS(WIN).GE.1.D-6) WI=DATAN((YMD(IORDN,IR-1)+1.D0/OKR(IZ,IUZ))MAIN7900
                   1*DSIN(PI*DABS(OKR(IZ,IUZ))*DU(IZ)*(XD(IORDN,IR)-XD(IORDN,IR-1)))/WMAIN7910
                   2IN)                                                           MAIN7920
0589                YM(IZ,IC)=(YMD(IORDN,IR)+1.D0/OKR(IZ,IUZ))*DSIN(WI)/DSIN(PI*(1.D0-MAIN7930
                   1DU(IZ)*DABS(OKR(IZ,IUZ))*(XD(IORDN,IR)-X(IZ,IC)))-WI)-1.D0/OKR(IZ,MAIN7940
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     21UZ)                                                                  MAIN7950
0590      GO TO 1195                                                        MAIN7960
C                                                                           MAIN7970
0591    1080 IF(IZYKL.GT.1) GO TO 1100                                      MAIN7980
0592      IF(DABS(OKR(IZ,IUZ)).GT.0.D0) GO TO 1090                          MAIN7990
0593      YM(IZ,IC)=PITCH(IZ,IUZ)/2.D0+(PI*DU(IZ)*(X(IZ,IC)-XG(IZ,IUZ+IMIN))MAIN8000
     1)**2/(2.D0*(2.D0/OKR(IZI,IUZI)+PITCH(IZ,IUZ)))                        MAIN8010
0594      GO TO 1110                                                        MAIN8020
0595    1090 YM(IZ,IC)=(PITCH(IZ,IUZ)*OKR(IZ,IUZ)*(1.D0+PITCH(IZ,IUZ)*OKR(IZI,IMAIN8030
     1UZI)/2.D0)+(OKR(IZI,IUZI)/OKR(IZ,IUZ)+1.D0+PITCH(IZ,IUZ)*OKR(IZI,IMAIN8040
     2UZI))*(1.D0-DCOS(PI*DU(IZ)*DABS(OKR(IZ,IUZ))*(X(IZ,IC)-XG(IZ,IUZ+IMAIN8050
     3MIN))))/(OKR(IZ,IUZ)-OKR(IZI,IUZI)+(OKR(IZ,IUZ)+OKR(IZI,IUZI)+PITMAIN8060
     4CH(IZ,IUZ)*OKR(IZ,IUZ)*OKR(IZI,IUZI))*DCOS(PI*DU(IZ)*DABS(OKR(IZ,IMAIN8070
     5UZ))*(X(IZ,IC)-XG(IZ,IUZ+IMIN))))                                    MAIN8080
0596      GO TO 1110                                                        MAIN8090
0597    1100 IF (YM(IZ,IC).LT.1.D-8) GO TO 1110                             MAIN8100
0598      YM(IZ,IC)=YM(IZ,IC)/VUMAX(IZ,IUV)                                 MAIN8110
0599      IUV=IUV+1                                                         MAIN8120
0600      IF (IUV.GT.NUV(IZ)) VUMAX(IZ,IUV)=VUMAX(IZ,IUV-1)                 MAIN8130
0601    1110 IF(ID.GT.0) GO TO 1120                                         MAIN8140
0602      ID=ID+1                                                           MAIN8150
0603      IR=IABS(IMIN-IMINI)                                               MAIN8160
0604      YMD(IORDN,ID)=YG(IZI,IUZI+IR)                                     MAIN8170
0605      XD(IORDN,ID)=XG(IZI,IUZI+IR)                                      MAIN8180
0606      IF (IC.GT.1) GO TO 1120                                           MAIN8190
0607      ID=ID+1                                                           MAIN8200
0608      YMD(IORDN,ID)=YMD(IORDN,IC-1)                                     MAIN8210
0609      XD(IORDN,ID)=XD(IORDN,ID-1)                                       MAIN8220
0610      GO TO 1150                                                        MAIN8230
0611    1120 ID=ID+1                                                        MAIN8240
0612      IF(IMINI.EQ.1) IVZ=-1                                             MAIN8250
0613      IF(IMINI.EQ.0) IVZ=1                                              MAIN8260
0614      IF(DABS(OKR(IZ,IUZ)).GT.0.D0) GO TO 1130                          MAIN8270
0615      YMD(IORDN,ID)=DSQRT((PI*DU(IZ)*(X(IZ,IC)-XG(IZ,IUZ+IMIN)))**2+(1.DMAIN8280
     1C/OKR(IZI,IUZI)+PITCH(IZ,IUZ)-YM(IZ,IC))**2)-1.D0/OKR(IZI,IUZI)      MAIN8290
0616      ARG=(1.D0/OKR(IZI,IUZI)+PITCH(IZ,IUZ)-YM(IZ,IC))/(1.D0/OKR(IZI,IUZMAIN8300
     1I)+YMD(IORDN,ID))                                                     MAIN8310
0617      IF (ARG.GE.1.D0) XD(IORDN,ID)=XG(IZI,IUZI+IMINI)                  MAIN8320
0618      IF (ARG.LT.1.D0) XD(IORDN,ID)=XG(IZI,IUZI+IMINI)+IVZ*DARCOS(ARG)/(MAIN8330
     1PI*DU(IZI)*DABS(OKR(IZI,IUZI)))                                       MAIN8340
0619      GO TO 1150                                                        MAIN8350
0620    1130 IF(DABS(OKR(IZI,IUZI)).GT.0.D0) GO TO 1140                     MAIN8360
0621      YMD(IORDN,ID)=1.D0/OKR(IZ,IUZ)+PITCH(IZ,IUZ)-(1.D0/OKR(IZ,IUZ)+YM(MAIN8370
     1IZ,IC))*DCOS(PI*DU(IZ)*DABS(OKR(IZ,IUZ))*(X(IZ,IC)-XG(IZ,IUZ+IMIN)MAIN8380
     2))                                                                    MAIN8390
0622      XD(IORDN,ID)=XG(IZI,IUZI+IMINI)+IVZ*(1.D0/OKR(IZ,IUZ)+YM(IZ,IC))*DMAIN8400
     1SIN(PI*DU(IZ)*DABS(X(IZ,IC)-XG(IZ,IUZ+IMIN))*OKR(IZ,IUZ))/(PI*DU(IMAIN8410
     2ZI))                                                                  MAIN8420
0623      GO TO 1150                                                        MAIN8430
0624    1140 YMD(IORDN,ID)=(DSQRT(((1.D0/OKR(IZ,IUZ)+YM(IZ,IC))*DSIN(PI*DU(IZ)*MAIN8440
     1DABS(OKR(IZ,IUZ))*(X(IZ,IC)-XG(IZ,IUZ+IMIN))))**2+(1.D0/OKR(IZ,IUZMAIN8450
     2)+PITCH(IZ,IUZ)+1.D0/OKR(IZI,IUZI)-DCOS(PI*DU(IZ)*DABS(OKR(IZ,IUZ)MAIN8460
     3)*(X(IZ,IC)-XG(IZ,IUZ+IMIN)))*(1.D0/OKR(IZ,IUZ)+YM(IZ,IC)))**2)*DAMAIN8470
```

```
                4BS(OKR(IZI,IUZI))-1.DO)/OKR(IZI,IUZI)                                  MAIN8480
0625             ARG=(1.DO/OKR(IZ,IUZ)+PITCH(IZ,IUZ)+1.DO/OKR(IZI,IUZI)-(1.DO/OKR(IMAIN8490
                1Z,IUZ)+YM(IZ,IC))*DCOS(PI*DU(IZ)*DABS(OKR(IZ,IUZ))*(X(IZ,IC)-XG(IZMAIN8500
                2,IUZ+IMIN))))/(1.DO/OKR(IZI,IUZI)+YMD(IORDN,ID))                       MAIN8510
0626             IF (ARG.GE.1.DO) XD(IORDN,ID)=XG(IZI,IUZI+IMINI)                       MAIN8520
0627             IF (ARG.LE.-1.DO) XD(IORDN,ID)=XG(IZI,IUZI+IMINI)+IVZ/(DU(IZI)*DABMAIN8530
                1S(OKR(IZI,IUZI)))                                                      MAIN8540
0628             IF (DABS(ARG).LT.1.DO) XD(IORDN,ID)=XG(IZI,IUZI+IMINI)+IVZ*DARCOS(MAIN8550
                1ARG)/(PI*DU(IZI)*DABS(OKR(IZI,IUZI)))                                  MAIN8560
0629          1150 IF ((XG(IZ,IUZ+1)-X(IZ,IC)-DX(IZ)+1.D-5).GT.0.DO) GO TO 1195         MAIN8570
0630               ID=ID+1                                                              MAIN8580
0631               YMD(IORDN,ID)=YG(IZI,IUZI+1-IR)                                      MAIN8590
0632               XD(IORDN,ID)=XG(IZI,IUZI+1-IR)                                       MAIN8600
0633               ND(IORDN)=ID                                                         MAIN8610
0634               IF (ID.GT.NDDIM) WRITE (6,9760) ID,IUZACT                            MAIN8620
0635               IF (ID.GT.NDDIM) GO TO 9999                                          MAIN8630
0636               IF(IR.EQ.0) GO TO 1195                                               MAIN8640
0637               DO 1160 I=1,ID                                                       MAIN8650
0638               XDR(I)=XD(IORDN,I)                                                   MAIN8660
0639          1160 YMDR(I)=YMD(IORDN,I)                                                 MAIN8670
0640               DO 1170 I=1,ID                                                       MAIN8680
0641               IDR=ID+1-I                                                           MAIN8690
0642               XD(IORDN,I)=XDR(IDR)                                                 MAIN8700
0643          1170 YMD(IORDN,I)=YMDR(IDR)                                               MAIN8710
0644          1195 G(IZ,IC)=1.DO+YM(IZ,IC)*OKR(IZ,IUZ)                                  MAIN8720
0645               IF(IC.EQ.NCR) GO TO 1003                                             MAIN8730
0646          1200 CONTINUE                                                             MAIN8740
C                                                                                       MAIN8750
C                                                                                       MAIN8760
CCCCC     ********************************************************************      MAIN8770
C                                                                                       MAIN8780
CCCCC     2.2.- SOLUTION OF THE INTEGRO-DIFFERENTIAL EQUATIONS FOR THE                  MAIN8790
C               WALL SHEAR STRESS DISTRIBUTIONS                                       MAIN8800
C                                                                                       MAIN8810
CCCCC     ********************************************************************      MAIN8820
C                                                                                       MAIN8830
C                                                                                       MAIN8840
0647          1510 WRITE (6,9078)                                                       MAIN8850
0648               IF (NWRITE.EQ.1) WRITE (6,9420)                                      MAIN8860
C                                                                                       MAIN8870
CCC       2.2.1.- THE GEOMETRICAL TERM CHI                                            MAIN8880
CCC       ********************************************************************      MAIN8890
C                                                                                       MAIN8900
0649               IF(IZYKL.EQ.1) IDH=1                                                 MAIN8910
0650               IF(IZYKL.GT.1) IDH=0                                                 MAIN8920
0651          1515 DO 1700 IZ=1,NZ                                                      MAIN8930
0652               IF (NWRITE.EQ.1) WRITE (6,9210) IZ                                   MAIN8940
0653               NCR=NC(IZ)                                                           MAIN8950
0654               IUZ=1                                                                MAIN8960
0655               IF (OKR(IZ,IUZ).EQ.0.DO) GO TO 1517                                  MAIN8970
0656               FSIN=DSIN(DX(IZ)*DU(IZ)*DABS(OKR(IZ,IUZ))*PI)/(DX(IZ)*DU(IZ)*PI*DAMAIN8980
                1BS(OKR(IZ,IUZ)))                                                       MAIN8990
0657          1517 IF(IZYKL.EQ.1.AND.IDH.EQ.1) DHTOT=1.DO                               MAIN9000
```

```
0658                DO 1590 IC=1,NCR                                                    MAIN9010
0659                IF(IC.GT.1) GO TO 1520                                              MAIN9020
0660                DHI(IC)=0.D0                                                        MAIN9030
0661                GO TO 1590                                                          MAIN9040
0662          1520  IF (IC.EQ.NCR) GO TO 1570                                           MAIN9050
0663                IF ((XG(IZ,IUZ+1)-X(IZ,IC)+1.D-3).GT.0.D0) GO TO 1570               MAIN9060
0664                DX1=XG(IZ,IUZ+1)-X(IZ,IC-1)                                         MAIN9070
0665                DX2=X(IZ,IC)-XG(IZ,IUZ+1)                                           MAIN9080
0666                IF(DABS(OKR(IZ,IUZ)).GT.1.D-5) GO TO 1530                           MAIN9090
0667                DHI(IC)=DHI(IC-1)+DX1*(YG(IZ,IUZ+1)+YM(IZ,IC-1))/DHTOT              MAIN9100
0668                GO TO 1540                                                          MAIN9110
0669          1530  DHI(IC)=DHI(IC-1)+1.D0/(OKR(IZ,IUZ)*DHTOT)*((1.D0+YM(IZ,IC-1)*OKR(MAIN9120
                   1IZ,IUZ))*(1.D0+YG(IZ,IUZ+1)*OKR(IZ,IUZ))*DSIN(DU(IZ)*PI*DX1*DABS(OMAIN9130
                   2KR(IZ,IUZ)))/(DU(IZ)*PI*DABS(OKR(IZ,IUZ)))-DX1)                    MAIN9140
0670          1540  IF(DABS(OKR(IZ,IUZ+1)).GT.1.D-5) GO TO 1550                        MAIN9150
0671                DHI(IC)=DHI(IC)+DX2*(YG(IZ,IUZ+1)+YM(IZ,IC))/DHTOT                  MAIN9160
0672                GO TO 1560                                                          MAIN9170
0673          1550  DHI(IC)=DHI(IC)+1.D0/(OKR(IZ,IUZ+1)*DHTOT)*((1.D0+YM(IZ,IC)*OKR(IZMAIN9180
                   1,IUZ+1))*(1.D0+YG(IZ,IUZ+1)*OKR(IZ,IUZ+1))*DSIN(DU(IZ)*PI*DABS(OKRMAIN9190
                   2(IZ,IUZ+1))*DX2)/(DU(IZ)*PI*DABS(OKR(IZ,IUZ+1)))-DX2)              MAIN9200
0674          1560  IUZ=IUZ+1                                                           MAIN9210
0675                IF (IUZ.GT.NUZ(IZ)) WRITE (6,9750) IUZ                              MAIN9220
0676                IF (IUZ.GT.NUZ(IZ)) GO TO 9999                                      MAIN9230
0677                IF((X(IZ,IC)+1.D-3).GE.XG(IZ,IUZ+1)) GO TO 1560                     MAIN9240
0678                IF (IUZ.EQ.NUZ(IZ)) GO TO 1566                                      MAIN9250
0679                IF((X(IZ,IC)+1.D-3).GE.XG(IZ,IUZ+2)) GO TO 1560                     MAIN9260
0680          1566  IF(OKR(IZ,IUZ).EQ.0.D0) GO TO 1590                                MAIN9270
0681                FSIN=DSIN(DX(IZ)*DU(IZ)*DABS(OKR(IZ,IUZ))*PI)/(DX(IZ)*DU(IZ)*PI*DAMAIN9280
                   1BS(OKR(IZ,IUZ)))                                                   MAIN9290
0682                GO TO 1590                                                          MAIN9300
0683          1570  IF(DABS(OKR(IZ,IUZ)).GT.1.D-5) GO TO 1580                          MAIN9310
0684                DHI(IC)=DHI(IC-1)+DX(IZ)*(YM(IZ,IC)+YM(IZ,IC-1))/DHTOT              MAIN9320
0685                GO TO 1590                                                          MAIN9330
0686          1580  DHI(IC)=DHI(IC-1)+DX(IZ)/(OKR(IZ,IUZ)*DHTOT)*((1.D0+YM(IZ,IC)*OKR(MAIN9340
                   1IZ,IUZ))*(1.D0+YM(IZ,IC-1)*OKR(IZ,IUZ))*FSIN-1.D0)                 MAIN9350
0687          1590  CONTINUE                                                            MAIN9360
0688                IF (NWRITE.EQ.0) GO TO 1595                                         MAIN9370
0689                WRITE (6,9440)                                                      MAIN9380
0690                WRITE (6,9290) (DHI(L),L=1,NCR)                                     MAIN9390
0691                WRITE (6,9078)                                                      MAIN9400
0692          1595  TAUM(IZ)=DHI(NCR)                                                   MAIN9410
0693                IF(IDH.EQ.1) GO TO 1700                                             MAIN9420
                C                                                                       MAIN9430
                C     2.2.2.- THE COEFFICIENT COEF PERTAINING TO THE                    MAIN9440
                C             WALL SHEAR STRESS GRADIENT                                MAIN9450
                C     ************************************************************    MAIN9460
                C                                                                       MAIN9470
0694                IDT=2                                                               MAIN9480
0695                IF(IZYKL.EQ.1) XDT(IZ,2)=1.01D0                                     MAIN9490
0696                IF(IZYKL.EQ.1) VZUV(IZ,1)=.5D0                                      MAIN9500
0697                IF(IZYKL.EQ.1) RET=RE/15.D0                                         MAIN9510
0698                IF(IZYKL.EQ.1) WUT=1.D0                                             MAIN9520
0699                DO 1635 IC=1,NCR                                                    MAIN9530
```

```
0700                COEF(IC)=0.D0                                                  MAIN9540
0701                FNL=1.D0                                                       MAIN9550
0702                IF (YM(IZ,IC).LT.1.D-5) GO TO 1635                             MAIN9560
0703                IF(IZYKL.GT.1) WUT=DSQRT(DABS(T(IZ,IC)))                       MAIN9570
0704                YPM=WUT*RET*YM(IZ,IC)/(2.D0*DHTUT)                             MAIN9580
0705                GR=1.D0+YM(IZ,IC)*CK(IZ)                                       MAIN9590
0706                IF (RAU(IZ).LT.1.D-8) RLN=0.D0                                 MAIN9600
0707                IF (RAU(IZ).GE.1.D-8) RLN=DLOG(YPM*RAU(IZ)/YM(IZ,IC))          MAIN9610
0708                CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                MAIN9620
0709                YPD=YP1                                                        MAIN9630
0710                IF(YPM.LE.21.D0) GO TO 1612                                    MAIN9640
0711                YPD=21.D0                                                      MAIN9650
0712                UPM=DLOG(YPM*TE/2.D0)+(CE+DUR)*CA                              MAIN9660
0713                FNL=(UPM+DLOG(YPD/YPM*(2.D0-YPD/YPM)/(1.D0+(TE-1.D0)*(1.D0-YPD/YPMMAIN9670
                   1)**2)))/(CA*12.471D0)                                          MAIN9680
0714                IF(FNL.LT.0.D0) FNL=1.D-6                                      MAIN9690
0715          1612  IF(X(IZ,IC).GT.XDT(IZ,IDT)) IDT=IDT+1                        MAIN9700
0716                IF (X(IZ,IC).GT.XDT(IZ,IDT)) GO TO 1612                        MAIN9710
0717                TDIFT=.154D0*(YM(IZ,IC)/(DU(IZ)*PI))**2/(2.D0*CA)              MAIN9720
0718                TDIFV=2.D0*TDIFT*CA*YPM*FNL                                    MAIN9730
0719                TSECT=-.573D0*YM(IZ,IC)/(DU(IZ)*PI)*V2DV(IZ,IDT-1)/CA          MAIN9740
0720                TSECV=TSECT*CA*YPM*FNL                                         MAIN9750
0721                DO 1620 I=1,101                                                MAIN9760
0722                YR=DFLOAT(I-1)*1.D-2                                           MAIN9770
0723                IF (YR.LE.(YPD/YPM)) GO TO 1615                                MAIN9780
0724                FY=DLOG(YR*(2.D0-YR)/(1.D0+(TE-1.D0)*(1.D0-YR)*(1.D0-YR)))     MAIN9790
0725                IF ((UPM+FY).GT.0.D0) GO TO 1613                               MAIN9800
0726                FINTA(I)=0.D0                                                  MAIN9810
0727                GO TO 1620                                                     MAIN9820
0728          1613  IF (G(IZ,IC).LE.1.D-6.AND.YR.GT..995D0) FINTA1=0.D0            MAIN9830
0729                IF (G(IZ,IC).GT.1.D-8.OR.YR.LE..995D0) FINTA1=TDIFT*(1.D0+UPM+FY)/MAIN9840
                   1(1.D0+YR*(G(IZ,IC)-1.D0))                                      MAIN9850
0730                FINTA(I)=FINTA1+TSECT*DCOS(PI*YR)*(UPM+FY)                     MAIN9860
0731                GO TO 1620                                                     MAIN9870
0732          1615  FY1=1.D0-2.313D-2*YPM*YR+1.805D-4*YPM*YPM*YR*YR                MAIN9880
0733                FY2=1.D0-0.347D-1*YPM*YR+0.361D-3*YPM*YPM*YR*YR                MAIN9890
0734                IF (G(IZ,IC).LE.1.D-8.AND.YR.GT..995D0) FINTA1=0.D0            MAIN9900
0735                IF (G(IZ,IC).GT.1.D-8.OR.YR.LE..995D0) FINTA1=TDIFV*YR*FY2/(1.D0+YMAIN9910
                   1R*(G(IZ,IC)-1.D0))                                             MAIN9920
0736                FINTA(I)=FINTA1+TSECV*DCOS(PI*YR)*YR*FY1                       MAIN9930
0737          1620  CONTINUE                                                       MAIN9940
0738                COEF(IC)=FSUM(FINTA,101)                                       MAIN9950
0739          1635  CONTINUE                                                       MAIN9960
0740                IF (NWRITL.EQ.0) GO TO 1640                                    MAIN9970
0741                WRITE (6,9480)                                                 MAIN9980
0742                WRITE (6,9296) (COEF(L),L=1,NCR)                               MAIN9990
0743                WRITE (6,9078)                                                 MAIN  10
                  C                                                              MAIN  20
                  C     2.2.5.- THE FOURIER COEFFICIENTS BT                      MAIN  30
                  C     ***********************************************************MAIN  40
                  C                                                              MAIN  50
0744           1640 NCOFR=NCOF(IZ)                                                 MAIN  60
0745                NPASR=NPASC(IZ)                                                MAIN  70
```

```
0746              LA=0                                                                  MAIN  80
0747              IF(NSIN(IZ).GT.0) GO TO 1675                                          MAIN  90
0748              DO 1670 L1=1,NCR,NPASR                                                MAIN 100
0749              LA=LA+1                                                               MAIN 110
0750              DO 1665 L2=1,NCOFR                                                    MAIN 120
0751              AX=1.D0/(PI*DFLOAT(L2))+PI*DFLOAT(L2)*COEF(L1)                        MAIN 130
0752              IF(L1.EQ.1.OR.L1.EQ.NCR) GO TO 1660                                   MAIN 140
0753              AA(LA,L2)=DSIN(DFLOAT(L2)*PI*X(IZ,L1))*AX/(DHI(L1)-X(IZ,L1)*DHI(NCMAIN 150
                 1R))                                                                   MAIN 160
0754              GO TO 1665                                                            MAIN 170
0755         1660 AA(LA,L2)=DFLOAT(L2)*PI*DCOS(DFLOAT(L2)*PI*X(IZ,L1))*AX/(YM(IZ,L1)MAIN 180
                1*(1.D0+G(IZ,L1))/DHTOT-DHI(NCR))                                     MAIN 190
0756         1665 CONTINUE                                                          MAIN 200
0757         1670 CONTINUE                                                          MAIN 210
0758              GO TO 1690                                                        MAIN 220
0759         1675 NCE=NSIN(IZ)                                                      MAIN 230
0760              NCA=NCE+1                                                         MAIN 240
0761              DO 1685 L1=1,NCR,NPASR                                            MAIN 250
0762              IF (L1.EQ.NCR) GO TO 1685                                         MAIN 260
0763              LA=LA+1                                                           MAIN 270
0764              DO 1680 L2=1,NCE                                                  MAIN 280
0765              FL2=2.D0*PI*DFLOAT(L2)                                            MAIN 290
0766              IF(L1.EQ.1) AA(LA,L2)=0.D0                                        MAIN 300
0767              IF(L1.GT.1) AA(LA,L2)=((1.D0/FL2+FL2*COEF(1))-DCOS(FL2*X(IZ,L1))*(MAIN 310
                 11.D0/FL2+FL2*COEF(L1)))/(DHI(L1)-DHI(NCR)*X(IZ,L1))              MAIN 320
0768         1680 CONTINUE                                                          MAIN 330
0769              DO 1685 L2=NCA,NCOFR                                              MAIN 340
0770              FL2=2.D0*PI*DFLOAT(L2-NCE)                                        MAIN 350
0771              IF(L1.EQ.1) AA(LA,L2)=(1.D0+FL2**2*COEF(1))/(YM(IZ,1)*(1.D0+G(IZ,1MAIN 360
                 1))/DHTOT-DHI(NCR))                                               MAIN 370
0772              IF(L1.GT.1) AA(LA,L2)=DSIN(FL2*X(IZ,L1))*(1.D0/FL2+FL2*COEF(L1))/(MAIN 380
                1DHI(L1)-DHI(NCR)*X(IZ,L1))                                        MAIN 390
0773         1685 CONTINUE                                                          MAIN 400
0774         1690 CALL INMAT(NCOFR)                                                 MAIN 410
0775              DO 1695 L1=1,NCOFR                                                MAIN 420
0776              BT(IZ,L1)=0.D0                                                    MAIN 430
0777              DO 1695 L2=1,NCOFR                                                MAIN 440
0778         1695 BT(IZ,L1)=BT(IZ,L1)+AA(L1,L2)                                     MAIN 450
0779              IF (NWRITE.EQ.0) GO TO 1700                                       MAIN 460
0780              WRITE (6,9470) TAUM(IZ)                                           MAIN 470
0781              WRITE (6,9475) NSIN(IZ)                                           MAIN 480
0782              WRITE (6,9480)                                                    MAIN 490
0783              WRITE (6,9285) (BT(IZ,L),L=1,NCOFR)                               MAIN 500
0784              WRITE (6,9078)                                                    MAIN 510
0785         1700 CONTINUE                                                          MAIN 520
0786              IF(IDH.EQ.0) GO TO 1702                                           MAIN 530
0787              SUM1=0.D0                                                         MAIN 540
0788              SUM2=0.D0                                                         MAIN 550
0789              DO 1701 IZ=1,NZ                                                   MAIN 560
0790              SUM1=SUM1+DU(IZ)*TAUM(IZ)*NNZ(IZ)                                 MAIN 570
0791         1701 SUM2=SUM2+DU(IZ)*NNZ(IZ)                                          MAIN 580
0792              DHTOT=SUM1/SUM2                                                   MAIN 590
0793              IF(NWRITE.EQ.1) WRITE(6,9450) DHTOT                               MAIN 600
```

```
0794                IDH=0                                                                 MAIN 610
0795                GO TO 1515                                                            MAIN 620
                C                                                                         MAIN 630
                C     2.2.4.- THE WALL SHEAR STRESS T AND ITS GRADIENT DT,                MAIN 640
                C             THE DISTANCES VZUV BETWEEN TWO ADJACENT POSITIONS DT=0      MAIN 650
                C     ***************************************************************** MAIN 660
                C                                                                         MAIN 670
0796          1702 DO 1800 IZ=1,NZ                                                        MAIN 680
0797                IF (NWRITE.EQ.1) WRITE (6,9210) IZ                                    MAIN 690
0798                NCR=NC(IZ)                                                            MAIN 700
0799                NCOFR=NCOF(IZ)                                                        MAIN 710
0800                IDT=2                                                                 MAIN 720
0801                XDT(IZ,1)=0.D0                                                        MAIN 730
0802          1706 DO 1770 IC=1,NCR                                                       MAIN 740
0803                T(IZ,IC)=TAUM(IZ)                                                     MAIN 750
0804                DT(IZ,IC)=0.D0                                                        MAIN 760
0805                IF(NSIN(IZ).GT.0) GO TO 1720                                          MAIN 770
0806                DO 1710 IB=1,NCOFR                                                    MAIN 780
0807                FIB=DFLOAT(IB)                                                        MAIN 790
0808                T(IZ,IC)=T(IZ,IC)+BT(IZ,IB)*DCOS(FIB*PI*X(IZ,IC))                     MAIN 800
0809          1710 DT(IZ,IC)=DT(IZ,IC)-FIB*PI*BT(IZ,IB)*DSIN(FIB*PI*X(IZ,IC))             MAIN 810
0810                GO TO 1750                                                            MAIN 820
0811          1720 NCE=NSIN(IZ)                                                           MAIN 830
0812                NCA=NCE+1                                                             MAIN 840
0813                DO 1730 IB=1,NCE                                                      MAIN 850
0814                FIB=2.D0*DFLOAT(IB)*PI                                                MAIN 860
0815                T(IZ,IC)=T(IZ,IC)+BT(IZ,IB)*DSIN(FIB*X(IZ,IC))                        MAIN 870
0816          1730 DT(IZ,IC)=DT(IZ,IC)+FIB*BT(IZ,IB)*DCOS(FIB*X(IZ,IC))                   MAIN 880
0817                DO 1740 IB=NCA,NCOFR                                                  MAIN 890
0818                FIB=2.D0*DFLOAT(IB-NCE)*PI                                            MAIN 900
0819                T(IZ,IC)=T(IZ,IC)+BT(IZ,IB)*DCOS(FIB*X(IZ,IC))                        MAIN 910
0820          1740 DT(IZ,IC)=DT(IZ,IC)-FIB*BT(IZ,IB)*DSIN(FIB*X(IZ,IC))                   MAIN 920
0821          1750 IF (IC.EQ.1) GO TO 1770                                                MAIN 930
0822                IF(IC.EQ.2.AND.DABS(DT(IZ,1)).LE.1.D-06) GO TO 1770                   MAIN 940
0823                IF (IC.EQ.NCR.AND.DABS(DT(IZ,NCR)).LE.1.D-6) GO TO 1760               MAIN 950
0824                VDT=DT(IZ,IC)/DT(IZ,IC-1)                                             MAIN 960
0825                IF (VDT.GE.0.D0.AND.IC.LT.NCR) GO TO 1770                             MAIN 970
0826                IF (VDT.GE.0.D0.AND.IC.EQ.NCR) GO TO 1760                             MAIN 980
0827                XDT(IZ,IDT)=(X(IZ,IC)*DABS(DT(IZ,IC-1))+X(IZ,IC-1)*DABS(DT(IZ,IC))MAIN 990
                   1)/(DABS(DT(IZ,IC))+DABS(DT(IZ,IC-1)))                                 MAIN1000
0828                IDT=IDT+1                                                             MAIN1010
0829                IF(IC.EQ.NCR) GO TO 1760                                              MAIN1020
0830                GO TO 1770                                                            MAIN1030
0831          1760 XDT(IZ,IDT)=1.D0                                                       MAIN1040
0832                NDT(IZ)=IDT                                                           MAIN1050
0833          1770 CONTINUE                                                               MAIN1060
0834                DO 1780 I=2,IDT                                                       MAIN1070
0835          1780 VZUV(IZ,I-1)=XDT(IZ,I)-XDT(IZ,I-1)                                     MAIN1080
0836                IF(DABS(DT(IZ,1)).LE.1.D-06) GO TO 1790                               MAIN1090
0837                VZUV(IZ,1)=VZUV(IZ,1)+VZUV(IZ,IDT-1)                                  MAIN1100
0838                VZUV(IZ,IDT-1)=VZUV(IZ,1)                                             MAIN1110
0839          1790 IF (NWRITE.EQ.0) GO TO 1800                                            MAIN1120
0840                WRITE (6,9240)                                                        MAIN1130
```

```
0841              WRITE (6,9290) (T(IZ,L),L=1,NCR)                                    MAIN1140
0842              WRITE (6,9490)                                                      MAIN1150
0843              WRITE (6,9290) (DT(IZ,L),L=1,NCR)                                   MAIN1160
0844              WRITE (6,9270)                                                      MAIN1170
0845              WRITE (6,9290) (XDT(IZ,L),L=1,IDT)                                  MAIN1180
0846              IDT1=IDT-1                                                          MAIN1190
0847              WRITE (6,9280)                                                      MAIN1200
0848              WRITE (6,9290) (VZDV(IZ,L),L=1,IDT1)                                MAIN1210
0849              WRITE (6,9078)                                                      MAIN1220
0850           1800 CONTINUE                                                          MAIN1230
0851              DO 1805 IZ=1,NZ                                                     MAIN1240
0852              IF (NDT(IZ).GT.NDTDIM) WRITE (6,9780) NDT(IZ)                       MAIN1250
0853              IF (NDT(IZ).GT.NDTDIM) GO TO 9999                                   MAIN1260
0854           1805 CONTINUE                                                          MAIN1270
                C                                                                    MAIN1280
                C     2.2.5.- THE FRICTION FACTOR F                                  MAIN1290
                C     ****************************************************************MAIN1300
                C                                                                    MAIN1310
0855              IF (NWRITE.EQ.1) WRITE (6,9520)                                     MAIN1320
0856              SUM1=0.D0                                                           MAIN1330
0857              SUM2=0.D0                                                           MAIN1340
0858              IF(IZYKL.EQ.1) RF=15.D0                                             MAIN1350
0859              IF (IZYKL.GT.1) RF=RE/RET                                           MAIN1360
0860              DO 1850 IZ=1,NZ                                                     MAIN1370
0861              IF (NWRITE.EQ.1) WRITE (6,9210) IZ                                  MAIN1380
0862              NCR=NC(IZ)                                                          MAIN1390
0863              DO 1835 IC=1,NCR                                                    MAIN1400
0864              FINTB(IC)=0.D0                                                      MAIN1410
0865              ETA(IZ,IC)=0.D0                                                     MAIN1420
0866              FNL=1.D0                                                            MAIN1430
0867              IF (YM(IZ,IC).LT.1.D-5) GO TO 1835                                  MAIN1440
0868              YPM=DSQRT(DABS(T(IZ,IC)))*RET*YM(IZ,IC)/(2.D0*DHTOT)                MAIN1450
0869              GR=1.D0+YM(IZ,IC)*OK(IZ)                                            MAIN1460
0870              IF (RAU(IZ).LT.1.D-6) RLN=0.D0                                      MAIN1470
0871              IF (RAU(IZ).GE.1.D-6) RLN=DLOG(YPM*RAU(IZ)/YM(IZ,IC))               MAIN1480
0872              CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                     MAIN1490
0873              YPD=YPM                                                             MAIN1500
0874              IF(YPM.LE.21.D0) GO TO 1808                                         MAIN1510
0875              YPD=21.D0                                                           MAIN1520
0876              UPM=DLOG(YPM*TE/2.D0)/CA+CE+DUR                                     MAIN1530
0877              FNL=(UPM+DLOG(YPD/YPM*(2.D0-YPD/YPM)/(1.D0+(TE-1.D0)*(1.D0-YPD/YPMMAIN1540
                 1)**2))/CA)/12.47100                                               MAIN1550
0878              IF(FNL.LT.0.D0) FNL=1.D-6                                           MAIN1560
0879           1808 DO 1820 I=1,101                                                   MAIN1570
0880              YR=DFLOAT(I-1)*1.D-2                                                MAIN1580
0881              IF (YR.LE.(YPD/YPM)) GO TO 1810                                     MAIN1590
0882              FY=DLOG(YR*(2.D0-YR)/(1.D0+(TE-1.D0)*(1.D0-YR)*(1.D0-YR)))/CA       MAIN1600
0883              FINTA(I)=2.D0*(1.D0+YR*(G(IZ,IC)-1.D0))*(UPM+FY)/(1.D0+G(IZ,IC))    MAIN1610
0884              IF (FINTA(I).LT.0.D0) FINTA(I)=0.D0                                 MAIN1620
0885              GO TO 1820                                                          MAIN1630
0886           1810 FY=(1.D0-.2313D-1*YPM*YR+1.805D-4*YPM*YPM*YR*YR)*FNL              MAIN1640
0887              FINTA(I)=2.D0*(1.D0+YR*(G(IZ,IC)-1.D0))*YPM*YR*FY/(1.D0+G(IZ,IC))   MAIN1650
0888           1820 CONTINUE                                                          MAIN1660
```

```
0889              RFX=FSUM(FINTA,101)                                                MAIN1670
0890              ETA(IZ,IC)=DSQRT(DABS(T(IZ,IC)))*RFX/RF                            MAIN1680
0891              FINTB(IC)=DSQRT(DABS(T(IZ,IC)))*RFX*YM(IZ,IC)*(1.D0+(G(IZ,IC)-1.D0MAIN1690
                 1)/2.D0)                                                           MAIN1700
0892           1835 CONTINUE                                                         MAIN1710
0893              FUM=FSUM(FINTB,NCR)                                                MAIN1720
0894              IF (NWRITE.EQ.1) WRITE (6,9530) FUM                                MAIN1730
0895              SUM1=SUM1+FUM*DU(IZ)*NNZ(IZ)                                       MAIN1740
0896           1850 SUM2=SUM2+DU(IZ)*NNZ(IZ)                                         MAIN1750
0897              RF=2.D0/DHTOT*SUM1/SUM2                                            MAIN1760
0898              RET=RE/RF                                                          MAIN1770
0899              F=8.D0/(RF*RF)                                                     MAIN1780
0900              IF (NWRITE.EQ.1) WRITE (6,9540) RE,F,RF,RET                        MAIN1790
                C                                                                    MAIN1800
                C                                                                    MAIN1810
                C     ***************************************************************MAIN1820
                C                                                                    MAIN1830
                C     2.3.- CALCULATION AND CONTROL OF THE VELOCITY RATIOS           MAIN1840
                C           ON THE ZERO SHEAR LINE                                   MAIN1850
                C                                                                    MAIN1860
                C     ***************************************************************MAIN1870
                C                                                                    MAIN1880
                C                                                                    MAIN1890
0901              IF(NZ.EQ.1) GO TO 1998                                             MAIN1900
                C                                                                    MAIN1910
                C     2.3.1.- THE VELOCITY RATIOS VUMX AT THE POSITIONS XG           MAIN1920
                C     ***************************************************************MAIN1930
                C                                                                    MAIN1940
0902              WRITE (6,9550)                                                     MAIN1950
0903              DO=RET/(4.D0*DHTOT)                                                MAIN1960
0904              DO 1870 IGG=1,NGG                                                  MAIN1970
0905              IZT=IZR(IGG)                                                       MAIN1980
0906              NCOFR=NCOF(IZT)                                                    MAIN1990
0907              IXGT=IXGR(IGG)                                                     MAIN2000
0908              TR=TAUM(IZT)                                                       MAIN2010
0909              IF(NSIN(IZT).GT.0) GO TO 1862                                      MAIN2020
0910              DO 1860 IB=1,NCOFR                                                 MAIN2030
0911           1860 TR=TR+BT(IZT,IB)*DCOS(DFLOAT(IB)*PI*XG(IZT,IXGT))                MAIN2040
0912              GO TO 1868                                                         MAIN2050
0913           1862 NCE=NSIN(IZT)                                                    MAIN2060
0914              NCA=NCE+1                                                          MAIN2070
0915              DO 1864 IB=1,NCE                                                   MAIN2080
0916              FIB=2.D0*DFLOAT(IB)*PI                                             MAIN2090
0917           1864 TR=TR+BT(IZT,IB)*DSIN(FIB*XG(IZT,IXGT))                          MAIN2100
0918              DO 1866 IB=NCA,NCOFR                                               MAIN2110
0919              FIB=2.D0*DFLOAT(IB-NCE)*PI                                         MAIN2120
0920           1866 TR=TR+BT(IZT,IB)*DCOS(FIB*XG(IZT,IXGT))                          MAIN2130
0921           1868 D1=DSQRT(DABS(TR))                                               MAIN2140
0922              YPM=2.D0*D1*D0*YG(IZT,IXGT)                                        MAIN2150
0923              GR=1.D0+YG(IZT,IXGT)*DK(IZT)                                       MAIN2160
0924              IF (RAU(IZT).LT.1.D-6) RLN=0.D0                                    MAIN2170
0925              IF (RAU(IZT).GE.1.D-6) RLN=DLOG(YPM*RAU(IZT)/YG(IZT,IXGT))        MAIN2180
0926              CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                    MAIN2190
```

```
0927              IF (YPM.LE.21.D0) UMX(IGG)=D1*YPM*(1.D0-.2313D-1*YPM+.1805D-3*YPM*MAIN2200
                 1YPM)                                                          MAIN2210
0928              IF(YPM.GT.21.D0) UMX(IGG)=D1*(DLOG(YPM*TE/2.D0)/CA+CE+DUR)     MAIN2220
0929              IF (UMX(IGG).LE.0.D0) UMX(IGG)=1.D-4                           MAIN2230
0930           1870 CONTINUE                                                     MAIN2240
0931              IGG=1                                                          MAIN2250
0932              IUVG=1                                                         MAIN2260
0933              NENDE=0                                                        MAIN2270
0934              DO 1920 IZ=1,NZ                                                MAIN2280
0935              NXG=NUZ(IZ)+1                                                  MAIN2290
0936              DO 1920 IXG=1,NXG                                              MAIN2300
0937              IF(LCH1(IZ,IXG).LT.3) GO TO 1920                               MAIN2310
0938              IF(LCH1(IZ,IXG).LT.6) IE=1                                     MAIN2320
0939              IF(LCH1(IZ,IXG).EQ.6) IE=3                                     MAIN2330
0940              IF(LCH1(IZ,IXG).EQ.7) IE=6                                     MAIN2340
0941              DO 1915 I=1,IE                                                 MAIN2350
0942              GO TO (1880,1880,1890,1890,1900,1900),I                        MAIN2360
0943           1880 VUMX(IUVG-1+I)=UMX(IGG)/UMX(IGG+I)                           MAIN2370
0944              GO TO 1910                                                     MAIN2380
0945           1890 IF(IE.EQ.3.OR.I.EQ.4) VUMX(IUVG-1+I)=UMX(IGG+1)/UMX(IGG+2)  MAIN2390
0946              IF(IE.EQ.6.AND.I.EQ.3) VUMX(IUVG-1+I)=UMX(IGG)/UMX(IGG+3)      MAIN2400
0947              GO TO 1910                                                     MAIN2410
0948           1900 VUMX(IUVG-1+I)=UMX(IGG-4+I)/UMX(IGG+3)                       MAIN2420
0949           1910 IF(DABS(VUMX(IUVG-1+I)-1.D0).LT.GRENZ) NENDE=NENDE+1         MAIN2430
0950           1915 CONTINUE                                                     MAIN2440
0951              IGG=IGG+2+(IE-1)/2                                             MAIN2450
0952              IUVG=IUVG+IE                                                   MAIN2460
0953           1920 CONTINUE                                                     MAIN2470
0954              NUVG=IUVG-1                                                    MAIN2480
0955              IF (NUVG.GT.NSXDIM) WRITE (6,9790) NUVG                        MAIN2490
0956              IF (NUVG.GT.NSXDIM) GO TO 9999                                 MAIN2500
0957              DO 1922 IUVG=1,NUVG                                            MAIN2510
0958              IF (VUMX(IUVG).LT..8D0) VUMX(IUVG)=.8D0                        MAIN2520
0959              IF (VUMX(IUVG).GT.1.2D0) VUMX(IUVG)=1.2D0                      MAIN2530
0960           1922 CONTINUE                                                     MAIN2540
0961              IF (NWRITE.EQ.0) GO TO 1929                                    MAIN2550
0962              WRITE (6,9560)                                                 MAIN2560
0963              IGG=1                                                          MAIN2570
0964              IUVG=1                                                         MAIN2580
0965              DO 1928 IZ=1,NZ                                                MAIN2590
0966              NXG=NUZ(IZ)+1                                                  MAIN2600
0967              DO 1928 IXG=1,NXG                                              MAIN2610
0968              IXGACT=LCH1(IZ,IXG)                                            MAIN2620
0969              GO TO (1927,1927,1924,1924,1924,1925,1926),IXGACT              MAIN2630
0970           1924 WRITE (6,9570) IZ,IXG,IZR(IGG),IXGR(IGG),IZR(IGG+1),IXGR(IGG+1),UMMAIN2640
                1X(IGG),UMX(IGG+1),VUMX(IUVG)                                   MAIN2650
0971              IGG=IGG+2                                                      MAIN2660
0972              IUVG=IUVG+1                                                    MAIN2670
0973              GO TO 1928                                                     MAIN2680
0974           1925 WRITE (6,9580) IZ,IXG,IZR(IGG),IXGR(IGG),IZR(IGG+1),IXGR(IGG+1),IZMAIN2690
                1R(IGG+2),IXGR(IGG+2),UMX(IGG),UMX(IGG+1),UMX(IGG+2),VUMX(IUVG),VUMMAIN2700
                2X(IUVG+1),VUMX(IUVG+2)                                         MAIN2710
0975              IGG=IGG+3                                                      MAIN2720
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0976                IUVG=IUVG+3                                                    MAIN2730
0977                GO TO 1928                                                     MAIN2740
0978          1926 WRITE (6,9590) IZ,IXG,IZR(IGG),IXGR(IGG),IZR(IGG+1),IXGR(IGG+1),IZMAIN2750
                  1R(IGG+2),IXGR(IGG+2),IZR(IGG+3),IXGR(IGG+3),UMX(IGG),UMX(IGG+1),UMMAIN2760
                  2X(IGG+2),UMX(IGG+3),VUMX(IUVG),VUMX(IUVG+1),VUMX(IUVG+2),VUMX(IUVGMAIN2770
                  3+3),VUMX(IUVG+4),VUMX(IUVG+5)                                 MAIN2780
0979                IGG=IGG+4                                                      MAIN2790
0980                IUVG=IUVG+6                                                    MAIN2800
0981                GO TO 1928                                                     MAIN2810
0982          1927 WRITE (6,9600) IZ,IXG                                          MAIN2820
0983          1928 CONTINUE                                                       MAIN2830
0984          1929 WRITE (6,9610) NENDE,NUVG                                      MAIN2840
0985                NENDE1=NENDE                                                   MAIN2850
                C                                                                 MAIN2860
                C     2.3.2.- THE VELOCITY RATIOS VUMAX AT THE POSITIONS X        MAIN2870
                C     ****************************************************************MAIN2880
                C                                                                 MAIN2890
0986                WRITE (6,9620)                                                 MAIN2900
0987                DO 1993 IZ=1,NZ                                                MAIN2910
0988                NUZR=NUZ(IZ)                                                   MAIN2920
0989                IUV=1                                                          MAIN2930
0990                DO 1990 IUZ=1,NUZR                                             MAIN2940
0991                IUZACT=MCH1(IZ,IUZ)                                            MAIN2950
0992                IF(IUZACT.LT.3.AND.NWRITE.EQ.1) WRITE (6,9630) IZ,IUZ,IUZACT   MAIN2960
0993                IF(IUZACT.LT.3) GO TO 1990                                     MAIN2970
0994                IORDN=MCH2(IZ,IUZ)                                             MAIN2980
0995                IF (ND(IORDN).EQ.0.AND.NWRITE.EQ.1) WRITE (6,9635) IZ,IUZ,IUZACT,NMAIN2990
                  1D(IORDN)                                                       MAIN3000
0996                IF (ND(IORDN).EQ.0) NUM(IORDN)=0                               MAIN3010
0997                IF (ND(IORDN).EQ.0) GO TO 1990                                 MAIN3020
0998                IZI=MCH3(IZ,IUZ)                                               MAIN3030
0999                IUZI=MCH4(IZ,IUZ)                                              MAIN3040
1000                IMIN=MCH5(IZ,IUZ)                                              MAIN3050
1001                IMINI=MCH6(IZ,IUZ)                                             MAIN3060
1002                NCR=NC(IZ)                                                     MAIN3070
1003                NCOFR=NCOF(IZI)                                                MAIN3080
1004                IF (IUZ.EQ.1) IR=1                                             MAIN3090
1005                IF (IUZ.EQ.1) GO TO 1940                                       MAIN3100
1006                DO 1935 IC=1,NCR                                               MAIN3110
1007                IR=IC                                                          MAIN3120
1008                IF ((X(IZ,IC)-1.D-5).GE.XG(IZ,IUZ)) GO TO 1940                 MAIN3130
1009          1935 CONTINUE                                                       MAIN3140
1010          1940 NUM(IORDN)=ND(IORDN)-2                                         MAIN3150
1011                IF(NWRITE.EQ.1) WRITE (6,9640) IZ,IUZ,IUZACT,IZI,IUZI,NUM(IORDN)MAIN3160
1012                NUMR=NUM(IORDN)                                                MAIN3170
1013                NUMS=2*NUMR                                                    MAIN3180
1014                IF (NUMS.GT.400) WRITE (6,9790) NUMS                           MAIN3190
1015                IF (NUMS.GT.400) GO TO 9999                                    MAIN3200
1016                NCA=IR                                                         MAIN3210
1017                NCE=NCA-1+NUMR                                                 MAIN3220
1018                DO 1950 IC=NCA,NCE                                             MAIN3230
1019                IF (YM(IZ,IC).GT.1.D-6) GO TO 1945                             MAIN3240
1020                UMX(IC+1-NCA)=1.D-4                                            MAIN3250
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```
1021            GO TO 1950                                                      MAIN3260
1022       1945 D1=DSQRT(DABS(T(IZ,IC)))                                        MAIN3270
1023            YPM=2.D0*D1*D0*YM(IZ,IC)                                        MAIN3280
1024            GR=1.D0+YM(IZ,IC)*GK(IZ)                                        MAIN3290
1025            IF (RAU(IZ).LT.1.D-6) RLN=0.D0                                  MAIN3300
1026            IF (RAU(IZ).GE.1.D-6) RLN=DLOG(YPM*RAU(IZ)/YM(IZ,IC))           MAIN3310
1027            CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                 MAIN3320
1028            IF (YPM.LE.21.D0) UMX(IC+1-NCA)=D1*YPM*(1.D0-.2313D-1*YPM+.1805D-3MAIN3330
               1*YPM*YPM)                                                       MAIN3340
1029            IF(YPM.GT.21.D0) UMX(IC+1-NCA)=D1*(DLOG(YPM*TE/2.D0)/CA+CE+DUR) MAIN3350
1030            IF (UMX(IC+1-NCA).LE.0.D0) UMX(IC+1-NCA)=1.D-4                  MAIN3360
1031       1950 CONTINUE                                                        MAIN3370
1032            IF (NWRITE.EQ.0) GO TO 1952                                     MAIN3380
1033            WRITE (6,9650)                                                  MAIN3390
1034            WRITE (6,9290) (UMX(L),L=1,NUMR)                                MAIN3400
1035       1952 NDE=1+NUMR                                                      MAIN3410
1036            DO 1970 ID=2,NDE                                                MAIN3420
1037            IF(IABS(IMIN-IMINL).EQ.0) IDR=ID                                MAIN3430
1038            IF (IABS(IMIN-IMINL).GT.0) IDR=ND(IORDN)+1-ID                   MAIN3440
1039            IF (YMD(IORDN,IDR).GT.1.D-6) GO TO 1959                         MAIN3450
1040            UMX(ID-1+NUMR)=1.D-4                                            MAIN3460
1041            GO TO 1970                                                      MAIN3470
1042       1959 TR=TAUM(IZI)                                                    MAIN3480
1043            IF(NSIN(IZI).GT.0) GO TO 1962                                   MAIN3490
1044            DO 1960 IB=1,NCOFR                                              MAIN3500
1045       1960 TR=TR+BT(IZI,IB)*DCOS(DFLOAT(IB)*PI*XD(IORDN,IDR))              MAIN3510
1046            GO TO 1968                                                      MAIN3520
1047       1962 NCE=NSIN(IZI)                                                   MAIN3530
1048            NCA=NCE+1                                                       MAIN3540
1049            DO 1964 IB=1,NCE                                                MAIN3550
1050            FIB=2.D0*DFLOAT(IB)*PI                                          MAIN3560
1051       1964 TR=TR+BT(IZI,IB)*DSIN(FIB*XD(IORDN,IDR))                        MAIN3570
1052            DO 1966 IB=NCA,NCOFR                                            MAIN3580
1053            FIB=2.D0*DFLOAT(IB-NCE)*PI                                      MAIN3590
1054       1966 TR=TR+BT(IZI,IB)*DCOS(FIB*XD(IORDN,IDR))                        MAIN3600
1055       1968 D1=DSQRT(DABS(TR))                                              MAIN3610
1056            YPM=2.D0*D1*D0*YMD(IORDN,IDR)                                   MAIN3620
1057            GR=1.D0+YMD(IORDN,IDR)*GK(IZI)                                  MAIN3630
1058            IF (RAU(IZI).LT.1.D-6) RLN=0.D0                                 MAIN3640
1059            IF (RAU(IZI).GE.1.D-6) RLN=DLOG(YPM*RAU(IZI)/YMD(IORDN,IDR))    MAIN3650
1060            CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                 MAIN3660
1061            IF (YPM.LE.21.D0) UMX(ID-1+NUMR)=D1*YPM*(1.D0-.2313D-1*YPM+.1805D-MAIN3670
               13*YPM*YPM)                                                      MAIN3680
1062            IF(YPM.GT.21.D0) UMX(ID-1+NUMR)=D1*(DLOG(YPM*TE/2.D0)/CA+CE+DUR) MAIN3690
1063            IF (UMX(ID-1+NUMR).LE.0.D0) UMX(ID-1+NUMR)=1.D-4                MAIN3700
1064       1970 CONTINUE                                                        MAIN3710
1065            IF (NWRITE.EQ.0) GO TO 1975                                     MAIN3720
1066            WRITE (6,9660)                                                  MAIN3730
1067            NDSA=1+NUMR                                                     MAIN3740
1068            NDSE=2*NUMR                                                     MAIN3750
1069            WRITE (6,9290) (UMX(L),L=NDSA,NDSE)                             MAIN3760
1070       1975 NENDE2=NENDE                                                    MAIN3770
1071            IUVA=IUV                                                        MAIN3780
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```
1072                DO 1980 IU=1,NUMR                                                  MAIN3790
1073                VUMAX(IZ,IUV)=UMX(IU)/UMX(IU+NUMR)                                 MAIN3800
1074                IF (VUMAX(IZ,IUV).LT..8D0)  VUMAX(IZ,IUV)=.8D0                     MAIN3810
1075                IF (VUMAX(IZ,IUV).GT.1.2D0) VUMAX(IZ,IUV)=1.2D0                    MAIN3820
1076                IF (DABS(VUMAX(IZ,IUV)-1.D0).LT.GRENZ) NENDE=NENDE+1               MAIN3830
1077             1980 IUV=IUV+1                                                        MAIN3840
1078                IUVE=IUV-1                                                         MAIN3850
1079                IF(NWRITE.EQ.0) GO TO 1990                                         MAIN3860
1080                WRITE (6,9670)                                                     MAIN3870
1081                WRITE (6,9290) (VUMAX(IZ,L),L=IUVA,IUVE)                           MAIN3880
1082                WRITE (6,9078)                                                     MAIN3890
1083             1990 CONTINUE                                                         MAIN3900
1084                IF (IUV.EQ.1) IUVE=0                                               MAIN3910
1085                NUV(IZ)=IUVE                                                       MAIN3920
1086                IF (NUV(IZ).GT.NCDIM) WRITE (6,9800) NUV(IZ)                       MAIN3930
1087                IF (NUV(IZ).GT.NCDIM) GO TO 9999                                   MAIN3940
1088             1993 CONTINUE                                                         MAIN3950
                C                                                                     MAIN3960
                C     2.3.3.- DECISION ON THE CONTINUATION OF THE ITERATION           MAIN3970
                C     ****************************************************************MAIN3980
                C                                                                     MAIN3990
1089                NENSO=NUVG                                                        MAIN4000
1090                DO 1995 IO=1,NORDN                                                MAIN4010
1091             1995 NENSO=NENSO+NUM(IO)                                             MAIN4020
1092                NENSO2=NENSO-NUVG                                                 MAIN4030
1093                NENDE2=NENDE-NENDE1                                               MAIN4040
1094                WRITE (6,9610) NENDE2,NENSO2                                      MAIN4050
1095                WRITE (6,9700) NENDE,NENSO                                        MAIN4060
1096                IF (NENDE.EQ.NENSO.AND.NWRITE.EQ.1) GO TO 2010                    MAIN4070
1097             1998 CALL TIME (TI2)                                                 MAIN4080
1098                TZYKL=TI2-TI1                                                     MAIN4090
1099                TI1=TI2                                                           MAIN4100
1100                WRITE (6,9070) TZYKL                                              MAIN4110
1101                IF ((TIT-TI2).LT.TZYKL) GO TO 2010                                MAIN4120
1102                IF (NENDE.EQ.NENSO.AND.NWRITE.EQ.0) GO TO 501                     MAIN4130
1103             2000 CONTINUE                                                        MAIN4140
                C                                                                     MAIN4150
                C                                                                     MAIN4160
                C     ****************************************************************MAIN4170
                C                                                                     MAIN4180
                C     3.-  O U T P U T - D A T A                                      MAIN4190
                C                                                                     MAIN4200
                C     ****************************************************************MAIN4210
                C                                                                     MAIN4220
                C                                                                     MAIN4230
                C     ****************************************************************MAIN4240
                C                                                                     MAIN4250
                C     3.1.- PUNCH OF THE DATA NEEDED FOR AN EVENTUAL CONTINUATION     MAIN4260
                C           OF THE ITERATION CALCULATIONS                             MAIN4270
                C                                                                     MAIN4280
                C     ****************************************************************MAIN4290
                C                                                                     MAIN4300
                C                                                                     MAIN4310
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1104          2010 WRITE (7,9010) IZYKL                                          MAIN4320
1105               WRITE (7,9040) RET,DHTOT                                      MAIN4330
1106               DO 2020 IZ=1,NZ                                               MAIN4340
1107               NCR=NC(IZ)                                                    MAIN4350
1108               NUZR=NUZ(IZ)                                                  MAIN4360
1109               NXG=NUZR+1                                                    MAIN4370
1110               WRITE (7,9040) (YM(IZ,L),L=1,NCR)                             MAIN4380
1111               WRITE (7,9040) (T(IZ,L),L=1,NCR)                              MAIN4390
1112               WRITE (7,9040) (XG(IZ,L),L=1,NXG)                             MAIN4400
1113               WRITE (7,9040) (YG(IZ,L),L=1,NXG)                             MAIN4410
1114               WRITE (7,9010) NDT(IZ)                                        MAIN4420
1115               NDTR=NDT(IZ)                                                  MAIN4430
1116               NDTR1=NDTR-1                                                  MAIN4440
1117               WRITE (7,9040) (XDT(IZ,L),L=1,NDTR)                           MAIN4450
1118               WRITE (7,9040) (VZUV(IZ,L),L=1,NDTR1)                         MAIN4460
1119          2020 CONTINUE                                                      MAIN4470
                C                                                                MAIN4480
1120               IF (NZ.EQ.1) GO TO 2050                                       MAIN4490
                C                                                                MAIN4500
1121               WRITE (7,9010) NUVG                                           MAIN4510
1122               WRITE (7,9040) (VUMX(L),L=1,NUVG)                             MAIN4520
1123               DO 2030 IZ=1,NZ                                               MAIN4530
1124               WRITE (7,9010) NUV(IZ)                                        MAIN4540
1125               NUVR=NUV(IZ)                                                  MAIN4550
1126               IF (NUVR.EQ.0) GO TO 2030                                     MAIN4560
1127               WRITE (7,9040) (VUMAX(IZ,L),L=1,NUVR)                         MAIN4570
1128          2030 CONTINUE                                                      MAIN4580
1129          2050 IF (NFIRE1.EQ.0) GO TO 9998                                   MAIN4590
                C                                                                MAIN4600
                C                                                                MAIN4610
                C     ***********************************************************MAIN4620
                C                                                                MAIN4630
                C     3.2.- PREPARATION AND WRITING OF THE FINAL RESULTS         MAIN4640
                C                                                                MAIN4650
                C     ***********************************************************MAIN4660
                C                                                                MAIN4670
                C                                                                MAIN4680
                C     3.2.1.- GENERAL RESULTS                                    MAIN4690
                C     ***********************************************************MAIN4700
                C                                                                MAIN4710
1130               LA=0                                                          MAIN4720
1131               DO 2380 IUK=1,NUK                                             MAIN4730
1132               NIZ=NCH1(IUK)                                                 MAIN4740
1133               LA1=LA+1                                                      MAIN4750
1134               DO 2360 IZ=1,NIZ                                              MAIN4760
1135               LA=LA+1                                                       MAIN4770
1136               GO TO (2200,2210,2220,2230),IZ                                MAIN4780
1137          2200 IZI=NCH2(IUK)                                                 MAIN4790
1138               IXG1=NCH6(IUK)                                                MAIN4800
1139               IXG2=NCH10(IUK)                                               MAIN4810
1140               GO TO 2240                                                    MAIN4820
1141          2210 IZI=NCH3(IUK)                                                 MAIN4830
1142               IXG1=NCH7(IUK)                                                MAIN4840
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1143                IXG2=NCH11(IUK)                                                 MAIN4850
1144                GO TO 2240                                                      MAIN4860
1145          2220  IZT=NCH4(IUK)                                                   MAIN4870
1146                IXG1=NCH8(IUK)                                                  MAIN4880
1147                IXG2=NCH12(IUK)                                                 MAIN4890
1148                GO TO 2240                                                      MAIN4900
1149          2230  IZT=NCH5(IUK)                                                   MAIN4910
1150                IXG1=NCH9(IUK)                                                  MAIN4920
1151                IXG2=NCH13(IUK)                                                 MAIN4930
1152          2240  NXR=NCH14(IUK)                                                  MAIN4940
1153                DXR=(XG(IZT,IXG2)-XG(IZT,IXG1))/DFLOAT(NXR-1)                   MAIN4950
1154                IF (DXR.LT.0.D0) DXR=DXR+1.D0/DFLOAT(NXR-1)                     MAIN4960
1155                NCR=NC(IZT)                                                     MAIN4970
1156                DO 2330 I=1,NXR                                                 MAIN4980
1157                XR=XG(IZT,IXG1)+DFLOAT(I-1)*DXR                                 MAIN4990
1158                IF (XR.GT.1.D0) XR=XR-1.D0                                      MAIN5000
1159                IRS=0                                                           MAIN5010
1160                DO 2270 IS=1,NCR                                                MAIN5020
1161                IR=IS                                                           MAIN5030
1162                IF ((XR+1.D-5).LT.X(IZT,IS)) GO TO 2280                         MAIN5040
1163                IRS=IRS+1                                                       MAIN5050
1164          2270  CONTINUE                                                        MAIN5060
1165          2280  IF (IRS.LT.NCR) GO TO 2290                                      MAIN5070
1166                YMR=YM(IZT,NCR)                                                 MAIN5080
1167                GR=G(IZT,NCR)                                                   MAIN5090
1168                ETAR=ETA(IZT,NCR)                                               MAIN5100
1169                GO TO 2320                                                      MAIN5110
1170          2290  FG=(XR-X(IZT,IR-1))/(X(IZT,IR)-X(IZT,IR-1))                    MAIN5120
1171                YMR=YM(IZT,IR-1)*(1.D0-FG)+YM(IZT,IR)*FG                        MAIN5130
1172                GR=G(IZT,IR-1)*(1.D0-FG)+G(IZT,IR)*FG                           MAIN5140
1173                ETAR=ETA(IZT,IR-1)*(1.D0-FG)+ETA(IZT,IR)*FG                     MAIN5150
1174          2320  FINTA(I)=YMR*(1.D0+(GR-1.D0)/2.D0)*DU(IZT)                      MAIN5160
1175          2330  FINTB(I)=FINTA(I)*ETAR                                          MAIN5170
1176                FUMA(LA)=FSUM(FINTA,NXR)                                        MAIN5180
1177                FUMB(LA)=FSUM(FINTB,NXR)                                        MAIN5190
1178          2360  CONTINUE                                                        MAIN5200
1179                FUM1=0.D0                                                       MAIN5210
1180                FUM2=0.D0                                                       MAIN5220
1181                DO 2370 I=LA1,LA                                                MAIN5230
1182                FUM1=FUM1+FUMA(I)                                               MAIN5240
1183          2370  FUM2=FUM2+FUMB(I)                                               MAIN5250
1184          2380  UB(IUK)=FUM2/FUM1                                               MAIN5260
1185                FUM1=0.D0                                                       MAIN5270
1186                FUM2=0.D0                                                       MAIN5280
1187                DO 2390 I=1,LA                                                  MAIN5290
1188                FUM1=FUM1+FUMA(I)                                               MAIN5300
1189          2390  FUM2=FUM2+FUMB(I)                                               MAIN5310
1190                UBTOT=FUM2/FUM1                                                 MAIN5320
1191                DO 2395 I=1,NUK                                                 MAIN5330
1192          2395  UB(I)=UB(I)/UBTOT                                               MAIN5340
1193                IPAGE=1                                                         MAIN5350
1194                WRITE (6,9810) NTEST1,NTEST2,NTEST3,NTEST4,IPAGE                MAIN5360
1195                LA=1                                                            MAIN5370
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1196                LE=18                                                                  MAIN5380
1197                DO 2398 IN=1,NTITLE                                                    MAIN5390
1198                WRITE (6,9077) (TITLE(L),L=LA,LE)                                      MAIN5400
1199                LA=LA+18                                                               MAIN5410
1200          2398  LE=LE+18                                                               MAIN5420
1201                WRITE (6,9078)                                                         MAIN5430
1202                WRITE (6,9820) RE,F,DHTOT                                              MAIN5440
1203                WRITE (6,9830)                                                         MAIN5450
1204                IA=1                                                                   MAIN5460
1205                NI=NUK                                                                 MAIN5470
1206          2400  NI=NI-10                                                               MAIN5480
1207                IF (NI.GT.0) GO TO 2410                                                MAIN5490
1208                IE=NUK                                                                 MAIN5500
1209                GO TO 2420                                                             MAIN5510
1210          2410  IE=IA+9                                                                MAIN5520
1211          2420  WRITE (6,9840) (L,L=IA,IE)                                             MAIN5530
1212                WRITE (6,9930)                                                         MAIN5540
1213                WRITE (6,9850) (UB(L),L=IA,IE)                                         MAIN5550
1214                WRITE (6,9078)                                                         MAIN5560
1215                IA=IE+1                                                                MAIN5570
1216                IF (IA.LE.NUK) GO TO 2400                                              MAIN5580
1217                DO 2460 IZ=1,NZ                                                        MAIN5590
1218                IPAGE=IPAGE+1                                                          MAIN5600
1219                WRITE (6,9860) NTEST1,NTEST2,NTEST3,NTEST4,IPAGE                       MAIN5610
1220                WRITE (6,9210) IZ                                                      MAIN5620
1221                WRITE (6,9865)                                                         MAIN5630
1222                WRITE (6,9870) TAUM(IZ),NCOF(IZ),NSIN(IZ)                              MAIN5640
1223                WRITE (6,9480)                                                         MAIN5650
1224                NCOFR=NCOF(IZ)                                                         MAIN5660
1225                WRITE (6,9285) (BT(IZ,L),L=1,NCOFR)                                    MAIN5670
1226                NI=NC(IZ)                                                              MAIN5680
1227                IDT=2                                                                  MAIN5690
1228                DO 2426 IC=1,NI                                                        MAIN5700
1229                RELOC(IC)=0.D0                                                         MAIN5710
1230                AMPSEC(IC)=0.D0                                                        MAIN5720
1231                DUPR(IC)=0.D0                                                          MAIN5730
1232                IF(YM(IZ,IC).LT.1.D-5) GO TO 2426                                      MAIN5740
1233          2423  IF(X(IZ,IC).GT.XDT(IZ,IDT)) IDT=IDT+1                                 MAIN5750
1234                IF(X(IZ,IC).GT.XDT(IZ,IDT)) GO TO 2423                                 MAIN5760
1235                RELOC(IC)=RE*ETA(IZ,IC)*YM(IZ,IC)*(2.D0+YM(IZ,IC)*OK(IZ))/DHTOT       MAIN5770
1236                AMPSEC(IC)=.573D0*VZUV(IZ,IDT-1)*DT(IZ,IC)/(RF*DSQRT(DABS(T(IZ,IC)MAIN5780
                   1)))                                                                   MAIN5790
1237                IF (RAU(IZ).LT.1.D-6) RLN=0.D0                                         MAIN5800
1238                IF (RAU(IZ).GE.1.D-6) RLN=DLOG(DSQRT(DABS(T(IZ,IC)))*RET*RAU(IZ)/(MAIN5810
                   12.D0*DHTOT))                                                          MAIN5820
1239                GR=G(IZ,IC)                                                            MAIN5830
1240                CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                        MAIN5840
1241                DUPR(IC)=DUR                                                           MAIN5850
1242          2426  CONTINUE                                                               MAIN5860
1243                IA=1                                                                   MAIN5870
1244          2430  NI=NI-50                                                               MAIN5880
1245                IF (NI.GT.0) GO TO 2440                                                MAIN5890
1246                IE=NC(IZ)                                                              MAIN5900
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1247                GO TO 2450                                                          MAIN5910
1248          2440 IE=IA+49                                                             MAIN5920
1249          2450 IPAGE=IPAGE+1                                                        MAIN5930
1250               WRITE (6,9860) NTEST1,NTEST2,NTEST3,NTEST4,IPAGE                     MAIN5940
1251               IF (IA.EQ.1) WRITE (6,9210) IZ                                       MAIN5950
1252               IF (IA.GT.1) WRITE (6,9880) IZ                                       MAIN5960
1253               WRITE (6,9890)                                                       MAIN5970
1254               WRITE (6,9900) (X(IZ,L),YM(IZ,L),T(IZ,L),ETA(IZ,L),RELOC(L),DT(IZ,MAIN5980
                  1L),AMPSEC(L),DUPR(L),L=IA,IE)                                      MAIN5990
1255               IA=IE+1                                                              MAIN6000
1256               IF (IA.LE.NC(IZ)) GO TO 2430                                         MAIN6010
1257          2460 CONTINUE                                                             MAIN6020
1258               IF (NFIRE2.EQ.0) GO TO 9998                                          MAIN6030
                C                                                                      MAIN6040
                C     3.2.2.- VELOCITY FIELD U/UB                                      MAIN6050
                C     ***************************************************************MAIN6060
                C                                                                      MAIN6070
1259               LA=0                                                                 MAIN6080
1260               DO 2630 IZ=1,NZ                                                      MAIN6090
1261               NCR=NC(IZ)                                                           MAIN6100
1262               DO 2630 IC=1,NCR                                                     MAIN6110
1263               LA=LA+1                                                              MAIN6120
1264               U(LA,1)=0.D0                                                         MAIN6130
1265               Y(LA,1)=0.D0                                                         MAIN6140
1266               IR=1                                                                 MAIN6150
1267               IF (YM(IZ,IC).LE.1.D-5) GO TO 2570                                   MAIN6160
1268               WUT=DSQRT(DABS(T(IZ,IC)))                                            MAIN6170
1269               YPM=WUT*RET*YM(IZ,IC)/(2.D0*DHTOT)                                   MAIN6180
1270               GR=1.D0+YM(IZ,IC)*OK(IZ)                                             MAIN6190
1271               IF (RAU(IZ).LT.1.D-6) RLN=0.D0                                       MAIN6200
1272               IF (RAU(IZ).GE.1.D-6) RLN=DLOG(YPM*RAU(IZ)/YM(IZ,IC))                MAIN6210
1273               CALL PROPA(GR,RLN,CA,CE,TE,DUR)                                      MAIN6220
1274               YPD=YPM                                                              MAIN6230
1275               FNL=1.D0                                                             MAIN6240
1276               IF(YPM.LE.21.D0) GO TO 2490                                          MAIN6250
1277               YPD=21.D0                                                            MAIN6260
1278               FNL=(DLOG(YPD*TE/2.D0*(2.D0-YPD/YPM)/(1.D0+(TE-1.D0)*(1.D0-YPD/YPMMAIN6270
                  1)**2))/CA+CE+DUR)/12.471D0                                         MAIN6280
1279               IF(FNL.LT.0.D0) FNL=1.D-6                                            MAIN6290
1280          2490 UDELTA=WUT*YPD/RF*(1.D0-.2313D-1*YPD*(1.D0-.7804D-2*YPD))*FNL        MAIN6300
1281          2500 IR=IR+1                                                              MAIN6310
1282               U(LA,IR)=U(LA,IR-1)+.1D0                                             MAIN6320
1283               IF (U(LA,IR).GE.UDELTA) GO TO 2520                                   MAIN6330
1284               YA=0.D0                                                              MAIN6340
1285          2510 Y(LA,IR)=U(LA,IR)*RF/(WUT*YPM*(1.D0-.2313D-1*YA*YPM*(1.D0-.7804D-2MAIN6350
                  1*YA*YPM))*FNL)                                                     MAIN6360
1286               IF (DABS(YA/Y(LA,IR)-1.D0).LT.1.D-4) GO TO 2500                      MAIN6370
1287               YA=Y(LA,IR)                                                          MAIN6380
1288               GO TO 2510                                                           MAIN6390
1289          2520 IF (YPM.GT.21.D0) IR=IR-1                                            MAIN6400
1290               IF (YPM.GT.21.D0) GO TO 2530                                         MAIN6410
1291               U(LA,IR)=UDELTA                                                      MAIN6420
1292               Y(LA,IR)=1.D0                                                        MAIN6430
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1293                GO TO 2570                                                                  MAIN6440
1294          2530 UMAX=WUT/RF*(DLOG(YPM*TE/2.D0)/CA+CE+DUR)                                    MAIN6450
1295          2540 IR=IR+1                                                                      MAIN6460
1296                IF (U(LA,IR-1).LE..8D0) U(LA,IR)=U(LA,IR-1)+.1D0                            MAIN6470
1297                IF (U(LA,IR-1).GT..8D0) U(LA,IR)=U(LA,IR-1)+.5D-1                           MAIN6480
1298                IF (U(LA,IR).GE.UMAX) GO TO 2560                                            MAIN6490
1299                YA=1.D0                                                                     MAIN6500
1300          2550 Y(LA,IR)=DEXP((U(LA,IR)-UMAX)*CA*RF/WUT)*(1.D0+(TE-1.D0)*(1.D0-YA)MAIN651C
                  1*(1.D0-YA))/(2.D0-YA)                                                        MAIN6520
1301                IF (DABS(Y(LA,IR)/YA-1.D0).LT.1.D-4) GO TO 2540                             MAIN6530
1302                YA=Y(LA,IR)                                                                 MAIN6540
1303                GO TO 2550                                                                  MAIN6550
1304          2560 U(LA,IR)=UMAX                                                                MAIN6560
1305                Y(LA,IR)=1.D0                                                               MAIN6570
1306          2570 IZB(LA)=IZ                                                                   MAIN6580
1307                XT(LA)=X(IZ,IC)                                                             MAIN6590
1308                NRAD(LA)=IR                                                                 MAIN6600
1309                IF (IZ.EQ.NZ.AND.IC.EQ.NCR) GO TO 2580                                      MAIN6610
1310                IF (LA.LT.8) GO TO 2630                                                     MAIN6620
1311          2580 IF (LA.LT.5) LEND=LA                                                         MAIN6630
1312                IF (LA.GT.4) LEND=4                                                         MAIN6640
1313                IPAGE=IPAGE+1                                                               MAIN6650
1314                WRITE (6,9860) NTEST1,NTEST2,NTEST3,NTEST4,IPAGE                            MAIN6660
1315                NLA=0                                                                       MAIN6670
1316          2590 WRITE (6,9911) IZB(1+NLA),XT(1+NLA)                                          MAIN6680
1317                IF (LEND.EQ.(1+NLA)) GO TO 2600                                             MAIN6690
1318                WRITE (6,9912) IZB(2+NLA),XT(2+NLA)                                         MAIN6700
1319                IF (LEND.EQ.(2+NLA)) GO TO 2600                                             MAIN6710
1320                WRITE (6,9913) IZB(3+NLA),XT(3+NLA)                                         MAIN6720
1321                IF (LEND.EQ.(3+NLA)) GO TO 2600                                             MAIN6730
1322                WRITE (6,9914) IZB(4+NLA),XT(4+NLA)                                         MAIN6740
1323          2600 WRITE (6,9921)                                                               MAIN6750
1324                IF (LEND.EQ.(1+NLA)) GO TO 2610                                             MAIN6760
1325                WRITE (6,9922)                                                              MAIN6770
1326                IF (LEND.EQ.(2+NLA)) GO TO 2610                                             MAIN6780
1327                WRITE (6,9923)                                                              MAIN6790
1328                IF (LEND.EQ.(3+NLA)) GO TO 2610                                             MAIN6800
1329                WRITE (6,9924)                                                              MAIN6810
1330          2610 WRITE (6,9930)                                                               MAIN6820
1331                DO 2620 I=1,24                                                              MAIN6830
1332                WRITE (6,9930)                                                              MAIN6840
1333                IF (NRAD(1+NLA).GE.I) WRITE (6,9941) U(1+NLA,I),Y(1+NLA,I)                  MAIN6850
1334                IF (LEND.EQ.(1+NLA)) GO TO 2620                                             MAIN6860
1335                IF (NRAD(2+NLA).GE.I) WRITE (6,9942) U(2+NLA,I),Y(2+NLA,I)                  MAIN6870
1336                IF (LEND.EQ.(2+NLA)) GO TO 2620                                             MAIN6880
1337                IF (NRAD(3+NLA).GE.I) WRITE (6,9943) U(3+NLA,I),Y(3+NLA,I)                  MAIN6890
1338                IF (LEND.EQ.(3+NLA)) GO TO 2620                                             MAIN6900
1339                IF (NRAD(4+NLA).GE.I) WRITE (6,9944) U(4+NLA,I),Y(4+NLA,I)                  MAIN6910
1340          2620 CONTINUE                                                                     MAIN6920
1341                IF (LA.LE.LEND) LA=0                                                        MAIN6930
1342                IF (LA.LE.LEND) GO TO 2630                                                  MAIN6940
1343                NLA=4                                                                       MAIN6950
1344                LEND=LA                                                                     MAIN6960
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1345                GO TO 2590                                                          MAIN6970
1346           2630 CONTINUE                                                            MAIN6980
C                                                                                       MAIN6990
C                                                                                       MAIN7000
C      ************************************************************************MAIN7010
C                                                                                       MAIN7020
C      FORMAT STATEMENTS                                                                MAIN7030
C                                                                                       MAIN7040
C      ************************************************************************MAIN7050
C                                                                                       MAIN7060
C                                                                                       MAIN7070
1347           9000 FORMAT (7D10.6)                                                     MAIN7080
1348           9005 FORMAT (18A4)                                                       MAIN7090
1349           9010 FORMAT (1415)                                                       MAIN7100
1350           9015 FORMAT (515,3D10.6)                                                 MAIN7110
1351           9030 FORMAT (615,3D10.6)                                                 MAIN7120
1352           9035 FORMAT (12,10I3,4D10.6)                                             MAIN7130
1353           9040 FORMAT (5D14.6)                                                     MAIN7140
1354           9060 FORMAT ('1',10X,'CYCLE',I3/11X,'********'///)                       MAIN7150
1355           9070 FORMAT (' ',10X,'CYCLE TIME (SEC)',F8.2//)                          MAIN7160
1356           9075 FORMAT ('1',10X,'V E L A S C O  CASE-NR.',4I1/11X,'**********MAIN7170
              1**********'//)                                                           MAIN7180
1357           9077 FORMAT (' ',10X,18A4/)                                              MAIN7190
1358           9078 FORMAT('0')                                                         MAIN7200
1359           9080 FORMAT ('0',10X,'INPUT-DATA'/11X,'**********'///)                   MAIN7210
1360           9085 FORMAT (' ',5X,'RE =',F10.0,10X,'GRENZ =',F10.5//6X,'NZ =',I4,5X,'MAIN7220
              1NORDN =',I4,5X,'NUK =',I4///)                                            MAIN7230
1361           9090 FORMAT (' ',5X,'CHARACTERISTIC DATA OF THE ZONE'//3X,'NC',4X,'NUZ'MAIN7240
              1,3X,'NSIN',2X,'NNZ',3X,'NPASC',13X,'DU',8X,'RAU',7X,'OK'//I5,4I6,1MAIN7250
              21X,3F10.3/)                                                          MAIN7260
1362           9095 FORMAT (' ',5X,'CHARACTERISTIC DATA OF THE SUBZONES'//3X,'IUZ',3X,MAIN7270
              1'M1',4X,'M2',4X,'M3',4X,'M4',4X,'M5',4X,'M6',16X,'A1',8X,'A2',8X,'MAIN7280
              2A3'//)                                                               MAIN7290
1363           9120 FORMAT (' ',I4,6I6,11X,3F10.3/)                                     MAIN7300
1364           9125 FORMAT ('0',5X,'CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNMAIN7310
              1DARIES'//3X,'IXG',3X,'L01',3X,'L02',3X,'L03',3X,'L04',3X,'L05',3X,MAIN7320
              2'L06',3X,'L07',3X,'L08',3X,'L09',3X,'L10',3X,'L11',16X,'B1',8X,'B2MAIN7330
              3',8X,'B3',8X,'B4'//)                                                 MAIN7340
1365           9180 FORMAT (' ',I4,11I6,11X,4F10.3/)                                    MAIN7350
1366           9200 FORMAT ('1',10X,'RESULTS OF FIRST',I3,' CYCLES NEEDED FOR THE CONTMAIN7360
              1INUATION OF THE ITERATION CALCULATIONS'/11X,'**********************MAIN7370
              1**********************************************************'//)MAIN7380
1367           9202 FORMAT (' ',5X,'RET =',F10.2,10X,'DHTOT =',F10.4//)                 MAIN7390
1368           9204 FORMAT ('1',5X,'SUBCHANNEL DATA'/6X,'***************'//3X,'IUK',3XMAIN7400
              1,'N01',3X,'N02',3X,'N03',3X,'N04',3X,'N05',3X,'N06',3X,'N07',3X,'NMAIN7410
              208',3X,'N09',3X,'N10',3X,'N11',3X,'N12',3X,'N13',3X,'N14'//)         MAIN7420
1369           9208 FORMAT (' ',I4,14I6/)                                               MAIN7430
1370           9209 FORMAT ('1')                                                        MAIN7435
1371           9210 FORMAT (' ',5X,'ZONE',I4/6X,'********'//)                           MAIN7440
1372           9230 FORMAT ('0',5X,'YM'/)                                               MAIN7450
1373           9240 FORMAT ('0',5X,'T'/)                                                MAIN7460
1374           9250 FORMAT ('0',5X,'XG'/)                                               MAIN7470
1375           9260 FORMAT ('0',5X,'YG'/)                                               MAIN7480
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1376          9270 FORMAT ('0',5X,'XDT'/)                                                                    MAIN7490
1377          9280 FORMAT ('0',5X,'VZUV'/)                                                                   MAIN7500
1378          9285 FORMAT (' ',9D14.4/)                                                                      MAIN7510
1379          9290 FORMAT (' ',9F14.4)                                                                       MAIN7520
1380          9300 FORMAT (' ',5X,'VUMX'/6X,'****'//)                                                        MAIN7530
1381          9320 FORMAT (' ',5X,'VUMAX'/6X,'*****'//)                                                      MAIN7540
1382          9330 FORMAT ('0',5X,'X'/)                                                                      MAIN7550
1383          9340 FORMAT ('0',3X,'IXG',5X,'IXGACT',5X,'XG1',9X,'YG1',9X,'XG2',9X,'YG                        MAIN7560
             12',9X,'XG3',9X,'YG3',9X,'XG4',9X,'YG4'//)                                                      MAIN7570
1384          9350 FORMAT (' ',2I8,8F12.5)                                                                   MAIN7580
1385          9360 FORMAT ('0',10X,   'PERIPHERAL EXTENT OF SUBZONES (XG,YG)'/11X,'**                        MAIN7590
             1**********************************'//)                                                        MAIN7600
1386          9370 FORMAT ('0',10X,   'RADIAL EXTENT (-YM-) OF SUBZONES AT POSITIONS                         MAIN7610
             1X'/11X,'**************************************************'//)                                MAIN7620
1387          9380 FORMAT (' ',10X,'IUZ =',I3,5X,'IUZACT =',I3/11X,'-----------------                        MAIN7630
             1-------'/)                                                                                     MAIN7640
1388          9390 FORMAT (' ',5X,'IZI =',I3,5X,'IUZI =',I3,5X,'IORDN =',I3,5X,'ND =                         MAIN7650
             1,I3/)                                                                                          MAIN7660
1389          9400 FORMAT ('0',5X,'XD'/)                                                                     MAIN7670
1390          9410 FORMAT ('0',5X,'YMD'/)                                                                    MAIN7680
1391          9420 FORMAT ('0',10X,'SOLUTION OF THE DIFFERENTIAL EQUATION'/11X,'*****                        MAIN7690
             1*********************************'//)                                                        MAIN7700
1392          9440 FORMAT ('0',5X,'DHI'/)                                                                    MAIN7710
1393          9450 FORMAT (' ',5X,'DHTGT =',F8.5/)                                                           MAIN7720
1394          9460 FORMAT ('0',5X,'COEF'/)                                                                   MAIN7730
1395          9470 FORMAT ('0',5X,'TAUM =',F8.5/)                                                            MAIN7740
1396          9475 FORMAT ('0',5X,'NUMBER OF SINUS-TERMS =',I5/)                                             MAIN7750
1397          9480 FORMAT ('0',5X,'BT'/)                                                                     MAIN7760
1398          9490 FORMAT ('0',5X,'DT'/)                                                                     MAIN7770
1399          9520 FORMAT ('0',10X,'CALCULATION OF THE FRICTION FACTOR'/11X,'********                         MAIN7780
             1************************'//)                                                                  MAIN7790
1400          9530 FORMAT ('0',5X,'FUM(IZ) =',F8.5///)                                                       MAIN7800
1401          9540 FORMAT (' ',5X,'RE =',F8.0,5X,'F =',F8.5,5X,'RF =',F8.3,5X,'RET =                         MAIN7810
             1,F8.2//)                                                                                       MAIN7820
1402          9550 FORMAT ('0',10X,'VELOCITY RATIOS AT BOUNDARY POSITIONS XG'/11X,'**                        MAIN7830
             1************************************'//)                                                      MAIN7840
1403          9560 FORMAT ('0',5X,'IZ/IXG - UMX - VU'/)                                                      MAIN7850
1404          9570 FORMAT (' ',I15,'/',I2,I15,'/',I2,I15,'/',I2//22X,2F18.4//40X,F18.                        MAIN7860
             14/)                                                                                            MAIN7870
1405          9580 FORMAT (' ',I15,'/',I2,I15,'/',I2,I15,'/',I2,I15,'/',I2//22X,3F18.                        MAIN7880
             14//40X,2F18.4//58X,F18.4/)                                                                     MAIN7890
1406          9590 FORMAT (' ',I15,'/',I2,I15,'/',I2,I15,'/',I2,I15,'/',I2,I15,'/',I2                        MAIN7900
             1//22X,4F18.4//40X,3F18.4//58X,2F18.4//76X,F18.4/)                                              MAIN7910
1407          9600 FORMAT (' ',I15,'/',I2/)                                                                  MAIN7920
1408          9610 FORMAT (' ',13X,'NENDE =',I4,5X,'NENDE(MAX) =',I4//)                                      MAIN7930
1409          9620 FORMAT ('0',10X,'VELOCITY RATIOS AT POSITIONS X'/11X,'************                        MAIN7940
             1*****************'//)                                                                          MAIN7950
1410          9630 FORMAT (' ',5X,'IZ =',I3,3X,'IUZ =',I3,3X,'IUZACT =',I3/6X,'------                        MAIN7960
             1----------'/)                                                                                  MAIN7970
1411          9635 FORMAT (' ',5X,'IZ =',I3,3X,'IUZ =',I3,3X,'IUZACT =',I3,3X,'ND =',                        MAIN7980
             1I3/6X,'-----------------'/)                                                                    MAIN7990
1412          9640 FORMAT (' ',5X,'IZ =',I3,3X,'IUZ =',I3,3X,'IUZACT =',I3,3X,'IZI =                         MAIN8000
             1,I3,3X,'IUZI =',I3,3X,'NUM =',I3/6X,'------------------'/)                                    MAIN8010
```

```
1413          9650 FORMAT (' ',5X,'UMX'/)                                                    MAIN8020
1414          9660 FORMAT ('0',5X,'UMXD'/)                                                   MAIN8030
1415          9670 FORMAT ('0',5X,'VU'/)                                                     MAIN8040
1416          9700 FORMAT ('0',5X,'TOTAL - NENDE =',I4,5X,'NENDE(MAX) =',I4/6X,'*****MAIN8050
             1'///)                                                                          MAIN8060
1417          9710 FORMAT ('0',10X,'TOTAL TIME (SEC)',F8.2//)                                MAIN8070
1418          9720 FORMAT ('1',5X,'CONTROL OF INPUT DATA ON LOGICAL ERRORS'/6X,'*****MAIN8080
             1**********'//)                                                                 MAIN8090
1419          9730 FORMAT (' ',5X,'NFAIL =',I3//)                                            MAIN8100
1420          9740 FORMAT ('0',5X,'NGG GREATER THAN NSXDIM, NGG =',I5//)                     MAIN8110
1421          9745 FORMAT ('0',5X,'NGG GREATER THAN 400, NGG =',I5//)                        MAIN8120
1422          9750 FORMAT ('0',5X,'IUZ GREATER THAN NUZ(IZ), IUZ =',I5//)                    MAIN8130
1423          9760 FORMAT ('0',5X,'ND GRATER THAN NDDIM, ND =',I5,' FOR IUZACT =',I5/MAIN8140
             1/)                                                                             MAIN8150
1424          9770 FORMAT ('0',5X,'ND GREATER THAN NDDIM, ND =',I5//)                        MAIN8160
1425          9780 FORMAT ('0',5X,'NDT GREATER THAN NDTDIM, NDT =',I5//)                     MAIN8170
1426          9790 FORMAT ('0',5X,'NUMS GREATER THAN 400, NUMS =',I5//)                      MAIN8180
1427          9800 FORMAT ('0',5X,'NUV(IZ) GREATER THAN NCDIM, NUV(IZ) =', I5//)             MAIN8190
1428          9810 FORMAT ('1',10X,'V E L A S C O   CASE-NR.',4I1,41X,'FINAL RESULTS MAIN8200
             1PAGE ',I2/11X,'**************************'///)                               MAIN8210
1429          9820 FORMAT ('0',5X,'REYNOLDSNUMBER ',F12.0,10X,'FRICTION FACTOR ',F12.MAIN8220
             15,9X,'HYDRAULIC DIAMETER ',F12.4//)                                            MAIN8230
1430          9830 FORMAT (' ',5X,'SUBCHANNEL BULK VELOCITIES'/6X,'------------------MAIN8240
             1--------'//)                                                                   MAIN8250
1431          9840 FORMAT (' ',2X,'SUBCH.NR.',I9,9I11)                                       MAIN8260
1432          9850 FORMAT (' ',2X,'UB/UB(TOT)',10F11.3)                                      MAIN8270
1433          9860 FORMAT ('1',10X,'V E L A S C O  ',4I1,50X,'FINAL RESULTS PAGE ',I2MAIN8280
             1//)                                                                            MAIN8290
1434          9865 FORMAT (' ',5X,'COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR MAIN8300
             1STRESS DISTRIBUTION'///)                                                       MAIN8310
1435          9870 FORMAT (' ',5X,'TAUM =',F8.4,5X,'N(COF) =',I4,7X,'N(SIN) =',I4//) MAIN8320
1436          9875 FORMAT (' ',5X,'BETA'/)                                                   MAIN8330
1437          9880 FORMAT (' ',5X,'ZONE',I4,3X,'(CONTINUATION)'/6X,'********'//)             MAIN8340
1438          9890 FORMAT (' ',5X,'X',14X,'YM',13X,'T',14X,'ETA',12X,'RE(LOC)',8X,'DIMAIN8350
             1',13X,'AMPL.OF',8X,'DUP(RAU)'/96X,'SEC.FLOW'/)                                 MAIN8360
1439          9900 FORMAT (' ',F11.4,3F15.4,F15.0,2F15.4,F15.2)                              MAIN8370
1440          9911 FORMAT (' ', 9X,'ZONE',I2,', X=',F6.4)                                    MAIN8380
1441          9912 FORMAT ('+',39X,'ZONE',I2,', X=',F6.4)                                    MAIN8390
1442          9913 FORMAT ('+',69X,'ZONE',I2,', X=',F6.4)                                    MAIN8400
1443          9914 FORMAT ('+',99X,'ZONE',I2,', X=',F6.4)                                    MAIN8410
1444          9921 FORMAT ('0', 9X,'U/UB',11X,'Y/YM')                                        MAIN8420
1445          9922 FORMAT ('+',39X,'U/UB',11X,'Y/YM')                                        MAIN8430
1446          9923 FORMAT ('+',69X,'U/UB',11X,'Y/YM')                                        MAIN8440
1447          9924 FORMAT ('+',99X,'U/UB',11X,'Y/YM')                                        MAIN8450
1448          9930 FORMAT (' ')                                                              MAIN8460
1449          9941 FORMAT ('+',2F15.5)                                                       MAIN8470
1450          9942 FORMAT ('+',30X,2F15.5)                                                   MAIN8480
1451          9943 FORMAT ('+',60X,2F15.5)                                                   MAIN8490
1452          9944 FORMAT ('+',90X,2F15.5)                                                   MAIN8500
          C                                                                                  MAIN8510
          C                                                                                  MAIN8520
1453          9998 CALL TIME (TITOT)                                                         MAIN8530
1454               WRITE (6,9710) TITOT                                                      MAIN8540
```

```
1455                GO TO 1                                          MAIN8550
1456          9999  STOP                                             MAIN8560
1457                END                                              MAIN8570
```

```
0001                  SUBROUTINE INMAT(N)                                                  INMA  10
                C     MATRIX INVERSION IN PLACE                                            INMA  20
                C     NOTE ORIGINAL MATRIX IS DESTROYED                                    INMA  30
                C     IPIV IS ARRAY TO PREVENT DUPLICATE PIVOTINGS                         INMA  40
                C     ON SINGLE ROWS(HAVE VALUES 0 OR 1)                                   INMA  50
                C     PUTTING PIVOT ELEMENT ON DIAGONAL IMPLIES ROW INTERCHANGE(IR,IC)      INMA  60
                C     INTERCHANGE OF ROWS IN THE INPUT MATRIX REQUIRES                     INMA  70
                C     SUBSEQUENT INTERCHANGE OF COLUMNS                                    INMA  80
                C                                                                          INMA  90
                C     DIMENSIONS IN COMMON BLOCK /MATRIX/ VARYING WITH NC(MAX),NC(MAX)     INMA 100
                C                                                                          INMA 110
0002                  COMMON /MATRIX/ A(81,81)                                             INMA 120
0003                  DIMENSION IPIV(100),IND(100,2),PIV(100)                              INMA 130
0004                  EQUIVALENCE (IR,JR),(IC,JC)                                          INMA 140
0005                  DOUBLE PRECISION A,X,PIV                                             INMA 150
                C     2 STATEMENTS FOR INITIALIZATION                                      INMA 160
0006                  DO 5 J=1,N                                                           INMA 170
0007                5 IPIV(J)=0                                                            INMA 180
                C                                                                          INMA 190
0008                  DO 10 I=1,N                                                          INMA 200
                C     12 STATEMENTS FOR SEARCHING PIVOT ELEMENT                            INMA 210
0009                  X=0.0D0                                                              INMA 220
0010                  DO 15 J=1,N                                                          INMA 230
0011                  M=0                                                                  INMA 240
0012                  IF(IPIV(J)-1) 20,15,20                                               INMA 250
0013               20 DO 55 K=1,N                                                          INMA 260
0014                  IF(A(J,K)) 1,2,1                                                     INMA 270
0015                2 M=M+1                                                              INMA 280
0016                1 IF(IPIV(K)-1) 25,55,25                                             INMA 290
0017               25 IF(DABS(X)-DABS(A(J,K))) 30,55,55                                  INMA 300
0018               30 IR=J                                                              INMA 310
0019                  IC=K                                                             INMA 320
0020                  X=A(J,K)                                                         INMA 330
0021               55 CONTINUE                                                         INMA 340
0022                  IF(M-N) 15,4,4                                                   INMA 350
0023               15 CONTINUE                                                         INMA 360
0024                  IPIV(IC)=IPIV(IC)+1                                              INMA 370
                C     8 STATEMENTS TO BRING PIVOT ELEMENT IN DIAGONAL POSITION             INMA 380
0025                  IF(IR-IC) 35,40,35                                               INMA 390
0026               35 DO 45 L=1,N                                                      INMA 400
0027                  X=A(IR,L)                                                        INMA 410
0028                  A(IR,L)=A(IC,L)                                                  INMA 420
0029               45 A(IC,L)=X                                                        INMA 430
0030               40 IND(I,1)=IR                                                      INMA 440
0031                  IND(I,2)=IC                                                      INMA 450
0032                  PIV(I)=A(IC,IC)                                                  INMA 460
                C                                                                          INMA 470
                C     3 STATEMENTS FOR DIVISION OF PIVOT ROW BY PIVOT ELEMENT           INMA 480
0033                  A(IC,IC)=1.0D0                                                   INMA 490
0034                  DO 50 L=1,N                                                      INMA 500
0035               50 A(IC,L)=A(IC,L)/PIV(I)                                           INMA 510
                C                                                                          INMA 520
                C     7 STATEMENTS FOR REDUCING NON-PIVOT ROWS                         INMA 530
```

```
0036              DO 10 LI=1,N                                                  INMA 540
0037              IF(LI-IC) 60,10,60                                            INMA 550
0038           60 X=A(LI,IC)                                                    INMA 560
0039              A(LI,IC)=0.0D0                                                INMA 570
0040              DO 65 L=1,N                                                   INMA 580
0041           65 A(LI,L)=A(LI,L)-A(IC,L)*X                                     INMA 590
0042           10 CONTINUE                                                      INMA 600
                C                                                              INMA 610
                C     11 STATEMENTS FOR INTERCHANGING COLUMNS                  INMA 620
0043              DO 70 I=1,N                                                   INMA 630
0044              L=N-I+1                                                       INMA 640
0045              IF(IND(L,1)-IND(L,2)) 75,70,75                                INMA 650
0046           75 JR=IND(L,1)                                                   INMA 660
0047              JC=IND(L,2)                                                   INMA 670
0048              DO 80 K=1,N                                                   INMA 680
0049              X=A(K,JR)                                                     INMA 690
0050              A(K,JR)=A(K,JC)                                               INMA 700
0051              A(K,JC)=X                                                     INMA 710
0052           80 CONTINUE                                                      INMA 720
0053           70 CONTINUE                                                      INMA 730
0054              RETURN                                                        INMA 740
0055            4 WRITE (6,100)                                                 INMA 750
0056          100 FORMAT ('SIGNAL','MATRIX IS SINGULAR INVERSE DOES NOT EXIST') INMA 760
0057              STOP                                                          INMA 770
0058              END                                                           INMA 780
```

```
FORTRAN IV G LEVEL  20                    FSUM                DATE = 72341          11/37/55                PAGE 0001

0001                  FUNCTION FSUM(VINT,N)                                                          FSUM  10
                C                                                                                    FSUM  20
0002                  IMPLICIT REAL*8(A-H,O-Z)                                                       FSUM  30
0003                  DIMENSION VINT(101),VINTR(5)                                                   FSUM  40
0004                  FSUM=0.D0                                                                      FSUM  50
0005                  DO 2 I=5,N,4                                                                   FSUM  60
0006                  DO 1 K=1,5                                                                     FSUM  70
0007                  I5=K+I-5                                                                       FSUM  80
0008                  VINTR(K)=VINT(I5)                                                              FSUM  90
0009                1 CONTINUE                                                                       FSUM 100
0010                  FSUM=FSUM+2.D0/(45.D0*DFLOAT(N-1))*(7.D0*(VINTR(1)+VINTR(5))+32.D0*FSUM 110
                     1*(VINTR(2)+VINTR(4))+12.D0*VINTR(3))                                           FSUM 120
0011                2 CONTINUE                                                                       FSUM 130
0012                  RETURN                                                                         FSUM 140
0013                  END                                                                            FSUM 150
```

```
FORTRAN IV G LEVEL  20                    PROPA               DATE = 72341          11/37/55                PAGE 0001

0001                  SUBROUTINE PROPA(G,R,CA,CE,TE,DUR)                                             PROP  10
                C                                                                                    PROP  20
                C     DETERMINATION OF THE CHARACTERISTIC VELOCITY PROFILE PARAMETERS                 PROP  30
                C                                                                                    PROP  40
                C     ATTENTION, FUNCTIONS 'DUR' ARE SPECIFIC FOR EVERY TYP OF ROUGHNESSPROP  50
                C                                                                                    PROP  60
0002                  IMPLICIT REAL*8(A-H,O-Z)                                                       PROP  70
0003                  IF (G.LE.1.D0) TE=3.87D0-1.8D0*(DABS(G-.32D0))**1.4D0                          PROP  80
0004                  IF(G.GT.1.D0) TE=10.D0*DEXP(-1.26D0*DSQRT(G))                                  PROP  90
0005                  IF(G.LE.1.D0) CA=.407D0                                                        PROP 100
0006                  IF(G.GT.1.D0) CA=.387D0*(1.D0+G/20.D0)                                         PROP 110
0007                  CE=12.471D0-3.0445D0/CA                                                        PROP 120
0008                  IF(R.LE.1.D0) DUR=0.D0                                                         PROP 130
0009                  IF(R.GT.1.D0.AND.R.LT.5.D0) DUR=(1.D0-R)/CA-5.D0+7.4275D0*R-2.8070PROP 140
                     18D0*R*R+.3975D0*R*R*R-.1792D-1*R*R*R*R                                         PROP 150
0010                  IF(R.GE.5.D0) DUR=(1.D0-R)/CA+.45D0                                            PROP 160
0011                  IF (DUR.GT.0.D0) DUR=0.D0                                                      PROP 170
0012                  RETURN                                                                         PROP 180
0013                  END                                                                            PROP 190
```

## APPENDIX II

### INPUT FOR THE REFERENCE CASE

(for the graphical representation of this case see figs. 5, 6, 9 and 11)

V E L A S C O  CASE-NR.0027
**************************

VELOCITY DISTRIBUTION IN A HEXAGONAL THIRTYSEVEN-ROD BUNDLE
P/D = 1,25  PW/D =1,15

INPUT-DATA
**********

RE = 100000.  GRENZ = 0.00050
NZ = 7  NORDN = 18  NUK = 9

ZONE 1
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAJ | DK |
|---|---|---|---|---|---|---|---|
| 25 | 5 | 0 | 1 | 1 | 1.428 | 0.0 | 0.0 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 1 | 2 | 10 | 1 | 1 | 0.300 | 0.0 | 1.000 |
| 2 | 3 | 2 | 2 | 1 | 0 | 0 | 0.300 | 0.0 | 1.000 |
| 3 | 3 | 3 | 3 | 3 | 1 | 0 | 0.300 | 0.0 | 1.000 |
| 4 | 3 | 4 | 3 | 2 | 0 | 1 | 0.300 | 0.0 | 1.000 |
| 5 | 3 | 5 | 3 | 1 | 1 | 0 | 0.458 | -3.571 | 1.000 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 2 | 1 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 0.0 | 0.300 | 0.0 | 1.000 |
| 2 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.279 | 0.0 | 0.300 | 0.0 |
| 3 | 6 | 1 | 2 | 3 | 3 | 2 | 4 | 1 | -1 | 1 | 0 | 0.300 | 0.500 | 0.300 | 0.0 |
| 4 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.836 | 0.157 | 0.300 | 0.0 |
| 5 | 4 | 1 | 3 | 5 | 2 | -1 | 1 | 0 | 0 | 0 | 0 | 0.967 | 0.300 | 0.0 | 1.000 |
| 6 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.000 | 0.0 | 0.458 | 0.0 |

ZONE 2
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAU | DK |
|---|---|---|---|---|---|---|---|
| 49 | 10 | 24 | 1 | 1 | 2.000 | 0.000 | 1.000 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 1 | 2 | 0 | 0 | 0.300 | 1.000 | 0.0 |
| 2 | 3 | 6 | 3 | 4 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 3 | 3 | 7 | 3 | 5 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 4 | 3 | 8 | 5 | 2 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 5 | 3 | 9 | 5 | 3 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 6 | 3 | 10 | 4 | 2 | 1 | 0 | 0.500 | 1.000 | 1.000 |
| 7 | 3 | 11 | 4 | 1 | 0 | 1 | 0.500 | 1.000 | 1.000 |
| 8 | 1 | 0 | 0 | 0 | 1 | 0 | 0.500 | 1.000 | 1.000 |
| 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 10 | 2 | 1 | 1 | 1 | 1 | 1 | 0.300 | 1.000 | 0.0 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 3 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.250 | 0.667 | 0.500 | 0.0 |
| 4 | 6 | 2 | 3 | 5 | 4 | 6 | 2 | 1 | -1 | -1 | 0 | 0.500 | 0.500 | 0.500 | 0.0 |
| 5 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.417 | 0.333 | 0.500 | 0.0 |
| 6 | 6 | 2 | 4 | 5 | 6 | 3 | 4 | -1 | -1 | 1 | 0 | 0.500 | 0.500 | 0.500 | 0.0 |
| 7 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.583 | 0.167 | 0.500 | 0.0 |
| 8 | 4 | 4 | 2 | 1 | 8 | 1 | -1 | 0 | 0 | 0 | 0 | 0.0 | 0.500 | 1.000 | 1.000 |
| 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.750 | 0.250 | 0.0 | 0.0 |
| 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.000 | 0.279 | 0.300 | 0.0 |

ZONE 3
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAU | OK |
|---|---|---|---|---|---|---|---|
| 25 | 6 | 0 | 1 | 1 | 1.000 | 0.000 | 1.000 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 5 | 1 | 5 | 0 | 1 | 0.458 | 1.000 | -3.571 |
| 2 | 2 | 4 | 1 | 4 | 1 | 0 | 0.300 | 1.000 | 0.0 |
| 3 | 2 | 3 | 1 | 3 | 0 | 1 | 0.300 | 1.000 | 0.0 |
| 4 | 2 | 6 | 2 | 2 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 5 | 2 | 7 | 2 | 3 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 6 | 3 | 12 | 5 | 1 | 1 | 0 | 0.500 | 1.000 | 1.000 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.000 | 0.0 | 0.500 | 0.0 |

ZONE 4
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAU | OK |
|---|---|---|---|---|---|---|---|
| 25 | 6 | 0 | 1 | 1 | 1.000 | 0.000 | 1.000 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 11 | 2 | 7 | 1 | 0 | 0.500 | 1.000 | 1.000 |
| 2 | 2 | 10 | 2 | 6 | 0 | 1 | 0.500 | 1.000 | 1.000 |
| 3 | 3 | 13 | 5 | 4 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 4 | 3 | 14 | 5 | 5 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 5 | 3 | 15 | 6 | 2 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 6 | 3 | 16 | 6 | 3 | 0 | 0 | 0.500 | 1.000 | 1.000 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 3 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.500 | 0.667 | 0.500 | 0.0 |
| 5 | 6 | 4 | 5 | 6 | 5 | 6 | 2 | 1 | -1 | -1 | 0 | 0.500 | 0.500 | 0.500 | 0.0 |
| 6 | 3 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.833 | 0.333 | 0.500 | 0.0 |
| 7 | 4 | 4 | 6 | 7 | 4 | -1 | -1 | 0 | 0 | 0 | 0 | 1.000 | 0.500 | 1.000 | 1.000 |

ZONE 5
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAU | DK |
|---|---|---|---|---|---|---|---|
| 25 | 6 | 0 | 1 | 1 | 1.000 | 0.000 | 1.000 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 12 | 3 | 6 | 0 | 1 | 0.500 | 1.000 | 1.000 |
| 2 | 2 | 8 | 2 | 4 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 3 | 2 | 9 | 2 | 5 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 4 | 2 | 13 | 4 | 3 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 5 | 2 | 14 | 4 | 4 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 6 | 3 | 17 | 6 | 1 | 1 | 0 | 0.500 | 1.000 | 1.000 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 3 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.000 | 0.0 | 0.500 | 0.0 |

ZONE 6
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAU | OK |
|---|---|---|---|---|---|---|---|
| 25 | 6 | 0 | 1 | 1 | 1.000 | 0.0 | 1.000 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 17 | 5 | 6 | 0 | 1 | 0.500 | 1.000 | 1.000 |
| 2 | 2 | 15 | 4 | 5 | 1 | 1 | 0.500 | 1.000 | 1.000 |
| 3 | 2 | 16 | 4 | 6 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0.500 | 1.000 | 1.000 |
| 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0.500 | 1.000 | 1.000 |
| 6 | 3 | 18 | 7 | 1 | 1 | 0 | 0.500 | 1.000 | 1.000 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.667 | 0.250 | 0.0 | 0.0 |
| 6 | 4 | 7 | 6 | 2 | 5 | -1 | 1 | 0 | 0 | 0 | 0 | 1.000 | 0.500 | 1.000 | 1.000 |
| 7 | 3 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.000 | 0.0 | 0.500 | 0.0 |

ZONE 7
********

CHARACTERISTIC DATA OF THE ZONE

| NC | NUZ | NSIN | NNZ | NPASC | DU | RAU | OK |
|---|---|---|---|---|---|---|---|
| 5 | 1 | 0 | 1 | 1 | 0.167 | 0.000 | 1.000 |

CHARACTERISTIC DATA OF THE SUBZONES

| IUZ | M1 | M2 | M3 | M4 | M5 | M6 | A1 | A2 | A3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 18 | 6 | 6 | 0 | 1 | 0.500 | 1.000 | 1.000 |

CHARACTERISTIC DATA OF THE PERIPHERAL SUBZONE BOUNDARIES

| IXG | L01 | L02 | L03 | L04 | L05 | L06 | L07 | L08 | L09 | L10 | L11 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |

SUBCHANNEL DATA
**********

| IUK | N01 | N02 | N03 | N04 | N05 | N06 | N07 | N08 | N09 | N10 | N11 | N12 | N13 | N14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 2 | 0 | 0 | 4 | 1 | 0 | 0 | 6 | 3 | 0 | 0 | 9 |
| 2 | 3 | 1 | 2 | 3 | 0 | 2 | 1 | 3 | 0 | 4 | 3 | 5 | 0 | 17 |
| 3 | 2 | 1 | 2 | 0 | 0 | 1 | 9 | 0 | 0 | 2 | 11 | 0 | 0 | 17 |
| 4 | 3 | 2 | 3 | 5 | 0 | 3 | 5 | 1 | 0 | 5 | 7 | 3 | 0 | 17 |
| 5 | 2 | 2 | 4 | 0 | 0 | 7 | 1 | 0 | 0 | 9 | 2 | 0 | 0 | 9 |
| 6 | 3 | 2 | 4 | 5 | 0 | 5 | 2 | 3 | 0 | 7 | 4 | 5 | 0 | 9 |
| 7 | 3 | 4 | 5 | 0 | 0 | 4 | 5 | 1 | 0 | 6 | 7 | 3 | 0 | 9 |
| 8 | 2 | 4 | 6 | 0 | 0 | 6 | 3 | 0 | 0 | 7 | 5 | 0 | 0 | 9 |
| 9 | 2 | 6 | 7 | 0 | 0 | 5 | 1 | 0 | 0 | 7 | 2 | 0 | 0 | 9 |

# APPENDIX III

## OUTPUT FOR THE REFERENCE CASE

(only the final results)

V E L A S C O  CASE-NR.0027 FINAL RESULTS PAGE 1
**********

VELOCITY DISTRIBUTION IN A HEXAGONAL THIRTYSEVEN-ROD BUNDLE
P/D = 1,25 PW/D =1,15

REYNOLDSNUMBER 100000. FRICTION FACTOR 0.01874 HYDRAULIC DIAMETER 0.6590

SUBCHANNEL BULK VELOCITIES

| SUBCH.NR. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| UB/UB(TOT) | 0.889 | 0.944 | 0.948 | 1.033 | 1.034 | 1.037 | 1.038 | 1.039 | 1.039 |

ZONE 1
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUM = 0.8087 N(COF) = 25 N(SIN) = 0

BT

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.7721D-01 | -0.6773D-01 | 0.9943D-01 | 0.6233D-01 | -0.5680D-02 | 0.1894D-02 | -0.9689D-02 | -0.5825D-03 | -0.8890D-04 |
| 0.2542D-03 | 0.2535D-04 | 0.2149D-03 | -0.1765D-03 | 0.5968D-04 | -0.1378D-03 | 0.1582D-03 | -0.1192D-03 | 0.7542D-04 |
| -0.1163D-03 | 0.1080D-03 | 0.4106D-04 | -0.1156D-03 | 0.1044D-02 | -0.1966D-02 | 0.9158D-03 | | |

ZONE 1
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.5230 | 0.9661 | 1.0375 | 164683. | 0.0 | 0.0 | 0.0 |
| 0.0417 | 0.4247 | 0.9565 | 1.0071 | 129797. | -0.4683 | -0.0037 | 0.0 |
| 0.0833 | 0.3403 | 0.9271 | 0.9638 | 99531. | -0.9269 | -0.0075 | 0.0 |
| 0.1250 | 0.2696 | 0.8806 | 0.9099 | 74451. | -1.2954 | -0.0107 | 0.0 |
| 0.1667 | 0.2162 | 0.8222 | 0.8510 | 55832. | -1.4343 | -0.0123 | 0.0 |
| 0.2083 | 0.1794 | 0.7564 | 0.7977 | 43418. | -1.2116 | -0.0107 | 0.0 |
| 0.2500 | 0.1604 | 0.7264 | 0.7620 | 37090. | -0.5993 | -0.0055 | 0.0 |
| 0.2917 | 0.1586 | 0.7200 | 0.7557 | 35914. | 0.2359 | 0.0021 | 0.0 |
| 0.3333 | 0.1711 | 0.7441 | 0.7794 | 40470. | 0.9660 | 0.0084 | 0.0 |
| 0.3750 | 0.1999 | 0.7963 | 0.8271 | 50168. | 1.3603 | 0.0115 | 0.0 |
| 0.4167 | 0.2493 | 0.8509 | 0.8836 | 66844. | 1.3275 | 0.0108 | 0.0 |
| 0.4583 | 0.3108 | 0.9040 | 0.9398 | 88655. | 1.0411 | 0.0082 | 0.0 |
| 0.5000 | 0.3972 | 0.9345 | 0.9862 | 118873. | 0.5755 | 0.0045 | 0.0 |
| 0.5417 | 0.4894 | 0.9523 | 1.0214 | 151713. | 0.0991 | 0.0008 | 0.0 |
| 0.5833 | 0.4629 | 0.9431 | 1.0093 | 141770. | -0.3276 | -0.0034 | 0.0 |
| 0.6250 | 0.3670 | 0.9250 | 0.9714 | 108180. | -0.7752 | -0.0081 | 0.0 |
| 0.6667 | 0.2984 | 0.8793 | 0.9206 | 83360. | -1.1505 | -0.0123 | 0.0 |
| 0.7083 | 0.2323 | 0.8300 | 0.8636 | 60891. | -1.4705 | -0.0162 | 0.0 |
| 0.7500 | 0.1936 | 0.7609 | 0.8027 | 47158. | -1.4866 | -0.0171 | 0.0 |
| 0.7917 | 0.1629 | 0.7092 | 0.7533 | 37229. | -1.2325 | -0.0153 | 0.0 |
| 0.8333 | 0.1571 | 0.6583 | 0.7184 | 34256. | -0.7829 | -0.0097 | 0.0 |
| 0.8750 | 0.1589 | 0.6438 | 0.7104 | 34258. | -0.3033 | -0.0038 | 0.0 |
| 0.9167 | 0.1849 | 0.6307 | 0.7171 | 40242. | 0.0295 | 0.0001 | 0.0 |
| 0.9583 | 0.2151 | 0.6439 | 0.7406 | 48335. | 0.1789 | 0.0005 | 0.0 |
| 1.0000 | 0.2313 | 0.6407 | 0.7053 | 49514. | 0.0000 | 0.0000 | 0.0 |

ZONE 2
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUM = 1.0172 N(COF) = 48 N(SIN) = 24

BT

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -0.3269D-02 | -0.2306D-02 | -0.4057D-03 | 0.4874D-03 | 0.3504D-03 | -0.3673D-04 | -0.1242D-03 | -0.3020D-04 | 0.3666D-04 |
| -0.3434D-04 | -0.7904D-04 | -0.2034D-04 | -0.3135D-05 | -0.8032D-05 | -0.8174D-05 | -0.1310D-04 | -0.3613D-05 | -0.5726D-06 |
| -0.1924D-04 | -0.1611D-04 | 0.1119D-04 | 0.1782D-04 | 0.1031D-04 | 0.5754D-05 | -0.1206D 00 | -0.6839D-01 | -0.4157D-01 |
| -0.2916D-01 | -0.2132D-01 | 0.1498D-01 | -0.4336D-02 | -0.7023D-03 | 0.2785D-04 | 0.4149D-04 | 0.1034D-03 | -0.1257D-03 |
| -0.1262D-03 | 0.7373D-04 | 0.9487D-04 | 0.3056D-04 | -0.1031D-03 | -0.7521D-04 | 0.1758D-04 | 0.9040D-04 | 0.5733D-04 |
| -0.3894D-04 | -0.5589D-04 | 0.1105D-03 | | | | | | |

ZONE 2
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.1440 | 0.7462 | 0.7606 | 35622. | -0.0509 | -0.0003 | 0.0 |
| 0.0208 | 0.1461 | 0.7575 | 0.7687 | 36576. | 1.1341 | 0.0066 | 0.0 |
| 0.0417 | 0.1600 | 0.7918 | 0.7980 | 41834. | 2.0844 | 0.0118 | 0.0 |
| 0.0625 | 0.1847 | 0.8412 | 0.8415 | 51518. | 2.5961 | 0.0143 | 0.0 |
| 0.0833 | 0.2165 | 0.8974 | 0.8904 | 64847. | 2.7195 | 0.0145 | 0.0 |
| 0.1042 | 0.2623 | 0.9515 | 0.9416 | 84791. | 2.4221 | 0.0125 | 0.0 |
| 0.1250 | 0.3170 | 0.9967 | 0.9875 | 110042. | 1.8862 | 0.0095 | 0.0 |
| 0.1458 | 0.3923 | 1.0285 | 1.0283 | 146447. | 1.1277 | 0.0056 | 0.0 |
| 0.1667 | 0.4302 | 1.0436 | 1.0466 | 166024. | 0.3659 | 0.0018 | 0.0 |
| 0.1875 | 0.3464 | 1.0460 | 1.0244 | 126350. | -0.1069 | -0.0001 | 0.0 |
| 0.2083 | 0.2915 | 1.0400 | 1.0018 | 101527. | -0.4133 | -0.0005 | 0.0 |
| 0.2292 | 0.2600 | 1.0337 | 0.9855 | 87866. | -0.0676 | -0.0001 | 0.0 |
| 0.2500 | 0.2497 | 1.0386 | 0.9834 | 83815. | 0.5134 | 0.0015 | 0.0 |
| 0.2708 | 0.2607 | 1.0548 | 0.9970 | 89169. | 1.0440 | 0.0030 | 0.0 |
| 0.2917 | 0.2938 | 1.0794 | 1.0239 | 104684. | 1.1988 | 0.0034 | 0.0 |
| 0.3125 | 0.3527 | 1.1013 | 1.0564 | 132993. | 0.8512 | 0.0024 | 0.0 |
| 0.3333 | 0.4423 | 1.1122 | 1.0874 | 178223. | 0.1283 | 0.0004 | 0.0 |
| 0.3542 | 0.3561 | 1.1064 | 1.0602 | 134966. | -0.6225 | -0.0013 | 0.0 |
| 0.3750 | 0.2950 | 1.0893 | 1.0296 | 105774. | -0.9469 | -0.0020 | 0.0 |
| 0.3958 | 0.2614 | 1.0712 | 1.0060 | 90221. | -0.6607 | -0.0014 | 0.0 |
| 0.4167 | 0.2502 | 1.0650 | 0.9976 | 85201. | 0.0723 | 0.0002 | 0.0 |
| 0.4375 | 0.2610 | 1.0740 | 1.0073 | 90198. | 0.7725 | 0.0018 | 0.0 |
| 0.4583 | 0.2941 | 1.0941 | 1.0318 | 105639. | 1.0460 | 0.0024 | 0.0 |
| 0.4792 | 0.3535 | 1.1135 | 1.0632 | 134227. | 0.7390 | 0.0017 | 0.0 |
| 0.5000 | 0.4443 | 1.1219 | 1.0932 | 180128. | 0.0027 | 0.0000 | 0.0 |
| 0.5208 | 0.3535 | 1.1136 | 1.0632 | 134214. | -0.7348 | -0.0016 | 0.0 |
| 0.5417 | 0.2942 | 1.0943 | 1.0320 | 105693. | -1.0403 | -0.0023 | 0.0 |
| 0.5625 | 0.2610 | 1.0743 | 1.0074 | 90190. | -0.7646 | -0.0017 | 0.0 |
| 0.5833 | 0.2502 | 1.0655 | 0.9979 | 85254. | -0.0597 | -0.0001 | 0.0 |
| 0.6042 | 0.2613 | 1.0720 | 1.0064 | 90237. | 0.6710 | 0.0014 | 0.0 |
| 0.6250 | 0.2952 | 1.0903 | 1.0302 | 105892. | 0.9545 | 0.0020 | 0.0 |
| 0.6458 | 0.3563 | 1.1075 | 1.0609 | 135122. | 0.6305 | 0.0013 | 0.0 |
| 0.6667 | 0.4434 | 1.1137 | 1.0885 | 178930. | -0.0983 | -0.0003 | 0.0 |
| 0.6875 | 0.3530 | 1.1034 | 1.0576 | 133289. | -0.8286 | -0.0022 | 0.0 |
| 0.7083 | 0.2941 | 1.0820 | 1.0255 | 104968. | -1.1717 | -0.0031 | 0.0 |
| 0.7292 | 0.2608 | 1.0582 | 0.9988 | 87356. | -0.9989 | -0.0027 | 0.0 |
| 0.7500 | 0.2500 | 1.0431 | 0.9859 | 84151. | -0.4383 | -0.0012 | 0.0 |
| 0.7708 | 0.2608 | 1.0404 | 0.9894 | 88509. | 0.1948 | 0.0003 | 0.0 |
| 0.7917 | 0.2941 | 1.0491 | 1.0077 | 103166. | 0.5040 | 0.0007 | 0.0 |
| 0.8125 | 0.3530 | 1.0565 | 1.0322 | 130092. | 0.1628 | 0.0002 | 0.0 |
| 0.8333 | 0.4434 | 1.0549 | 1.0561 | 173599. | -0.3604 | -0.0018 | 0.0 |
| 0.8542 | 0.3981 | 1.0394 | 1.0359 | 150039. | -1.1546 | -0.0057 | 0.0 |
| 0.8750 | 0.3205 | 1.0070 | 0.9944 | 112212. | -1.9364 | -0.0097 | 0.0 |
| 0.8958 | 0.2613 | 0.9600 | 0.9459 | 84814. | -2.5201 | -0.0130 | 0.0 |
| 0.9167 | 0.2165 | 0.9041 | 0.8942 | 65115. | -2.8025 | -0.0149 | 0.0 |
| 0.9375 | 0.1837 | 0.8460 | 0.8436 | 51336. | -2.6878 | -0.0147 | 0.0 |
| 0.9583 | 0.1617 | 0.7952 | 0.8011 | 42500. | -2.1363 | -0.0121 | 0.0 |
| 0.9792 | 0.1473 | 0.7595 | 0.7707 | 36983. | -1.2195 | -0.0071 | 0.0 |
| 1.0000 | 0.1440 | 0.7462 | 0.7606 | 35622. | -0.0509 | -0.0003 | 0.0 |

ZONE 3
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUM = 0.9364  N(COF) = 25  N(SIN) = 0

BT

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -0.2156D 00 | -0.8021D-01 | -0.1611D-01 | 0.1304D-01 | 0.2610D-01 | -0.7592D-02 | 0.5718D-02 | 0.2530D-03 | 0.4111D-03 |
| 0.5231D-03 | 0.5200D-03 | 0.2019D-03 | 0.2965D-03 | 0.4639D-03 | 0.2126D-03 | 0.6443D-04 | 0.1973D-03 | 0.2161D-03 |
| 0.6509D-04 | 0.7167D-04 | 0.2211D-03 | 0.6028D-04 | -0.1266D-03 | -0.5809D-04 | 0.4001D-05 | | |

ZONE 3
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.2255 | 0.6653 | 0.7562 | 57876. | 0.0 | 0.0 | 0.0 |
| 0.0417 | 0.1906 | 0.6601 | 0.7364 | 46644. | -0.1815 | -0.0005 | 0.0 |
| 0.0833 | 0.1632 | 0.6567 | 0.7193 | 38520. | 0.0550 | 0.0009 | 0.0 |
| 0.1250 | 0.1512 | 0.6643 | 0.7166 | 35371. | 0.3024 | 0.0049 | 0.0 |
| 0.1667 | 0.1430 | 0.6837 | 0.7229 | 33618. | 0.6607 | 0.0105 | 0.0 |
| 0.2083 | 0.1485 | 0.7192 | 0.7479 | 36201. | 1.0156 | 0.0157 | 0.0 |
| 0.2500 | 0.1606 | 0.7676 | 0.7840 | 41121. | 1.3101 | 0.0196 | 0.0 |
| 0.2917 | 0.1826 | 0.8262 | 0.8318 | 50300. | 1.4525 | 0.0209 | 0.0 |
| 0.3333 | 0.2180 | 0.8859 | 0.8847 | 64919. | 1.4074 | 0.0196 | 0.0 |
| 0.3750 | 0.2593 | 0.9422 | 0.9351 | 83133. | 1.2558 | 0.0169 | 0.0 |
| 0.4167 | 0.3246 | 0.9830 | 0.9852 | 112816. | 0.9402 | 0.0124 | 0.0 |
| 0.4583 | 0.3966 | 1.0204 | 1.0249 | 147624. | 0.5909 | 0.0077 | 0.0 |
| 0.5000 | 0.4572 | 1.0365 | 1.0490 | 178828. | 0.2149 | 0.0028 | 0.0 |
| 0.5417 | 0.3597 | 1.0413 | 1.0256 | 132135. | 0.0180 | 0.0002 | 0.0 |
| 0.5833 | 0.2968 | 1.0376 | 1.0026 | 103684. | -0.1641 | -0.0004 | 0.0 |
| 0.6250 | 0.2616 | 1.0328 | 0.9857 | 88472. | -0.0098 | -0.0000 | 0.0 |
| 0.6667 | 0.2503 | 1.0382 | 0.9835 | 84059. | 0.2634 | 0.0015 | 0.0 |
| 0.7083 | 0.2609 | 1.0548 | 0.9971 | 89224. | 0.5241 | 0.0030 | 0.0 |
| 0.7500 | 0.2944 | 1.0791 | 1.0240 | 104956. | 0.5965 | 0.0034 | 0.0 |
| 0.7917 | 0.3533 | 1.1010 | 1.0565 | 133284. | 0.4213 | 0.0024 | 0.0 |
| 0.8333 | 0.4445 | 1.1115 | 1.0876 | 179332. | 0.0582 | 0.0003 | 0.0 |
| 0.8750 | 0.5565 | 1.1057 | 1.0599 | 135023. | -0.3200 | -0.0014 | 0.0 |
| 0.9167 | 0.2953 | 1.0879 | 1.0290 | 105845. | -0.4363 | -0.0021 | 0.0 |
| 0.9583 | 0.2614 | 1.0694 | 1.0050 | 90158. | -0.3539 | -0.0015 | 0.0 |
| 1.0000 | 0.2505 | 1.0615 | 0.9959 | 85205. | 0.0000 | 0.0000 | 0.0 |

ZONE 4
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUM = 1.0952 N(COF) = 25 N(SIN) = 0

BT

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -0.2439D-02 | -0.1131D-02 | -0.5566D-03 | -0.3832D-03 | -0.2941D-03 | 0.2719D-01 | -0.3529D-04 | 0.7626D-05 | 0.1945D-04 |
| -0.2717D-04 | 0.2500D-04 | 0.5343D-05 | -0.1200D-04 | -0.6682D-05 | -0.2185D-05 | -0.5936D-06 | 0.2414D-06 | 0.3899D-04 |
| 0.4553D-05 | 0.3397D-05 | 0.2291D-05 | 0.2584D-05 | 0.3353D-05 | 0.9058D-04 | 0.2315D-06 | | |

ZONE 4
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.4358 | 1.1177 | 1.0888 | 175397. | 0.0 | 0.0 | 0.0 |
| 0.0417 | 0.3498 | 1.1097 | 1.0599 | 132177. | -0.3555 | -0.0015 | 0.0 |
| 0.0833 | 0.2930 | 1.0912 | 1.0298 | 105001. | -0.4926 | -0.0021 | 0.0 |
| 0.1250 | 0.2603 | 1.0727 | 1.0063 | 89818. | -0.3415 | -0.0015 | 0.0 |
| 0.1667 | 0.2498 | 1.0658 | 0.9979 | 85088. | 0.0246 | 0.0001 | 0.0 |
| 0.2083 | 0.2606 | 1.0746 | 1.0074 | 90061. | 0.3805 | 0.0017 | 0.0 |
| 0.2500 | 0.2940 | 1.0945 | 1.0319 | 105593. | 0.5205 | 0.0023 | 0.0 |
| 0.2917 | 0.3525 | 1.1139 | 1.0631 | 133759. | 0.3718 | 0.0017 | 0.0 |
| 0.3333 | 0.4422 | 1.1224 | 1.0930 | 179090. | 0.0072 | 0.0000 | 0.0 |
| 0.3750 | 0.3530 | 1.1144 | 1.0635 | 134055. | -0.3594 | -0.0016 | 0.0 |
| 0.4167 | 0.2940 | 1.0936 | 1.0325 | 105663. | -0.5071 | -0.0022 | 0.0 |
| 0.4583 | 0.2608 | 1.0764 | 1.0085 | 90239. | -0.3591 | -0.0015 | 0.0 |
| 0.5000 | 0.2499 | 1.0688 | 0.9995 | 85281. | 0.0073 | 0.0000 | 0.0 |
| 0.5417 | 0.2608 | 1.0769 | 1.0088 | 90268. | 0.3702 | 0.0017 | 0.0 |
| 0.5833 | 0.2940 | 1.0965 | 1.0330 | 105723. | 0.5159 | 0.0023 | 0.0 |
| 0.6250 | 0.3531 | 1.1158 | 1.0643 | 134156. | 0.3678 | 0.0016 | 0.0 |
| 0.6667 | 0.4432 | 1.1241 | 1.0941 | 179782. | 0.0017 | 0.0000 | 0.0 |
| 0.7083 | 0.3532 | 1.1159 | 1.0644 | 134209. | -0.3649 | -0.0016 | 0.0 |
| 0.7500 | 0.2940 | 1.0968 | 1.0332 | 105750. | -0.5126 | -0.0023 | 0.0 |
| 0.7917 | 0.2609 | 1.0773 | 1.0090 | 90294. | -0.3650 | -0.0016 | 0.0 |
| 0.8333 | 0.2499 | 1.0695 | 0.9999 | 85320. | 0.0009 | 0.0000 | 0.0 |
| 0.8750 | 0.2609 | 1.0774 | 1.0090 | 90293. | 0.3663 | 0.0016 | 0.0 |
| 0.9167 | 0.2940 | 1.0969 | 1.0332 | 105746. | 0.5137 | 0.0023 | 0.0 |
| 0.9583 | 0.3531 | 1.1160 | 1.0644 | 134192. | 0.3663 | 0.0016 | 0.0 |
| 1.0000 | 0.4435 | 1.1243 | 1.0945 | 179833. | -0.0000 | -0.0000 | 0.0 |

ZONE 5
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUW = 1.0936 N(COF) = 25 N(SIN) = 0

BT

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -0.4068D-02 | -0.1141D-02 | -0.1648D-04 | 0.3712D-03 | 0.4843D-03 | -0.2706D-01 | 0.6053D-04 | -0.6995D-05 | -0.1413D-05 |
| 0.2255D-04 | 0.3679D-04 | 0.5018D-05 | -0.2238D-04 | -0.7666D-05 | -0.3178D-06 | 0.2793D-05 | 0.2613D-05 | -0.4356D-04 |
| -0.3905D-05 | -0.2267D-06 | 0.8126D-06 | 0.3773D-05 | 0.3533D-05 | 0.3786D-05 | -0.1877D-05 | | |

ZONE 5
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.2495 | 1.0623 | 0.9958 | 84797. | 0.0 | 0.0 | 0.0 |
| 0.0417 | 0.2601 | 1.0701 | 1.0049 | 89650. | 0.3570 | 0.0016 | 0.0 |
| 0.0833 | 0.2928 | 1.0890 | 1.0286 | 104795. | 0.5013 | 0.0022 | 0.0 |
| 0.1250 | 0.3497 | 1.1079 | 1.0590 | 132030. | 0.3608 | 0.0015 | 0.0 |
| 0.1667 | 0.4345 | 1.1160 | 1.0876 | 174537. | 0.0076 | 0.0000 | 0.0 |
| 0.2083 | 0.3499 | 1.1085 | 1.0594 | 132175. | -0.3486 | -0.0015 | 0.0 |
| 0.2500 | 0.2932 | 1.0901 | 1.0293 | 105002. | -0.4869 | -0.0021 | 0.0 |
| 0.2917 | 0.2602 | 1.0720 | 1.0059 | 89763. | -0.3360 | -0.0015 | 0.0 |
| 0.3333 | 0.2498 | 1.0652 | 0.9976 | 85086. | 0.0307 | 0.0001 | 0.0 |
| 0.3750 | 0.2606 | 1.0743 | 1.0073 | 90026. | 0.3847 | 0.0018 | 0.0 |
| 0.4167 | 0.2941 | 1.0942 | 1.0318 | 105620. | 0.5227 | 0.0024 | 0.0 |
| 0.4583 | 0.3525 | 1.1138 | 1.0630 | 133736. | 0.3736 | 0.0017 | 0.0 |
| 0.5000 | 0.4425 | 1.1422 | 1.0929 | 179226. | 0.0085 | 0.0000 | 0.0 |
| 0.5417 | 0.3529 | 1.1145 | 1.0635 | 134019. | -0.3590 | -0.0016 | 0.0 |
| 0.5833 | 0.2942 | 1.0955 | 1.0325 | 105744. | -0.5064 | -0.0022 | 0.0 |
| 0.6250 | 0.2607 | 1.0764 | 1.0085 | 90197. | -0.3593 | -0.0016 | 0.0 |
| 0.6667 | 0.2501 | 1.0687 | 0.9995 | 85333. | 0.0074 | 0.0000 | 0.0 |
| 0.7083 | 0.2607 | 1.0770 | 1.0088 | 90219. | 0.3705 | 0.0017 | 0.0 |
| 0.7500 | 0.2942 | 1.0964 | 1.0330 | 105788. | 0.5155 | 0.0023 | 0.0 |
| 0.7917 | 0.3529 | 1.1158 | 1.0642 | 134086. | 0.3681 | 0.0016 | 0.0 |
| 0.8333 | 0.4435 | 1.1240 | 1.0941 | 179925. | 0.0015 | 0.0000 | 0.0 |
| 0.8750 | 0.3531 | 1.1150 | 1.0644 | 134172. | -0.3653 | -0.0016 | 0.0 |
| 0.9167 | 0.2941 | 1.0967 | 1.0332 | 105779. | -0.5127 | -0.0023 | 0.0 |
| 0.9583 | 0.2608 | 1.0774 | 1.0090 | 90270. | -0.3656 | -0.0016 | 0.0 |
| 1.0000 | 0.2500 | 1.0693 | 0.9998 | 85340. | 0.0000 | 0.0000 | 0.0 |

ZONE 6
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUM = 1.0968 N(COF) = 25 N(SIN) = 0

BT

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -0.9620D-04 | -0.2699D-04 | 0.1095D-04 | -0.3886D-05 | 0.2047D-04 | -0.2735D-01 | 0.6587D-05 | -0.3965D-05 | 0.1036D-05 |
| -0.2958D-07 | 0.9810D-06 | 0.7107D-05 | -0.2164D-05 | 0.1304D-05 | -0.3990D-07 | 0.9019D-06 | -0.6521D-06 | -0.4117D-04 |
| -0.1217D-06 | -0.8891D-07 | 0.1359D-05 | -0.6000D-07 | -0.2934D-06 | 0.5971D-05 | -0.5911D-06 | | |

ZONE 6
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.2500 | 1.0693 | 0.9998 | 85330. | 0.0 | 0.0 | 0.0 |
| 0.0417 | 0.2608 | 1.0774 | 1.0090 | 90259. | 0.3657 | 0.0016 | 0.0 |
| 0.0833 | 0.2941 | 1.0967 | 1.0331 | 105754. | 0.5130 | 0.0023 | 0.0 |
| 0.1250 | 0.3529 | 1.1160 | 1.0643 | 134104. | 0.3662 | 0.0016 | 0.0 |
| 0.1667 | 0.4432 | 1.1241 | 1.0941 | 179745. | 0.0002 | 0.0000 | 0.0 |
| 0.2083 | 0.3528 | 1.1160 | 1.0643 | 134063. | -0.3661 | -0.0015 | 0.0 |
| 0.2500 | 0.2941 | 1.0967 | 1.0332 | 105790. | -0.5125 | -0.0023 | 0.0 |
| 0.2917 | 0.2607 | 1.0774 | 1.0090 | 90235. | -0.3654 | -0.0016 | 0.0 |
| 0.3333 | 0.2501 | 1.0694 | 0.9999 | 85360. | 0.0007 | 0.0000 | 0.0 |
| 0.3750 | 0.2607 | 1.0775 | 1.0090 | 90242. | 0.3664 | 0.0016 | 0.0 |
| 0.4167 | 0.2942 | 1.0968 | 1.0332 | 105805. | 0.5133 | 0.0023 | 0.0 |
| 0.4583 | 0.3529 | 1.1161 | 1.0644 | 134100. | 0.3666 | 0.0015 | 0.0 |
| 0.5000 | 0.4434 | 1.1242 | 1.0942 | 179871. | 0.0003 | 0.0000 | 0.0 |
| 0.5417 | 0.3530 | 1.1162 | 1.0644 | 134150. | -0.3661 | -0.0016 | 0.0 |
| 0.5833 | 0.2941 | 1.0969 | 1.0332 | 105776. | -0.5131 | -0.0023 | 0.0 |
| 0.6250 | 0.2608 | 1.0775 | 1.0091 | 90272. | -0.3656 | -0.0015 | 0.0 |
| 0.6667 | 0.2500 | 1.0695 | 0.9999 | 85342. | 0.0003 | 0.0000 | 0.0 |
| 0.7083 | 0.2608 | 1.0776 | 1.0091 | 90273. | 0.3661 | 0.0016 | 0.0 |
| 0.7500 | 0.2941 | 1.0969 | 1.0333 | 105778. | 0.5135 | 0.0023 | 0.0 |
| 0.7917 | 0.3530 | 1.1162 | 1.0645 | 134154. | 0.3665 | 0.0016 | 0.0 |
| 0.8333 | 0.4434 | 1.1243 | 1.0943 | 179877. | 0.0002 | 0.0000 | 0.0 |
| 0.8750 | 0.3529 | 1.1162 | 1.0645 | 134124. | -0.3671 | -0.0016 | 0.0 |
| 0.9167 | 0.2940 | 1.0969 | 1.0332 | 105751. | -0.5140 | -0.0023 | 0.0 |
| 0.9583 | 0.2607 | 1.0775 | 1.0090 | 90244. | -0.3663 | -0.0016 | 0.0 |
| 1.0000 | 0.2500 | 1.0695 | 0.9999 | 85329. | 0.0000 | 0.0000 | 0.0 |

ZONE 7
********

COEFFICIENTS OF FOURIER SERIES FOR THE WALL SHEAR STRESS DISTRIBUTION

TAUM = 1.0969 N(COF) = 5 N(SIN) = 0

BT

-0.2731D-01 0.7971D-07 -0.5537D-04 0.4065D-04 -0.1698D-04



ZONE 7
********

| X | YM | T | ETA | RE(LOC) | DT | AMPL. OF SEC. FLOW | DUP(RAU) |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.2500 | 1.0695 | 0.9999 | 85355. | 0.0 | 0.0 | 0.0 |
| 0.2500 | 0.2008 | 1.0776 | 1.0091 | 90300. | 0.0609 | 0.0016 | 0.0 |
| 0.5000 | 0.2942 | 1.0969 | 1.0333 | 105804. | 0.0854 | 0.0023 | 0.0 |
| 0.7500 | 0.3531 | 1.1161 | 1.0644 | 134174. | 0.0609 | 0.0016 | 0.0 |
| 1.0000 | 0.4429 | 1.1243 | 1.0942 | 179650. | -0.0000 | -0.0000 | 0.0 |

ZONE 1, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00117 |
| 0.20000 | 0.00248 |
| 0.30000 | 0.00399 |
| 0.40000 | 0.00578 |
| 0.50000 | 0.00805 |
| 0.60000 | 0.01167 |
| 0.70000 | 0.02711 |
| 0.80000 | 0.06202 |
| 0.90000 | 0.13739 |
| 0.95000 | 0.20043 |
| 1.00000 | 0.28729 |
| 1.05000 | 0.40442 |
| 1.10000 | 0.56375 |
| 1.15000 | 0.82967 |
| 1.15946 | 1.00000 |

ZONE 1, X=0.0417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00146 |
| 0.20000 | 0.00309 |
| 0.30000 | 0.00496 |
| 0.40000 | 0.00720 |
| 0.50000 | 0.01004 |
| 0.60000 | 0.01478 |
| 0.70000 | 0.03438 |
| 0.80000 | 0.07841 |
| 0.90000 | 0.17195 |
| 0.95000 | 0.24877 |
| 1.00000 | 0.35328 |
| 1.05000 | 0.49417 |
| 1.10000 | 0.69869 |
| 1.12887 | 1.00000 |

ZONE 1, X=0.0833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00187 |
| 0.20000 | 0.00398 |
| 0.30000 | 0.00641 |
| 0.40000 | 0.00932 |
| 0.50000 | 0.01305 |
| 0.60000 | 0.02023 |
| 0.70000 | 0.04741 |
| 0.80000 | 0.10816 |
| 0.90000 | 0.23434 |
| 0.95000 | 0.33561 |
| 1.00000 | 0.47266 |
| 1.05000 | 0.66841 |
| 1.08424 | 1.00000 |

ZONE 1, X=0.1250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00249 |
| 0.20000 | 0.00530 |
| 0.30000 | 0.00856 |
| 0.40000 | 0.01249 |
| 0.50000 | 0.01763 |
| 0.60000 | 0.02980 |
| 0.70000 | 0.07067 |
| 0.80000 | 0.16109 |
| 0.90000 | 0.34286 |
| 0.95000 | 0.48680 |
| 1.00000 | 0.69789 |
| 1.02784 | 1.00000 |

ZONE 1, X=0.1667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00333 |
| 0.20000 | 0.00711 |
| 0.30000 | 0.01152 |
| 0.40000 | 0.01691 |
| 0.50000 | 0.02414 |
| 0.60000 | 0.04583 |
| 0.70000 | 0.11006 |
| 0.80000 | 0.24918 |
| 0.90000 | 0.52149 |
| 0.95000 | 0.77116 |
| 0.98562 | 1.00000 |

ZONE 1, X=0.2083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00431 |
| 0.20000 | 0.00923 |
| 0.30000 | 0.01501 |
| 0.40000 | 0.02219 |
| 0.50000 | 0.03211 |
| 0.60000 | 0.06855 |
| 0.70000 | 0.16575 |
| 0.80000 | 0.37023 |
| 0.90000 | 0.82196 |
| 0.90920 | 1.00000 |

ZONE 1, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00509 |
| 0.20000 | 0.01092 |
| 0.30000 | 0.01782 |
| 0.40000 | 0.02649 |
| 0.50000 | 0.03882 |
| 0.60000 | 0.09049 |
| 0.70000 | 0.21910 |
| 0.80000 | 0.48530 |
| 0.87110 | 1.00000 |

ZONE 1, X=0.2917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00526 |
| 0.20000 | 0.01129 |
| 0.30000 | 0.01843 |
| 0.40000 | 0.02742 |
| 0.50000 | 0.04028 |
| 0.60000 | 0.09519 |
| 0.70000 | 0.23032 |
| 0.80000 | 0.50959 |
| 0.86442 | 1.00000 |

ZONE 1, X=0.3333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00466 |
| 0.20000 | 0.00998 |
| 0.30000 | 0.01626 |
| 0.40000 | 0.02411 |
| 0.50000 | 0.03514 |
| 0.60000 | 0.07880 |
| 0.70000 | 0.19101 |
| 0.80000 | 0.42502 |
| 0.88953 | 1.00000 |

ZONE 1, X=0.3750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00372 |
| 0.20000 | 0.00795 |
| 0.30000 | 0.01291 |
| 0.40000 | 0.01901 |
| 0.50000 | 0.02730 |
| 0.60000 | 0.05471 |
| 0.70000 | 0.13199 |
| 0.80000 | 0.29743 |
| 0.90000 | 0.62507 |
| 0.94027 | 1.00000 |

ZONE 1, X=0.4167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00279 |
| 0.20000 | 0.00595 |
| 0.30000 | 0.00962 |
| 0.40000 | 0.01408 |
| 0.50000 | 0.01998 |
| 0.60000 | 0.03582 |
| 0.70000 | 0.08567 |
| 0.80000 | 0.19533 |
| 0.90000 | 0.41280 |
| 0.95000 | 0.58849 |
| 0.99984 | 1.00000 |

ZONE 1, X=0.4583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00211 |
| 0.20000 | 0.00448 |
| 0.30000 | 0.00721 |
| 0.40000 | 0.01051 |
| 0.50000 | 0.01477 |
| 0.60000 | 0.02390 |
| 0.70000 | 0.05640 |
| 0.80000 | 0.12889 |
| 0.90000 | 0.27761 |
| 0.95000 | 0.39588 |
| 1.00000 | 0.55812 |
| 1.05000 | 0.83144 |
| 1.05896 | 1.00000 |

ZONE 1, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00159 |
| 0.20000 | 0.00338 |
| 0.30000 | 0.00545 |
| 0.40000 | 0.00791 |
| 0.50000 | 0.01107 |
| 0.60000 | 0.01695 |
| 0.70000 | 0.03972 |
| 0.80000 | 0.09100 |
| 0.90000 | 0.19924 |
| 0.95000 | 0.28736 |
| 1.00000 | 0.40678 |
| 1.05000 | 0.57027 |
| 1.10000 | 0.85461 |
| 1.10680 | 1.00000 |

ZONE 1, X=0.5417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00127 |
| 0.20000 | 0.00269 |
| 0.30000 | 0.00433 |
| 0.40000 | 0.00628 |
| 0.50000 | 0.00877 |
| 0.60000 | 0.01301 |
| 0.70000 | 0.03038 |
| 0.80000 | 0.06970 |
| 0.90000 | 0.15422 |
| 0.95000 | 0.22443 |
| 1.00000 | 0.32065 |
| 1.05000 | 0.45031 |
| 1.10000 | 0.63126 |
| 1.14264 | 1.00000 |

ZONE 1, X=0.5833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00135 |
| 0.20000 | 0.00288 |
| 0.30000 | 0.00463 |
| 0.40000 | 0.00672 |
| 0.50000 | 0.00939 |
| 0.60000 | 0.01417 |
| 0.70000 | 0.03318 |
| 0.80000 | 0.07620 |
| 0.90000 | 0.16830 |
| 0.95000 | 0.24437 |
| 1.00000 | 0.34819 |
| 1.05000 | 0.48838 |
| 1.10000 | 0.69117 |
| 1.13007 | 1.00000 |

ZONE 1, X=0.6250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00174 |
| 0.20000 | 0.00370 |
| 0.30000 | 0.00596 |
| 0.40000 | 0.00867 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01891 |
| 0.70000 | 0.04442 |
| 0.80000 | 0.10171 |
| 0.90000 | 0.22166 |
| 0.95000 | 0.31851 |
| 1.00000 | 0.44962 |
| 1.05000 | 0.63350 |
| 1.09153 | 1.00000 |

ZONE 1, X=0.6667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00226 |
| 0.20000 | 0.00480 |
| 0.30000 | 0.00775 |
| 0.40000 | 0.01132 |
| 0.50000 | 0.01597 |
| 0.60000 | 0.02712 |
| 0.70000 | 0.06453 |
| 0.80000 | 0.14801 |
| 0.90000 | 0.31783 |
| 0.95000 | 0.45262 |
| 1.00000 | 0.64396 |
| 1.03828 | 1.00000 |

ZONE 1, X=0.7083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00307 |
| 0.20000 | 0.00655 |
| 0.30000 | 0.01061 |
| 0.40000 | 0.01556 |
| 0.50000 | 0.02218 |
| 0.60000 | 0.04147 |
| 0.70000 | 0.09965 |
| 0.80000 | 0.22670 |
| 0.90000 | 0.47654 |
| 0.95000 | 0.68923 |
| 0.97856 | 1.00000 |

ZONE 1, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00403 |
| 0.20000 | 0.00862 |
| 0.30000 | 0.01403 |
| 0.40000 | 0.02075 |
| 0.50000 | 0.03009 |
| 0.60000 | 0.06523 |
| 0.70000 | 0.15874 |
| 0.80000 | 0.35717 |
| 0.90000 | 0.78319 |
| 0.91352 | 1.00000 |

ZONE 1, X=0.7917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00514 |
| 0.20000 | 0.01103 |
| 0.30000 | 0.01804 |
| 0.40000 | 0.02689 |
| 0.50000 | 0.03966 |
| 0.60000 | 0.09638 |
| 0.70000 | 0.23443 |
| 0.80000 | 0.52092 |
| 0.86109 | 1.00000 |

ZONE 1, X=0.8333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00575 |
| 0.20000 | 0.01239 |
| 0.30000 | 0.02035 |
| 0.40000 | 0.03062 |
| 0.50000 | 0.04500 |
| 0.60000 | 0.12704 |
| 0.70000 | 0.31025 |
| 0.80000 | 0.70802 |
| 0.82252 | 1.00000 |

ZONE 1, X=0.8750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00582 |
| 0.20000 | 0.01235 |
| 0.30000 | 0.02065 |
| 0.40000 | 0.03116 |
| 0.50000 | 0.05076 |
| 0.60000 | 0.13531 |
| 0.70000 | 0.33126 |
| 0.80000 | 0.77467 |
| 0.81341 | 1.00000 |

ZONE 1, X=0.9167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00511 |
| 0.20000 | 0.01104 |
| 0.30000 | 0.01820 |
| 0.40000 | 0.02754 |
| 0.50000 | 0.04665 |
| 0.60000 | 0.12621 |
| 0.70000 | 0.31409 |
| 0.80000 | 0.73311 |
| 0.81850 | 1.00000 |

ZONE 1, X=0.9583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00431 |
| 0.20000 | 0.00929 |
| 0.30000 | 0.01529 |
| 0.40000 | 0.02308 |
| 0.50000 | 0.03786 |
| 0.60000 | 0.10252 |
| 0.70000 | 0.25841 |
| 0.80000 | 0.59313 |
| 0.84242 | 1.00000 |

ZONE 1, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00463 |
| 0.20000 | 0.00869 |
| 0.30000 | 0.01431 |
| 0.40000 | 0.02161 |
| 0.50000 | 0.03581 |
| 0.60000 | 0.09747 |
| 0.70000 | 0.24743 |
| 0.80000 | 0.57038 |
| 0.84701 | 1.00000 |

ZONE 2, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00552 |
| 0.20000 | 0.01182 |
| 0.30000 | 0.01925 |
| 0.40000 | 0.02853 |
| 0.50000 | 0.04154 |
| 0.60000 | 0.09266 |
| 0.70000 | 0.22431 |
| 0.80000 | 0.50322 |
| 0.86295 | 1.00000 |

ZONE 2, X=0.0208

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00535 |
| 0.20000 | 0.01146 |
| 0.30000 | 0.01865 |
| 0.40000 | 0.02760 |
| 0.50000 | 0.04004 |
| 0.60000 | 0.08709 |
| 0.70000 | 0.21051 |
| 0.80000 | 0.47176 |
| 0.87160 | 1.00000 |

ZONE 2, X=0.0417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00458 |
| 0.20000 | 0.00999 |
| 0.30000 | 0.01622 |
| 0.40000 | 0.02389 |
| 0.50000 | 0.03434 |
| 0.60000 | 0.06942 |
| 0.70000 | 0.16743 |
| 0.80000 | 0.37682 |
| 0.90000 | 0.91617 |
| 0.90190 | 1.00000 |

ZONE 2, X=0.0625

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00381 |
| 0.20000 | 0.00812 |
| 0.30000 | 0.01314 |
| 0.40000 | 0.01925 |
| 0.50000 | 0.02730 |
| 0.60000 | 0.04997 |
| 0.70000 | 0.11976 |
| 0.80000 | 0.27176 |
| 0.90000 | 0.53264 |
| 0.94643 | 1.00000 |

ZONE 2, X=0.0833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00304 |
| 0.20000 | 0.00647 |
| 0.30000 | 0.01043 |
| 0.40000 | 0.01520 |
| 0.50000 | 0.02139 |
| 0.60000 | 0.03500 |
| 0.70000 | 0.08288 |
| 0.80000 | 0.18875 |
| 0.90000 | 0.40469 |
| 0.95000 | 0.58671 |
| 0.99627 | 1.00000 |

ZONE 2, X=0.1042

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00237 |
| 0.20000 | 0.00502 |
| 0.30000 | 0.00807 |
| 0.40000 | 0.01172 |
| 0.50000 | 0.01635 |
| 0.60000 | 0.02423 |
| 0.70000 | 0.05666 |
| 0.80000 | 0.12905 |
| 0.90000 | 0.28025 |
| 0.95000 | 0.40441 |
| 1.00000 | 0.58331 |
| 1.04730 | 1.00000 |

ZONE 2, X=0.1250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00187 |
| 0.20000 | 0.00396 |
| 0.30000 | 0.00635 |
| 0.40000 | 0.00918 |
| 0.50000 | 0.01274 |
| 0.60000 | 0.01780 |
| 0.70000 | 0.04039 |
| 0.80000 | 0.09175 |
| 0.90000 | 0.20121 |
| 0.95000 | 0.29237 |
| 1.00000 | 0.41995 |
| 1.05000 | 0.60631 |
| 1.09207 | 1.00000 |

ZONE 2, X=0.1458

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00146 |
| 0.20000 | 0.00310 |
| 0.30000 | 0.00498 |
| 0.40000 | 0.00716 |
| 0.50000 | 0.00969 |
| 0.60000 | 0.01371 |
| 0.70000 | 0.02959 |
| 0.80000 | 0.06721 |
| 0.90000 | 0.14880 |
| 0.95000 | 0.21809 |
| 1.00000 | 0.31586 |
| 1.05000 | 0.45386 |
| 1.10000 | 0.66471 |
| 1.12986 | 1.00000 |

ZONE 2, X=0.1667

| J/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00131 |
| 0.20000 | 0.00278 |
| 0.30000 | 0.00445 |
| 0.40000 | 0.00642 |
| 0.50000 | 0.00886 |
| 0.60000 | 0.01223 |
| 0.70000 | 0.02576 |
| 0.80000 | 0.05846 |
| 0.90000 | 0.12975 |
| 0.95000 | 0.19076 |
| 1.00000 | 0.27735 |
| 1.05000 | 0.39943 |
| 1.10000 | 0.57822 |
| 1.14672 | 1.00000 |

ZONE 2, X=0.1875

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00163 |
| 0.20000 | 0.00344 |
| 0.30000 | 0.00551 |
| 0.40000 | 0.00794 |
| 0.50000 | 0.01096 |
| 0.60000 | 0.01512 |
| 0.70000 | 0.03152 |
| 0.80000 | 0.07082 |
| 0.90000 | 0.15487 |
| 0.95000 | 0.22543 |
| 1.00000 | 0.32411 |
| 1.05000 | 0.46218 |
| 1.10000 | 0.67149 |
| 1.12962 | 1.00000 |

ZONE 2, X=0.2083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00195 |
| 0.20000 | 0.00412 |
| 0.30000 | 0.00659 |
| 0.40000 | 0.00950 |
| 0.50000 | 0.01311 |
| 0.60000 | 0.01811 |
| 0.70000 | 0.03794 |
| 0.80000 | 0.08477 |
| 0.90000 | 0.18334 |
| 0.95000 | 0.26479 |
| 1.00000 | 0.37763 |
| 1.05000 | 0.53645 |
| 1.10000 | 0.80999 |
| 1.11027 | 1.00000 |

ZONE 2, X=0.2292

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00219 |
| 0.20000 | 0.00464 |
| 0.30000 | 0.00743 |
| 0.40000 | 0.01072 |
| 0.50000 | 0.01480 |
| 0.60000 | 0.02048 |
| 0.70000 | 0.04320 |
| 0.80000 | 0.09617 |
| 0.90000 | 0.20642 |
| 0.95000 | 0.29658 |
| 1.00000 | 0.42100 |
| 1.05000 | 0.59909 |
| 1.09573 | 1.00000 |

ZONE 2, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00227 |
| 0.20000 | 0.00481 |
| 0.30000 | 0.00770 |
| 0.40000 | 0.01110 |
| 0.50000 | 0.01532 |
| 0.60000 | 0.02116 |
| 0.70000 | 0.04421 |
| 0.80000 | 0.09810 |
| 0.90000 | 0.20975 |
| 0.95000 | 0.30073 |
| 1.00000 | 0.42600 |
| 1.05000 | 0.60533 |
| 1.09467 | 1.00000 |

ZONE 2, X=0.2708

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00214 |
| 0.20000 | 0.00453 |
| 0.30000 | 0.00725 |
| 0.40000 | 0.01044 |
| 0.50000 | 0.01439 |
| 0.60000 | 0.01980 |
| 0.70000 | 0.04029 |
| 0.80000 | 0.08919 |
| 0.90000 | 0.19084 |
| 0.95000 | 0.27402 |
| 1.00000 | 0.38848 |
| 1.05000 | 0.54889 |
| 1.10000 | 0.83083 |
| 1.10836 | 1.00000 |

ZONE 2, X=0.2917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00186 |
| 0.20000 | 0.00393 |
| 0.30000 | 0.00627 |
| 0.40000 | 0.00902 |
| 0.50000 | 0.01241 |
| 0.60000 | 0.01699 |
| 0.70000 | 0.03328 |
| 0.80000 | 0.07355 |
| 0.90000 | 0.15803 |
| 0.95000 | 0.22792 |
| 1.00000 | 0.32457 |
| 1.05000 | 0.45796 |
| 1.10000 | 0.65477 |
| 1.13414 | 1.00000 |

ZONE 2, X=0.3125

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00152 |
| 0.20000 | 0.00324 |
| 0.30000 | 0.00511 |
| 0.40000 | 0.00735 |
| 0.50000 | 0.01008 |
| 0.60000 | 0.01375 |
| 0.70000 | 0.02610 |
| 0.80000 | 0.05772 |
| 0.90000 | 0.12488 |
| 0.95000 | 0.18126 |
| 1.00000 | 0.26019 |
| 1.05000 | 0.36954 |
| 1.10000 | 0.52269 |
| 1.15000 | 0.77811 |
| 1.16389 | 1.00000 |

ZONE 2, X=0.3333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00120 |
| 0.20000 | 0.00253 |
| 0.30000 | 0.00404 |
| 0.40000 | 0.00580 |
| 0.50000 | 0.00795 |
| 0.60000 | 0.01082 |
| 0.70000 | 0.02027 |
| 0.80000 | 0.04504 |
| 0.90000 | 0.09845 |
| 0.95000 | 0.14406 |
| 1.00000 | 0.20883 |
| 1.05000 | 0.29960 |
| 1.10000 | 0.42664 |
| 1.15000 | 0.61451 |
| 1.19001 | 1.00000 |

ZONE 2, X=0.3542

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00724 |
| 0.50000 | 0.00993 |
| 0.60000 | 0.01353 |
| 0.70000 | 0.02547 |
| 0.80000 | 0.05625 |
| 0.90000 | 0.12163 |
| 0.95000 | 0.17657 |
| 1.00000 | 0.25349 |
| 1.05000 | 0.35987 |
| 1.10000 | 0.50882 |
| 1.15000 | 0.74903 |
| 1.16775 | 1.00000 |

ZONE 2, X=0.3750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00387 |
| 0.30000 | 0.00618 |
| 0.40000 | 0.00889 |
| 0.50000 | 0.01221 |
| 0.60000 | 0.01669 |
| 0.70000 | 0.03217 |
| 0.80000 | 0.07089 |
| 0.90000 | 0.15208 |
| 0.95000 | 0.21927 |
| 1.00000 | 0.31220 |
| 1.05000 | 0.44011 |
| 1.10000 | 0.62541 |
| 1.14030 | 1.00000 |

ZONE 2, X=0.3958

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00216 |
| 0.20000 | 0.00445 |
| 0.30000 | 0.00711 |
| 0.40000 | 0.01023 |
| 0.50000 | 0.01407 |
| 0.60000 | 0.01930 |
| 0.70000 | 0.03826 |
| 0.80000 | 0.08419 |
| 0.90000 | 0.17971 |
| 0.95000 | 0.25791 |
| 1.00000 | 0.36538 |
| 1.05000 | 0.51438 |
| 1.10000 | 0.75108 |
| 1.11312 | 1.00000 |

ZONE 2, X=0.4167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00221 |
| 0.20000 | 0.00467 |
| 0.30000 | 0.00747 |
| 0.40000 | 0.01076 |
| 0.50000 | 0.01481 |
| 0.60000 | 0.02034 |
| 0.70000 | 0.04062 |
| 0.80000 | 0.08951 |
| 0.90000 | 0.19066 |
| 0.95000 | 0.27313 |
| 1.00000 | 0.38629 |
| 1.05000 | 0.54415 |
| 1.10000 | 0.81417 |
| 1.11019 | 1.00000 |

ZONE 2, X=0.4375

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00444 |
| 0.30000 | 0.00710 |
| 0.40000 | 0.01021 |
| 0.50000 | 0.01404 |
| 0.60000 | 0.01925 |
| 0.70000 | 0.03793 |
| 0.80000 | 0.08353 |
| 0.90000 | 0.17819 |
| 0.95000 | 0.25569 |
| 1.00000 | 0.36217 |
| 1.05000 | 0.50959 |
| 1.10000 | 0.74137 |
| 1.11958 | 1.00000 |

ZONE 2, X=0.4583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00617 |
| 0.40000 | 0.00887 |
| 0.50000 | 0.01218 |
| 0.60000 | 0.01663 |
| 0.70000 | 0.03180 |
| 0.80000 | 0.06997 |
| 0.90000 | 0.14993 |
| 0.95000 | 0.21609 |
| 1.00000 | 0.30757 |
| 1.05000 | 0.43333 |
| 1.10000 | 0.61433 |
| 1.14281 | 1.00000 |

ZONE 2, X=0.4792

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00724 |
| 0.50000 | 0.00992 |
| 0.60000 | 0.01350 |
| 0.70000 | 0.02512 |
| 0.80000 | 0.05534 |
| 0.90000 | 0.11942 |
| 0.95000 | 0.17323 |
| 1.00000 | 0.24852 |
| 1.05000 | 0.35256 |
| 1.10000 | 0.49756 |
| 1.15000 | 0.72608 |
| 1.17122 | 1.00000 |

ZONE 2, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00249 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00782 |
| 0.60000 | 0.01063 |
| 0.70000 | 0.01962 |
| 0.80000 | 0.04346 |
| 0.90000 | 0.09477 |
| 0.95000 | 0.13858 |
| 1.00000 | 0.20079 |
| 1.05000 | 0.28796 |
| 1.10000 | 0.40968 |
| 1.15000 | 0.58707 |
| 1.19610 | 1.00000 |

ZONE 2, X=0.5208

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00724 |
| 0.50000 | 0.00992 |
| 0.60000 | 0.01350 |
| 0.70000 | 0.02511 |
| 0.80000 | 0.05532 |
| 0.90000 | 0.11939 |
| 0.95000 | 0.17319 |
| 1.00000 | 0.24846 |
| 1.05000 | 0.35246 |
| 1.10000 | 0.49751 |
| 1.15000 | 0.72576 |
| 1.17127 | 1.00000 |

ZONE 2, X=0.5417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00617 |
| 0.40000 | 0.00887 |
| 0.50000 | 0.01217 |
| 0.60000 | 0.01662 |
| 0.70000 | 0.03177 |
| 0.80000 | 0.06990 |
| 0.90000 | 0.14978 |
| 0.95000 | 0.21588 |
| 1.00000 | 0.30727 |
| 1.05000 | 0.43290 |
| 1.10000 | 0.61367 |
| 1.14296 | 1.00000 |

ZONE 2, X=0.5625

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00444 |
| 0.30000 | 0.00710 |
| 0.40000 | 0.01021 |
| 0.50000 | 0.01404 |
| 0.60000 | 0.01925 |
| 0.70000 | 0.03790 |
| 0.80000 | 0.08345 |
| 0.90000 | 0.17802 |
| 0.95000 | 0.25544 |
| 1.00000 | 0.36180 |
| 1.05000 | 0.50903 |
| 1.10000 | 0.74026 |
| 1.11975 | 1.00000 |

ZONE 2, X=0.5833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00221 |
| 0.20000 | 0.00467 |
| 0.30000 | 0.00747 |
| 0.40000 | 0.01075 |
| 0.50000 | 0.01480 |
| 0.60000 | 0.02031 |
| 0.70000 | 0.04054 |
| 0.80000 | 0.08932 |
| 0.90000 | 0.19024 |
| 0.95000 | 0.27254 |
| 1.00000 | 0.38544 |
| 1.05000 | 0.54288 |
| 1.10000 | 0.81101 |
| 1.11053 | 1.00000 |

ZONE 2, X=0.6042

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00444 |
| 0.30000 | 0.00710 |
| 0.40000 | 0.01022 |
| 0.50000 | 0.01406 |
| 0.60000 | 0.01928 |
| 0.70000 | 0.03811 |
| 0.80000 | 0.08398 |
| 0.90000 | 0.17924 |
| 0.95000 | 0.25722 |
| 1.00000 | 0.36439 |
| 1.05000 | 0.51290 |
| 1.10000 | 0.74807 |
| 1.11857 | 1.00000 |

ZONE 2, X=0.6250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00387 |
| 0.30000 | 0.00618 |
| 0.40000 | 0.00688 |
| 0.50000 | 0.01219 |
| 0.60000 | 0.01566 |
| 0.70000 | 0.03206 |
| 0.80000 | 0.07063 |
| 0.90000 | 0.15149 |
| 0.95000 | 0.21841 |
| 1.00000 | 0.31097 |
| 1.05000 | 0.43834 |
| 1.10000 | 0.62257 |
| 1.14092 | 1.00000 |

ZONE 2, X=0.6458

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00515 |
| 0.30000 | 0.00503 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00991 |
| 0.60000 | 0.01350 |
| 0.70000 | 0.02537 |
| 0.80000 | 0.05602 |
| 0.90000 | 0.12111 |
| 0.95000 | 0.17586 |
| 1.00000 | 0.25237 |
| 1.05000 | 0.35828 |
| 1.10000 | 0.50645 |
| 1.15000 | 0.74419 |
| 1.16845 | 1.00000 |

ZONE 2, X=0.6667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00119 |
| 0.20000 | 0.00252 |
| 0.30000 | 0.00402 |
| 0.40000 | 0.00577 |
| 0.50000 | 0.00791 |
| 0.60000 | 0.01077 |
| 0.70000 | 0.02013 |
| 0.80000 | 0.04471 |
| 0.90000 | 0.09771 |
| 0.95000 | 0.14297 |
| 1.00000 | 0.20725 |
| 1.05000 | 0.29734 |
| 1.10000 | 0.42339 |
| 1.15000 | 0.60928 |
| 1.19112 | 1.00000 |

ZONE 2, X=0.6875

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00151 |
| 0.20000 | 0.00319 |
| 0.30000 | 0.00510 |
| 0.40000 | 0.00732 |
| 0.50000 | 0.01005 |
| 0.60000 | 0.01370 |
| 0.70000 | 0.02592 |
| 0.80000 | 0.05727 |
| 0.90000 | 0.12386 |
| 0.95000 | 0.17978 |
| 1.00000 | 0.25803 |
| 1.05000 | 0.36623 |
| 1.10000 | 0.51804 |
| 1.15000 | 0.76787 |
| 1.16521 | 1.00000 |

ZONE 2, X=0.7083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00185 |
| 0.20000 | 0.00391 |
| 0.30000 | 0.00625 |
| 0.40000 | 0.00899 |
| 0.50000 | 0.01235 |
| 0.60000 | 0.01691 |
| 0.70000 | 0.03299 |
| 0.80000 | 0.07285 |
| 0.90000 | 0.15646 |
| 0.95000 | 0.22564 |
| 1.00000 | 0.32131 |
| 1.05000 | 0.45324 |
| 1.10000 | 0.64690 |
| 1.13574 | 1.00000 |

ZONE 2, X=0.7292

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00213 |
| 0.20000 | 0.00451 |
| 0.30000 | 0.00722 |
| 0.40000 | 0.01040 |
| 0.50000 | 0.01432 |
| 0.60000 | 0.01970 |
| 0.70000 | 0.03986 |
| 0.80000 | 0.08816 |
| 0.90000 | 0.18855 |
| 0.95000 | 0.27070 |
| 1.00000 | 0.38370 |
| 1.05000 | 0.54168 |
| 1.10000 | 0.81199 |
| 1.11053 | 1.00000 |

ZONE 2, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00226 |
| 0.20000 | 0.00478 |
| 0.30000 | 0.00765 |
| 0.40000 | 0.01103 |
| 0.50000 | 0.01522 |
| 0.60000 | 0.02100 |
| 0.70000 | 0.04353 |
| 0.80000 | 0.09647 |
| 0.90000 | 0.20616 |
| 0.95000 | 0.29555 |
| 1.00000 | 0.41855 |
| 1.05000 | 0.59361 |
| 1.09743 | 1.00000 |

ZONE 2, X=0.7708

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00217 |
| 0.20000 | 0.00460 |
| 0.30000 | 0.00736 |
| 0.40000 | 0.01061 |
| 0.50000 | 0.01464 |
| 0.60000 | 0.02021 |
| 0.70000 | 0.04216 |
| 0.80000 | 0.09371 |
| 0.90000 | 0.20097 |
| 0.95000 | 0.28872 |
| 1.00000 | 0.40969 |
| 1.05000 | 0.58146 |
| 1.09994 | 1.00000 |

ZONE 2, X=0.7917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00191 |
| 0.20000 | 0.00404 |
| 0.30000 | 0.00647 |
| 0.40000 | 0.00932 |
| 0.50000 | 0.01285 |
| 0.60000 | 0.01771 |
| 0.70000 | 0.03654 |
| 0.80000 | 0.08146 |
| 0.90000 | 0.17600 |
| 0.95000 | 0.25421 |
| 1.00000 | 0.36252 |
| 1.05000 | 0.51399 |
| 1.10000 | 0.75922 |
| 1.11648 | 1.00000 |

ZONE 2, X=0.8125

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00158 |
| 0.20000 | 0.00334 |
| 0.30000 | 0.00535 |
| 0.40000 | 0.00770 |
| 0.50000 | 0.01062 |
| 0.60000 | 0.01462 |
| 0.70000 | 0.02093 |
| 0.80000 | 0.03709 |
| 0.90000 | 0.14657 |
| 0.95000 | 0.21340 |
| 1.00000 | 0.30694 |
| 1.05000 | 0.43742 |
| 1.10000 | 0.63005 |
| 1.13757 | 1.00000 |

ZONE 2, X=0.8333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00126 |
| 0.20000 | 0.00267 |
| 0.30000 | 0.00427 |
| 0.40000 | 0.00615 |
| 0.50000 | 0.00848 |
| 0.60000 | 0.01167 |
| 0.70000 | 0.01693 |
| 0.80000 | 0.03461 |
| 0.90000 | 0.12112 |
| 0.95000 | 0.17814 |
| 1.00000 | 0.25922 |
| 1.05000 | 0.37347 |
| 1.10000 | 0.53844 |
| 1.15000 | 0.64908 |
| 1.15600 | 1.00000 |

ZONE 2, X=0.8542

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00143 |
| 0.20000 | 0.00302 |
| 0.30000 | 0.00483 |
| 0.40000 | 0.00697 |
| 0.50000 | 0.00962 |
| 0.60000 | 0.01330 |
| 0.70000 | 0.02816 |
| 0.80000 | 0.06377 |
| 0.90000 | 0.14098 |
| 0.95000 | 0.20660 |
| 1.00000 | 0.29926 |
| 1.05000 | 0.42961 |
| 1.10000 | 0.62366 |
| 1.13769 | 1.00000 |

ZONE 2, X=0.8750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00387 |
| 0.30000 | 0.00621 |
| 0.40000 | 0.00897 |
| 0.50000 | 0.01244 |
| 0.60000 | 0.01732 |
| 0.70000 | 0.03860 |
| 0.80000 | 0.08747 |
| 0.90000 | 0.19163 |
| 0.95000 | 0.27847 |
| 1.00000 | 0.39982 |
| 1.05000 | 0.57453 |
| 1.09927 | 1.00000 |

ZONE 2, X=0.8958

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00235 |
| 0.20000 | 0.00499 |
| 0.30000 | 0.00803 |
| 0.40000 | 0.01164 |
| 0.50000 | 0.01622 |
| 0.60000 | 0.02366 |
| 0.70000 | 0.05515 |
| 0.80000 | 0.12530 |
| 0.90000 | 0.27174 |
| 0.95000 | 0.39182 |
| 1.00000 | 0.56336 |
| 1.05000 | 0.91219 |
| 1.05210 | 1.00000 |

ZONE 2, X=0.9167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00302 |
| 0.20000 | 0.00642 |
| 0.30000 | 0.01035 |
| 0.40000 | 0.01507 |
| 0.50000 | 0.02117 |
| 0.60000 | 0.03420 |
| 0.70000 | 0.08079 |
| 0.80000 | 0.18373 |
| 0.90000 | 0.39364 |
| 0.95000 | 0.56924 |
| 1.00000 | 0.96251 |
| 1.00040 | 1.00000 |

ZONE 2, X=0.9375

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00381 |
| 0.20000 | 0.00811 |
| 0.30000 | 0.01313 |
| 0.40000 | 0.01922 |
| 0.50000 | 0.02729 |
| 0.60000 | 0.04934 |
| 0.70000 | 0.11802 |
| 0.80000 | 0.26749 |
| 0.90000 | 0.57213 |
| 0.94893 | 1.00000 |

ZONE 2, X=0.9583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00460 |
| 0.20000 | 0.00984 |
| 0.30000 | 0.01596 |
| 0.40000 | 0.02351 |
| 0.50000 | 0.03376 |
| 0.60000 | 0.06778 |
| 0.70000 | 0.16343 |
| 0.80000 | 0.36810 |
| 0.90000 | 0.86296 |
| 0.90507 | 1.00000 |

ZONE 2, X=0.9792

| U/UB | Y/Y.1 |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00530 |
| 0.20000 | 0.01134 |
| 0.30000 | 0.01845 |
| 0.40000 | 0.02729 |
| 0.50000 | 0.03957 |
| 0.60000 | 0.05571 |
| 0.70000 | 0.20721 |
| 0.80000 | 0.46454 |
| 0.87363 | 1.00000 |

ZONE 2, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00552 |
| 0.20000 | 0.01182 |
| 0.30000 | 0.01925 |
| 0.40000 | 0.02853 |
| 0.50000 | 0.04154 |
| 0.60000 | 0.09266 |
| 0.70000 | 0.22431 |
| 0.80000 | 0.50321 |
| 0.86295 | 1.00000 |

ZONE 3, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00396 |
| 0.20000 | 0.00852 |
| 0.30000 | 0.01400 |
| 0.40000 | 0.02104 |
| 0.50000 | 0.03274 |
| 0.60000 | 0.08913 |
| 0.70000 | 0.22958 |
| 0.80000 | 0.54924 |
| 0.84707 | 1.00000 |

ZONE 3, X=0.0417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00474 |
| 0.20000 | 0.01021 |
| 0.30000 | 0.01677 |
| 0.40000 | 0.02523 |
| 0.50000 | 0.03966 |
| 0.60000 | 0.10726 |
| 0.70000 | 0.27195 |
| 0.80000 | 0.64779 |
| 0.82936 | 1.00000 |

ZONE 3, X=0.0833

| U/UB | Y/Y.1 |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00556 |
| 0.20000 | 0.01197 |
| 0.30000 | 0.01968 |
| 0.40000 | 0.02962 |
| 0.50000 | 0.04681 |
| 0.60000 | 0.12565 |
| 0.70000 | 0.31367 |
| 0.80000 | 0.75960 |
| 0.81402 | 1.00000 |

ZONE 3, X=0.1250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00592 |
| 0.20000 | 0.01275 |
| 0.30000 | 0.02094 |
| 0.40000 | 0.03147 |
| 0.50000 | 0.04865 |
| 0.60000 | 0.12947 |
| 0.70000 | 0.32015 |
| 0.80000 | 0.77159 |
| 0.81284 | 1.00000 |

ZONE 3, X=0.1667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00608 |
| 0.20000 | 0.01307 |
| 0.30000 | 0.02141 |
| 0.40000 | 0.03205 |
| 0.50000 | 0.04780 |
| 0.60000 | 0.12385 |
| 0.70000 | 0.30345 |
| 0.80000 | 0.70847 |
| 0.82116 | 1.00000 |

ZONE 3, X=0.2083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00556 |
| 0.20000 | 0.01192 |
| 0.30000 | 0.01947 |
| 0.40000 | 0.02898 |
| 0.50000 | 0.04259 |
| 0.60000 | 0.10148 |
| 0.70000 | 0.24782 |
| 0.80000 | 0.56202 |
| 0.84809 | 1.00000 |

ZONE 3, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00483 |
| 0.20000 | 0.01932 |
| 0.30000 | 0.01679 |
| 0.40000 | 0.02462 |
| 0.50000 | 0.03590 |
| 0.60000 | 0.07668 |
| 0.70000 | 0.18622 |
| 0.80000 | 0.42052 |
| 0.88639 | 1.00000 |

ZONE 3, X=0.2917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00392 |
| 0.20000 | 0.00837 |
| 0.30000 | 0.01356 |
| 0.40000 | 0.01990 |
| 0.50000 | 0.02837 |
| 0.60000 | 0.05347 |
| 0.70000 | 0.12870 |
| 0.80000 | 0.29233 |
| 0.90000 | 0.63199 |
| 0.93596 | 1.00000 |

ZONE 3, X=0.3333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00306 |
| 0.20000 | 0.00651 |
| 0.30000 | 0.01051 |
| 0.40000 | 0.01533 |
| 0.50000 | 0.02162 |
| 0.60000 | 0.03620 |
| 0.70000 | 0.08610 |
| 0.80000 | 0.19667 |
| 0.90000 | 0.42251 |
| 0.95000 | 0.61583 |
| 0.98977 | 1.00000 |

ZONE 3, X=0.3750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00242 |
| 0.20000 | 0.00513 |
| 0.30000 | 0.00826 |
| 0.40000 | 0.01199 |
| 0.50000 | 0.01675 |
| 0.60000 | 0.02525 |
| 0.70000 | 0.05923 |
| 0.80000 | 0.13513 |
| 0.90000 | 0.29346 |
| 0.95000 | 0.42356 |
| 1.00000 | 0.61366 |
| 1.04058 | 1.00000 |

ZONE 3, X=0.4167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00184 |
| 0.20000 | 0.00390 |
| 0.30000 | 0.00626 |
| 0.40000 | 0.00906 |
| 0.50000 | 0.01259 |
| 0.60000 | 0.01763 |
| 0.70000 | 0.04388 |
| 0.80000 | 0.09278 |
| 0.90000 | 0.20410 |
| 0.95000 | 0.29712 |
| 1.00000 | 0.42762 |
| 1.05000 | 0.62312 |
| 1.08836 | 1.00000 |

ZONE 3, X=0.4583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00146 |
| 0.20000 | 0.00309 |
| 0.30000 | 0.00495 |
| 0.40000 | 0.00715 |
| 0.50000 | 0.00989 |
| 0.60000 | 0.01373 |
| 0.70000 | 0.03008 |
| 0.80000 | 0.06853 |
| 0.90000 | 0.15211 |
| 0.95000 | 0.22318 |
| 1.00000 | 0.32357 |
| 1.05000 | 0.46578 |
| 1.10000 | 0.68714 |
| 1.12586 | 1.00000 |

ZONE 3, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00125 |
| 0.20000 | 0.00264 |
| 0.30000 | 0.00422 |
| 0.40000 | 0.00609 |
| 0.50000 | 0.00841 |
| 0.60000 | 0.01163 |
| 0.70000 | 0.02486 |
| 0.80000 | 0.05669 |
| 0.90000 | 0.12655 |
| 0.95000 | 0.18667 |
| 1.00000 | 0.27237 |
| 1.05000 | 0.39379 |
| 1.10000 | 0.57227 |
| 1.14727 | 1.00000 |

ZONE 3, X=0.5417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00158 |
| 0.20000 | 0.00333 |
| 0.30000 | 0.00533 |
| 0.40000 | 0.00769 |
| 0.50000 | 0.01062 |
| 0.60000 | 0.01466 |
| 0.70000 | 0.03086 |
| 0.80000 | 0.06955 |
| 0.90000 | 0.15263 |
| 0.95000 | 0.22262 |
| 1.00000 | 0.32076 |
| 1.05000 | 0.45838 |
| 1.10000 | 0.66712 |
| 1.13013 | 1.00000 |

ZONE 3, X=0.5833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00192 |
| 0.20000 | 0.00405 |
| 0.30000 | 0.00649 |
| 0.40000 | 0.00935 |
| 0.50000 | 0.01292 |
| 0.60000 | 0.01785 |
| 0.70000 | 0.03758 |
| 0.80000 | 0.08408 |
| 0.90000 | 0.18215 |
| 0.95000 | 0.26334 |
| 1.00000 | 0.37593 |
| 1.05000 | 0.53451 |
| 1.10000 | 0.80697 |
| 1.11055 | 1.00000 |

ZONE 3, X=0.6250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00218 |
| 0.20000 | 0.00462 |
| 0.30000 | 0.00739 |
| 0.40000 | 0.01067 |
| 0.50000 | 0.01473 |
| 0.60000 | 0.02038 |
| 0.70000 | 0.04307 |
| 0.80000 | 0.09594 |
| 0.90000 | 0.20604 |
| 0.95000 | 0.29613 |
| 1.00000 | 0.42049 |
| 1.05000 | 0.59853 |
| 1.09580 | 1.00000 |

ZONE 3, X=0.6667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00227 |
| 0.20000 | 0.00480 |
| 0.30000 | 0.00768 |
| 0.40000 | 0.01107 |
| 0.50000 | 0.01529 |
| 0.60000 | 0.02112 |
| 0.70000 | 0.04416 |
| 0.80000 | 0.09802 |
| 0.90000 | 0.20962 |
| 0.95000 | 0.30058 |
| 1.00000 | 0.42586 |
| 1.05000 | 0.60521 |
| 1.09467 | 1.00000 |

ZONE 3, X=0.7083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00214 |
| 0.20000 | 0.00453 |
| 0.30000 | 0.00724 |
| 0.40000 | 0.01043 |
| 0.50000 | 0.01438 |
| 0.60000 | 0.01979 |
| 0.70000 | 0.04027 |
| 0.80000 | 0.08916 |
| 0.90000 | 0.19080 |
| 0.95000 | 0.27396 |
| 1.00000 | 0.38841 |
| 1.05000 | 0.54880 |
| 1.10000 | 0.83065 |
| 1.10837 | 1.00000 |

ZONE 3, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00185 |
| 0.20000 | 0.00392 |
| 0.30000 | 0.00626 |
| 0.40000 | 0.00901 |
| 0.50000 | 0.01238 |
| 0.60000 | 0.01696 |
| 0.70000 | 0.03324 |
| 0.80000 | 0.07347 |
| 0.90000 | 0.15789 |
| 0.95000 | 0.22775 |
| 1.00000 | 0.32436 |
| 1.05000 | 0.45772 |
| 1.10000 | 0.65449 |
| 1.13418 | 1.00000 |

ZONE 3, X=0.7917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00151 |
| 0.20000 | 0.00320 |
| 0.30000 | 0.00511 |
| 0.40000 | 0.00734 |
| 0.50000 | 0.01007 |
| 0.60000 | 0.01373 |
| 0.70000 | 0.02607 |
| 0.80000 | 0.05766 |
| 0.90000 | 0.12478 |
| 0.95000 | 0.18115 |
| 1.00000 | 0.26003 |
| 1.05000 | 0.36915 |
| 1.10000 | 0.52246 |
| 1.15000 | 0.77777 |
| 1.16393 | 1.00000 |

ZONE 3, X=0.8333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00119 |
| 0.20000 | 0.00252 |
| 0.30000 | 0.00402 |
| 0.40000 | 0.00577 |
| 0.50000 | 0.00791 |
| 0.60000 | 0.01077 |
| 0.70000 | 0.02021 |
| 0.80000 | 0.04493 |
| 0.90000 | 0.09824 |
| 0.95000 | 0.14379 |
| 1.00000 | 0.20850 |
| 1.05000 | 0.29921 |
| 1.10000 | 0.42622 |
| 1.15000 | 0.61411 |
| 1.19004 | 1.00000 |

ZONE 3, X=0.8750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00724 |
| 0.50000 | 0.00993 |
| 0.60000 | 0.01353 |
| 0.70000 | 0.02551 |
| 0.80000 | 0.05635 |
| 0.90000 | 0.12187 |
| 0.95000 | 0.17694 |
| 1.00000 | 0.25403 |
| 1.05000 | 0.36067 |
| 1.10000 | 0.51002 |
| 1.15000 | 0.75159 |
| 1.16739 | 1.00000 |

ZONE 3, X=0.9167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00387 |
| 0.30000 | 0.00619 |
| 0.40000 | 0.00889 |
| 0.50000 | 0.01222 |
| 0.60000 | 0.01670 |
| 0.70000 | 0.03227 |
| 0.80000 | 0.07115 |
| 0.90000 | 0.15269 |
| 0.95000 | 0.22017 |
| 1.00000 | 0.31352 |
| 1.05000 | 0.44205 |
| 1.10000 | 0.62863 |
| 1.13958 | 1.00000 |

ZONE 3, X=0.9583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00211 |
| 0.20000 | 0.00445 |
| 0.30000 | 0.00712 |
| 0.40000 | 0.01025 |
| 0.50000 | 0.01410 |
| 0.60000 | 0.01934 |
| 0.70000 | 0.03841 |
| 0.80000 | 0.08470 |
| 0.90000 | 0.18087 |
| 0.95000 | 0.25959 |
| 1.00000 | 0.36780 |
| 1.05000 | 0.51797 |
| 1.10000 | 0.75848 |
| 1.11705 | 1.00000 |

ZONE 3, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00221 |
| 0.20000 | 0.00468 |
| 0.30000 | 0.00749 |
| 0.40000 | 0.01078 |
| 0.50000 | 0.01485 |
| 0.60000 | 0.02040 |
| 0.70000 | 0.04100 |
| 0.80000 | 0.09043 |
| 0.90000 | 0.19273 |
| 0.95000 | 0.27615 |
| 1.00000 | 0.39066 |
| 1.05000 | 0.55079 |
| 1.10000 | 0.83170 |
| 1.10835 | 1.00000 |

ZONE 4, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00121 |
| 0.20000 | 0.00255 |
| 0.30000 | 0.00407 |
| 0.40000 | 0.00585 |
| 0.50000 | 0.00801 |
| 0.60000 | 0.01090 |
| 0.70000 | 0.02023 |
| 0.80000 | 0.04485 |
| 0.90000 | 0.09780 |
| 0.95000 | 0.14297 |
| 1.00000 | 0.20703 |
| 1.05000 | 0.29670 |
| 1.10000 | 0.42194 |
| 1.15000 | 0.60593 |
| 1.19206 | 1.00000 |

ZONE 4, X=0.0417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00152 |
| 0.20000 | 0.00320 |
| 0.30000 | 0.00511 |
| 0.40000 | 0.00734 |
| 0.50000 | 0.01007 |
| 0.60000 | 0.01371 |
| 0.70000 | 0.02566 |
| 0.80000 | 0.05659 |
| 0.90000 | 0.12214 |
| 0.95000 | 0.17715 |
| 1.00000 | 0.25406 |
| 1.05000 | 0.36031 |
| 1.10000 | 0.50884 |
| 1.15000 | 0.74757 |
| 1.16805 | 1.00000 |

ZONE 4, X=0.0833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00184 |
| 0.20000 | 0.00389 |
| 0.30000 | 0.00621 |
| 0.40000 | 0.00893 |
| 0.50000 | 0.01227 |
| 0.60000 | 0.01676 |
| 0.70000 | 0.03219 |
| 0.80000 | 0.07088 |
| 0.90000 | 0.15194 |
| 0.95000 | 0.21898 |
| 1.00000 | 0.31166 |
| 1.05000 | 0.43915 |
| 1.10000 | 0.62354 |
| 1.14077 | 1.00000 |

ZONE 4, X=0.1250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00211 |
| 0.20000 | 0.00446 |
| 0.30000 | 0.00713 |
| 0.40000 | 0.01025 |
| 0.50000 | 0.01411 |
| 0.60000 | 0.01934 |
| 0.70000 | 0.03818 |
| 0.80000 | 0.08411 |
| 0.90000 | 0.17944 |
| 0.95000 | 0.25747 |
| 1.00000 | 0.36465 |
| 1.05000 | 0.51317 |
| 1.10000 | 0.74833 |
| 1.11854 | 1.00000 |

ZONE 4, X=0.1667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00221 |
| 0.20000 | 0.00468 |
| 0.30000 | 0.00748 |
| 0.40000 | 0.01076 |
| 0.50000 | 0.01481 |
| 0.60000 | 0.02034 |
| 0.70000 | 0.04057 |
| 0.80000 | 0.08937 |
| 0.90000 | 0.19030 |
| 0.95000 | 0.27260 |
| 1.00000 | 0.38549 |
| 1.05000 | 0.54289 |
| 1.10000 | 0.81088 |
| 1.11055 | 1.00000 |

ZONE 4, X=0.2083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00444 |
| 0.30000 | 0.00710 |
| 0.40000 | 0.01022 |
| 0.50000 | 0.01406 |
| 0.60000 | 0.01926 |
| 0.70000 | 0.03791 |
| 0.80000 | 0.08348 |
| 0.90000 | 0.17805 |
| 0.95000 | 0.25546 |
| 1.00000 | 0.36181 |
| 1.05000 | 0.50901 |
| 1.10000 | 0.74013 |
| 1.11977 | 1.00000 |

ZONE 4, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00387 |
| 0.30000 | 0.00617 |
| 0.40000 | 0.00887 |
| 0.50000 | 0.01218 |
| 0.60000 | 0.01663 |
| 0.70000 | 0.03178 |
| 0.80000 | 0.06992 |
| 0.90000 | 0.14981 |
| 0.95000 | 0.21591 |
| 1.00000 | 0.30730 |
| 1.05000 | 0.43292 |
| 1.10000 | 0.61366 |
| 1.14297 | 1.00000 |

ZONE 4, X=0.2917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00317 |
| 0.30000 | 0.00505 |
| 0.40000 | 0.00725 |
| 0.50000 | 0.00994 |
| 0.60000 | 0.01353 |
| 0.70000 | 0.02516 |
| 0.80000 | 0.05541 |
| 0.90000 | 0.11956 |
| 0.95000 | 0.17340 |
| 1.00000 | 0.24873 |
| 1.05000 | 0.35280 |
| 1.10000 | 0.49791 |
| 1.15000 | 0.72633 |
| 1.17120 | 1.00000 |

ZONE 4, X=0.3333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00119 |
| 0.20000 | 0.00250 |
| 0.30000 | 0.00400 |
| 0.40000 | 0.00574 |
| 0.50000 | 0.00786 |
| 0.60000 | 0.01068 |
| 0.70000 | 0.01968 |
| 0.80000 | 0.04357 |
| 0.90000 | 0.09499 |
| 0.95000 | 0.13887 |
| 1.00000 | 0.20116 |
| 1.05000 | 0.28842 |
| 1.10000 | 0.41022 |
| 1.15000 | 0.58769 |
| 1.19601 | 1.00000 |

ZONE 4, X=0.3750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00724 |
| 0.50000 | 0.00992 |
| 0.60000 | 0.01350 |
| 0.70000 | 0.02508 |
| 0.80000 | 0.05523 |
| 0.90000 | 0.11916 |
| 0.95000 | 0.17283 |
| 1.00000 | 0.24792 |
| 1.05000 | 0.35167 |
| 1.10000 | 0.49629 |
| 1.15000 | 0.72329 |
| 1.17167 | 1.00000 |

ZONE 4, X=0.4167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00617 |
| 0.40000 | 0.00886 |
| 0.50000 | 0.01216 |
| 0.60000 | 0.01661 |
| 0.70000 | 0.03167 |
| 0.80000 | 0.06967 |
| 0.90000 | 0.14923 |
| 0.95000 | 0.21507 |
| 1.00000 | 0.30610 |
| 1.05000 | 0.43118 |
| 1.10000 | 0.61088 |
| 1.14360 | 1.00000 |

ZONE 4, X=0.4583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01019 |
| 0.50000 | 0.01401 |
| 0.60000 | 0.01920 |
| 0.70000 | 0.03768 |
| 0.80000 | 0.08292 |
| 0.90000 | 0.17682 |
| 0.95000 | 0.25369 |
| 1.00000 | 0.35928 |
| 1.05000 | 0.50530 |
| 1.10000 | 0.73293 |
| 1.12089 | 1.00000 |

ZONE 4, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00466 |
| 0.30000 | 0.00745 |
| 0.40000 | 0.01072 |
| 0.50000 | 0.01475 |
| 0.60000 | 0.02024 |
| 0.70000 | 0.04018 |
| 0.80000 | 0.08845 |
| 0.90000 | 0.18827 |
| 0.95000 | 0.26967 |
| 1.00000 | 0.38130 |
| 1.05000 | 0.53663 |
| 1.10000 | 0.79584 |
| 1.11230 | 1.00000 |

ZONE 4, X=0.5417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01918 |
| 0.70000 | 0.03761 |
| 0.80000 | 0.08276 |
| 0.90000 | 0.17647 |
| 0.95000 | 0.25319 |
| 1.00000 | 0.35857 |
| 1.05000 | 0.50425 |
| 1.10000 | 0.73090 |
| 1.12121 | 1.00000 |

ZONE 4, X=0.5833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01215 |
| 0.60000 | 0.01658 |
| 0.70000 | 0.03158 |
| 0.80000 | 0.06944 |
| 0.90000 | 0.14874 |
| 0.95000 | 0.21434 |
| 1.00000 | 0.30505 |
| 1.05000 | 0.42967 |
| 1.10000 | 0.60847 |
| 1.14416 | 1.00000 |

ZONE 4, X=0.6250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00991 |
| 0.60000 | 0.01348 |
| 0.70000 | 0.02498 |
| 0.80000 | 0.05499 |
| 0.90000 | 0.11861 |
| 0.95000 | 0.17202 |
| 1.00000 | 0.24674 |
| 1.05000 | 0.34997 |
| 1.10000 | 0.49377 |
| 1.15000 | 0.71844 |
| 1.17244 | 1.00000 |

ZONE 4, X=0.6667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00250 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00782 |
| 0.60000 | 0.01063 |
| 0.70000 | 0.01953 |
| 0.80000 | 0.04324 |
| 0.90000 | 0.09424 |
| 0.95000 | 0.13776 |
| 1.00000 | 0.19956 |
| 1.05000 | 0.28612 |
| 1.10000 | 0.40692 |
| 1.15000 | 0.58252 |
| 1.19719 | 1.00000 |

ZONE 4, X=0.7083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00315 |
| 0.30000 | 0.00503 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02496 |
| 0.80000 | 0.05496 |
| 0.90000 | 0.11853 |
| 0.95000 | 0.17191 |
| 1.00000 | 0.24658 |
| 1.05000 | 0.34975 |
| 1.10000 | 0.49345 |
| 1.15000 | 0.71784 |
| 1.17254 | 1.00000 |

ZONE 4, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01215 |
| 0.60000 | 0.01658 |
| 0.70000 | 0.03155 |
| 0.80000 | 0.06938 |
| 0.90000 | 0.14859 |
| 0.95000 | 0.21413 |
| 1.00000 | 0.30475 |
| 1.05000 | 0.42924 |
| 1.10000 | 0.60779 |
| 1.14432 | 1.00000 |

ZONE 4, X=0.7917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01917 |
| 0.70000 | 0.03756 |
| 0.80000 | 0.08264 |
| 0.90000 | 0.17620 |
| 0.95000 | 0.25280 |
| 1.00000 | 0.35801 |
| 1.05000 | 0.50343 |
| 1.10000 | 0.72932 |
| 1.12146 | 1.00000 |

ZONE 4, X=0.8333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00466 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04009 |
| 0.80000 | 0.08823 |
| 0.90000 | 0.18779 |
| 0.95000 | 0.26897 |
| 1.00000 | 0.38031 |
| 1.05000 | 0.53514 |
| 1.10000 | 0.79242 |
| 1.11272 | 1.00000 |

ZONE 4, X=0.8750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00216 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01917 |
| 0.70000 | 0.03756 |
| 0.80000 | 0.03263 |
| 0.90000 | 0.17617 |
| 0.95000 | 0.25275 |
| 1.00000 | 0.35794 |
| 1.05000 | 0.50332 |
| 1.10000 | 0.72911 |
| 1.12149 | 1.00000 |

ZONE 4, X=0.9167

| J/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01658 |
| 0.70000 | 0.03154 |
| 0.80000 | 0.06936 |
| 0.90000 | 0.14854 |
| 0.95000 | 0.21405 |
| 1.00000 | 0.30464 |
| 1.05000 | 0.42908 |
| 1.10000 | 0.60754 |
| 1.14438 | 1.00000 |

ZONE 4, X=0.9583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00315 |
| 0.30000 | 0.00503 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02496 |
| 0.80000 | 0.05494 |
| 0.90000 | 0.11848 |
| 0.95000 | 0.17183 |
| 1.00000 | 0.24647 |
| 1.05000 | 0.34958 |
| 1.10000 | 0.49320 |
| 1.15000 | 0.71736 |
| 1.17262 | 1.00000 |

ZONE 4, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00249 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00782 |
| 0.60000 | 0.01052 |
| 0.70000 | 0.01952 |
| 0.80000 | 0.04320 |
| 0.90000 | 0.09415 |
| 0.95000 | 0.13763 |
| 1.00000 | 0.19937 |
| 1.05000 | 0.28586 |
| 1.10000 | 0.40653 |
| 1.15000 | 0.58190 |
| 1.19734 | 1.00000 |

ZONE 5, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00222 |
| 0.20000 | 0.00470 |
| 0.30000 | 0.00751 |
| 0.40000 | 0.01082 |
| 0.50000 | 0.01496 |
| 0.60000 | 0.02047 |
| 0.70000 | 0.04107 |
| 0.80000 | 0.09055 |
| 0.90000 | 0.19291 |
| 0.95000 | 0.27635 |
| 1.00000 | 0.39085 |
| 1.05000 | 0.55093 |
| 1.10000 | 0.83165 |
| 1.10836 | 1.00000 |

ZONE 5, X=0.0417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00212 |
| 0.20000 | 0.00447 |
| 0.30000 | 0.00715 |
| 0.40000 | 0.01029 |
| 0.50000 | 0.01416 |
| 0.60000 | 0.01942 |
| 0.70000 | 0.03850 |
| 0.80000 | 0.08486 |
| 0.90000 | 0.18112 |
| 0.95000 | 0.25989 |
| 1.00000 | 0.36812 |
| 1.05000 | 0.51829 |
| 1.10000 | 0.75879 |
| 1.11703 | 1.00000 |

ZONE 5, X=0.0833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00185 |
| 0.20000 | 0.00390 |
| 0.30000 | 0.00623 |
| 0.40000 | 0.00896 |
| 0.50000 | 0.01231 |
| 0.60000 | 0.01682 |
| 0.70000 | 0.03243 |
| 0.80000 | 0.07145 |
| 0.90000 | 0.15321 |
| 0.95000 | 0.22083 |
| 1.00000 | 0.31432 |
| 1.05000 | 0.44298 |
| 1.10000 | 0.62974 |
| 1.13942 | 1.00000 |

ZONE 5, X=0.1250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00152 |
| 0.20000 | 0.00321 |
| 0.30000 | 0.00512 |
| 0.40000 | 0.00736 |
| 0.50000 | 0.01009 |
| 0.60000 | 0.01375 |
| 0.70000 | 0.02580 |
| 0.80000 | 0.05692 |
| 0.90000 | 0.12292 |
| 0.95000 | 0.17830 |
| 1.00000 | 0.25573 |
| 1.05000 | 0.36271 |
| 1.10000 | 0.51242 |
| 1.15000 | 0.75500 |
| 1.16699 | 1.00000 |

ZONE 5, X=0.1667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00122 |
| 0.20000 | 0.00256 |
| 0.30000 | 0.00409 |
| 0.40000 | 0.00588 |
| 0.50000 | 0.00805 |
| 0.60000 | 0.01096 |
| 0.70000 | 0.02040 |
| 0.80000 | 0.04523 |
| 0.90000 | 0.09867 |
| 0.95000 | 0.14423 |
| 1.00000 | 0.20386 |
| 1.05000 | 0.29950 |
| 1.10000 | 0.42566 |
| 1.15000 | 0.61168 |
| 1.19079 | 1.00000 |

ZONE 5, X=0.2083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00152 |
| 0.20000 | 0.00321 |
| 0.30000 | 0.00512 |
| 0.40000 | 0.00735 |
| 0.50000 | 0.01008 |
| 0.60000 | 0.01373 |
| 0.70000 | 0.02574 |
| 0.80000 | 0.05678 |
| 0.90000 | 0.12265 |
| 0.95000 | 0.17784 |
| 1.00000 | 0.25507 |
| 1.05000 | 0.36178 |
| 1.10000 | 0.51104 |
| 1.15000 | 0.75217 |
| 1.16739 | 1.00000 |

ZONE 5, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00184 |
| 0.20000 | 0.00389 |
| 0.30000 | 0.00622 |
| 0.40000 | 0.00894 |
| 0.50000 | 0.01228 |
| 0.60000 | 0.01678 |
| 0.70000 | 0.03228 |
| 0.80000 | 0.07112 |
| 0.90000 | 0.15247 |
| 0.95000 | 0.21977 |
| 1.00000 | 0.31280 |
| 1.05000 | 0.44081 |
| 1.10000 | 0.62626 |
| 1.14017 | 1.00000 |

ZONE 5, X=0.2917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00211 |
| 0.20000 | 0.00446 |
| 0.30000 | 0.00713 |
| 0.40000 | 0.01026 |
| 0.50000 | 0.01412 |
| 0.60000 | 0.01936 |
| 0.70000 | 0.03828 |
| 0.80000 | 0.08433 |
| 0.90000 | 0.17992 |
| 0.95000 | 0.25816 |
| 1.00000 | 0.36564 |
| 1.05000 | 0.51463 |
| 1.10000 | 0.75128 |
| 1.11811 | 1.00000 |

ZONE 5, X=0.3333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00221 |
| 0.20000 | 0.00468 |
| 0.30000 | 0.00748 |
| 0.40000 | 0.01077 |
| 0.50000 | 0.01482 |
| 0.60000 | 0.02085 |
| 0.70000 | 0.04064 |
| 0.80000 | 0.08954 |
| 0.90000 | 0.19076 |
| 0.95000 | 0.27317 |
| 1.00000 | 0.38632 |
| 1.05000 | 0.54415 |
| 1.10000 | 0.81405 |
| 1.11020 | 1.00000 |

ZONE 5, X=0.3750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00445 |
| 0.30000 | 0.00711 |
| 0.40000 | 0.01022 |
| 0.50000 | 0.01406 |
| 0.60000 | 0.01927 |
| 0.70000 | 0.03795 |
| 0.80000 | 0.08356 |
| 0.90000 | 0.17824 |
| 0.95000 | 0.25573 |
| 1.00000 | 0.36219 |
| 1.05000 | 0.50957 |
| 1.10000 | 0.74121 |
| 1.11961 | 1.00000 |

ZONE 5, X=0.4167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00387 |
| 0.30000 | 0.00617 |
| 0.40000 | 0.00887 |
| 0.50000 | 0.01218 |
| 0.60000 | 0.01663 |
| 0.70000 | 0.03180 |
| 0.80000 | 0.06997 |
| 0.90000 | 0.14992 |
| 0.95000 | 0.21608 |
| 1.00000 | 0.30755 |
| 1.05000 | 0.43330 |
| 1.10000 | 0.61427 |
| 1.14282 | 1.00000 |

ZONE 5, X=0.4583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00317 |
| 0.30000 | 0.00505 |
| 0.40000 | 0.00726 |
| 0.50000 | 0.00994 |
| 0.60000 | 0.01353 |
| 0.70000 | 0.02516 |
| 0.80000 | 0.05543 |
| 0.90000 | 0.11959 |
| 0.95000 | 0.17345 |
| 1.00000 | 0.24880 |
| 1.05000 | 0.35289 |
| 1.10000 | 0.49804 |
| 1.15000 | 0.72658 |
| 1.17116 | 1.00000 |

ZONE 5, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00119 |
| 0.20000 | 0.00250 |
| 0.30000 | 0.00406 |
| 0.40000 | 0.00573 |
| 0.50000 | 0.00765 |
| 0.60000 | 0.01007 |
| 0.70000 | 0.01967 |
| 0.80000 | 0.04357 |
| 0.90000 | 0.09499 |
| 0.95000 | 0.13367 |
| 1.00000 | 0.20117 |
| 1.05000 | 0.28345 |
| 1.10000 | 0.41028 |
| 1.15000 | 0.56761 |
| 1.19536 | 1.00000 |

ZONE 5, X=0.5417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00724 |
| 0.50000 | 0.00992 |
| 0.60000 | 0.01350 |
| 0.70000 | 0.02508 |
| 0.80000 | 0.05524 |
| 0.90000 | 0.11916 |
| 0.95000 | 0.17284 |
| 1.00000 | 0.24793 |
| 1.05000 | 0.35167 |
| 1.10000 | 0.49628 |
| 1.15000 | 0.72325 |
| 1.17163 | 1.00000 |

ZONE 5, X=0.5833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00886 |
| 0.50000 | 0.01216 |
| 0.60000 | 0.01660 |
| 0.70000 | 0.03166 |
| 0.80000 | 0.06965 |
| 0.90000 | 0.14920 |
| 0.95000 | 0.21503 |
| 1.00000 | 0.30605 |
| 1.05000 | 0.43114 |
| 1.10000 | 0.61083 |
| 1.14361 | 1.00000 |

ZONE 5, X=0.6250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00709 |
| 0.40000 | 0.01019 |
| 0.50000 | 0.01402 |
| 0.60000 | 0.01921 |
| 0.70000 | 0.03768 |
| 0.80000 | 0.08293 |
| 0.90000 | 0.17683 |
| 0.95000 | 0.25370 |
| 1.00000 | 0.35929 |
| 1.05000 | 0.50530 |
| 1.10000 | 0.73290 |
| 1.12089 | 1.00000 |

ZONE 5, X=0.6667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00224 |
| 0.20000 | 0.00466 |
| 0.30000 | 0.00745 |
| 0.40000 | 0.01072 |
| 0.50000 | 0.01475 |
| 0.60000 | 0.02024 |
| 0.70000 | 0.04017 |
| 0.80000 | 0.08845 |
| 0.90000 | 0.18825 |
| 0.95000 | 0.26964 |
| 1.00000 | 0.38128 |
| 1.05000 | 0.53961 |
| 1.10000 | 0.79586 |
| 1.11229 | 1.00000 |

ZONE 5, X=0.7083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01019 |
| 0.50000 | 0.01401 |
| 0.60000 | 0.01919 |
| 0.70000 | 0.03762 |
| 0.80000 | 0.08277 |
| 0.90000 | 0.17649 |
| 0.95000 | 0.25321 |
| 1.00000 | 0.35859 |
| 1.05000 | 0.50426 |
| 1.10000 | 0.73089 |
| 1.12121 | 1.00000 |

ZONE 5, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01658 |
| 0.70000 | 0.03157 |
| 0.80000 | 0.06943 |
| 0.90000 | 0.14871 |
| 0.95000 | 0.21431 |
| 1.00000 | 0.30502 |
| 1.05000 | 0.42964 |
| 1.10000 | 0.60845 |
| 1.14416 | 1.00000 |

ZONE 5, X=0.7917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00991 |
| 0.60000 | 0.01348 |
| 0.70000 | 0.02498 |
| 0.80000 | 0.05500 |
| 0.90000 | 0.11863 |
| 0.95000 | 0.17204 |
| 1.00000 | 0.24677 |
| 1.05000 | 0.35000 |
| 1.10000 | 0.49380 |
| 1.15000 | 0.71846 |
| 1.17244 | 1.00000 |

ZONE 5, X=0.8333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00249 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00782 |
| 0.60000 | 0.01062 |
| 0.70000 | 0.01953 |
| 0.80000 | 0.04323 |
| 0.90000 | 0.09421 |
| 0.95000 | 0.13772 |
| 1.00000 | 0.19951 |
| 1.05000 | 0.28607 |
| 1.10000 | 0.40686 |
| 1.15000 | 0.58246 |
| 1.19720 | 1.00000 |

ZONE 5, X=0.8750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00315 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02496 |
| 0.80000 | 0.05496 |
| 0.90000 | 0.11853 |
| 0.95000 | 0.17190 |
| 1.00000 | 0.24657 |
| 1.05000 | 0.34972 |
| 1.10000 | 0.49340 |
| 1.15000 | 0.71774 |
| 1.17255 | 1.00000 |

ZONE 5, X=0.9167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01657 |
| 0.70000 | 0.03155 |
| 0.80000 | 0.06939 |
| 0.90000 | 0.14861 |
| 0.95000 | 0.21416 |
| 1.00000 | 0.30480 |
| 1.05000 | 0.42932 |
| 1.10000 | 0.60793 |
| 1.14428 | 1.00000 |

ZONE 5, X=0.9583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01918 |
| 0.70000 | 0.03756 |
| 0.80000 | 0.08265 |
| 0.90000 | 0.17621 |
| 0.95000 | 0.25280 |
| 1.00000 | 0.35801 |
| 1.05000 | 0.50343 |
| 1.10000 | 0.72930 |
| 1.12146 | 1.00000 |

ZONE 5, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00466 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04010 |
| 0.80000 | 0.08826 |
| 0.90000 | 0.18786 |
| 0.95000 | 0.26907 |
| 1.00000 | 0.38045 |
| 1.05000 | 0.53536 |
| 1.10000 | 0.79293 |
| 1.11265 | 1.00000 |

ZONE 6, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00466 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04010 |
| 0.80000 | 0.08826 |
| 0.90000 | 0.18786 |
| 0.95000 | 0.26907 |
| 1.00000 | 0.38045 |
| 1.05000 | 0.53536 |
| 1.10000 | 0.79293 |
| 1.11265 | 1.00000 |

ZONE 6, X=0.0417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01918 |
| 0.70000 | 0.03757 |
| 0.80000 | 0.08265 |
| 0.90000 | 0.17621 |
| 0.95000 | 0.25281 |
| 1.00000 | 0.35802 |
| 1.05000 | 0.50343 |
| 1.10000 | 0.72930 |
| 1.12146 | 1.00000 |

ZONE 6, X=0.0833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01215 |
| 0.60000 | 0.01658 |
| 0.70000 | 0.03156 |
| 0.80000 | 0.06939 |
| 0.90000 | 0.14862 |
| 0.95000 | 0.21417 |
| 1.00000 | 0.30482 |
| 1.05000 | 0.42934 |
| 1.10000 | 0.60795 |
| 1.14428 | 1.00000 |

ZONE 6, X=0.1250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00991 |
| 0.60000 | 0.01348 |
| 0.70000 | 0.02497 |
| 0.80000 | 0.05497 |
| 0.90000 | 0.11855 |
| 0.95000 | 0.17193 |
| 1.00000 | 0.24661 |
| 1.05000 | 0.34977 |
| 1.10000 | 0.49346 |
| 1.15000 | 0.71782 |
| 1.17254 | 1.00000 |

ZONE 6, X=0.1667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00250 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00782 |
| 0.60000 | 0.01063 |
| 0.70000 | 0.01954 |
| 0.80000 | 0.04325 |
| 0.90000 | 0.09425 |
| 0.95000 | 0.13777 |
| 1.00000 | 0.19957 |
| 1.05000 | 0.28614 |
| 1.10000 | 0.40694 |
| 1.15000 | 0.58253 |
| 1.19719 | 1.00000 |

ZONE 6, X=0.2083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00991 |
| 0.60000 | 0.01348 |
| 0.70000 | 0.02498 |
| 0.80000 | 0.05498 |
| 0.90000 | 0.11858 |
| 0.95000 | 0.17196 |
| 1.00000 | 0.24665 |
| 1.05000 | 0.34982 |
| 1.10000 | 0.49353 |
| 1.15000 | 0.71793 |
| 1.17253 | 1.00000 |

ZONE 6, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00385 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01657 |
| 0.70000 | 0.03155 |
| 0.80000 | 0.06937 |
| 0.90000 | 0.14858 |
| 0.95000 | 0.21411 |
| 1.00000 | 0.30473 |
| 1.05000 | 0.42923 |
| 1.10000 | 0.60778 |
| 1.14431 | 1.00000 |

ZONE 6, X=0.2917

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01918 |
| 0.70000 | 0.03757 |
| 0.80000 | 0.08266 |
| 0.90000 | 0.17622 |
| 0.95000 | 0.25262 |
| 1.00000 | 0.35803 |
| 1.05000 | 0.50344 |
| 1.10000 | 0.72931 |
| 1.12146 | 1.00000 |

ZONE 6, X=0.3333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00465 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04008 |
| 0.80000 | 0.08822 |
| 0.90000 | 0.18778 |
| 0.95000 | 0.26896 |
| 1.00000 | 0.38030 |
| 1.05000 | 0.53514 |
| 1.10000 | 0.79245 |
| 1.11271 | 1.00000 |

ZONE 6, X=0.3750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01918 |
| 0.70000 | 0.03756 |
| 0.80000 | 0.08264 |
| 0.90000 | 0.17619 |
| 0.95000 | 0.25277 |
| 1.00000 | 0.35795 |
| 1.05000 | 0.50333 |
| 1.10000 | 0.72909 |
| 1.12150 | 1.00000 |

ZONE 6, X=0.4157

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00385 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00884 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01657 |
| 0.70000 | 0.03154 |
| 0.80000 | 0.06935 |
| 0.90000 | 0.14852 |
| 0.95000 | 0.21403 |
| 1.00000 | 0.30462 |
| 1.05000 | 0.42906 |
| 1.10000 | 0.60752 |
| 1.14437 | 1.00000 |

ZONE 6, X=0.4583

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00150 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00991 |
| 0.60000 | 0.01348 |
| 0.70000 | 0.02496 |
| 0.80000 | 0.05495 |
| 0.90000 | 0.11851 |
| 0.95000 | 0.17167 |
| 1.00000 | 0.24652 |
| 1.05000 | 0.34963 |
| 1.10000 | 0.49325 |
| 1.15000 | 0.71742 |
| 1.17261 | 1.00000 |

ZONE 6, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00249 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00782 |
| 0.60000 | 0.01062 |
| 0.70000 | 0.01952 |
| 0.80000 | 0.04321 |
| 0.90000 | 0.09416 |
| 0.95000 | 0.13764 |
| 1.00000 | 0.19939 |
| 1.05000 | 0.28589 |
| 1.10000 | 0.40658 |
| 1.15000 | 0.58199 |
| 1.19732 | 1.00000 |

ZONE 6, X=0.5417

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00315 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02495 |
| 0.80000 | 0.05493 |
| 0.90000 | 0.11847 |
| 0.95000 | 0.17181 |
| 1.00000 | 0.24844 |
| 1.05000 | 0.34953 |
| 1.10000 | 0.49311 |
| 1.15000 | 0.71716 |
| 1.17265 | 1.00000 |

ZONE 6, X=0.5833

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00385 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01657 |
| 0.70000 | 0.03154 |
| 0.80000 | 0.06935 |
| 0.90000 | 0.14853 |
| 0.95000 | 0.21405 |
| 1.00000 | 0.30463 |
| 1.05000 | 0.42908 |
| 1.10000 | 0.60754 |
| 1.14437 | 1.00000 |

ZONE 6, X=0.6250

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01414 |
| 0.60000 | 0.01917 |
| 0.70000 | 0.03755 |
| 0.80000 | 0.08261 |
| 0.90000 | 0.17612 |
| 0.95000 | 0.25267 |
| 1.00000 | 0.35782 |
| 1.05000 | 0.50314 |
| 1.10000 | 0.72874 |
| 1.12135 | 1.00000 |

ZONE 6, X=0.6667

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00465 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04008 |
| 0.80000 | 0.08821 |
| 0.90000 | 0.18774 |
| 0.95000 | 0.26891 |
| 1.00000 | 0.38022 |
| 1.05000 | 0.53502 |
| 1.10000 | 0.79216 |
| 1.11275 | 1.00000 |

ZONE 6, X=0.7083

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01917 |
| 0.70000 | 0.03755 |
| 0.80000 | 0.08260 |
| 0.90000 | 0.17610 |
| 0.95000 | 0.25265 |
| 1.00000 | 0.35779 |
| 1.05000 | 0.50309 |
| 1.10000 | 0.72865 |
| 1.12157 | 1.00000 |

ZONE 6, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00385 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00835 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01657 |
| 0.70000 | 0.03154 |
| 0.80000 | 0.06934 |
| 0.90000 | 0.14851 |
| 0.95000 | 0.21401 |
| 1.00000 | 0.30459 |
| 1.05000 | 0.42901 |
| 1.10000 | 0.60743 |
| 1.14440 | 1.00000 |

ZONE 6, X=0.7917

| U/UB | Y/Y.1 |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00315 |
| 0.30000 | 0.00503 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02495 |
| 0.80000 | 0.05492 |
| 0.90000 | 0.11845 |
| 0.95000 | 0.17178 |
| 1.00000 | 0.24639 |
| 1.05000 | 0.34946 |
| 1.10000 | 0.49300 |
| 1.15000 | 0.71696 |
| 1.17258 | 1.00000 |

ZONE 6, X=0.8333

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00249 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00762 |
| 0.60000 | 0.01062 |
| 0.70000 | 0.01952 |
| 0.80000 | 0.04319 |
| 0.90000 | 0.09413 |
| 0.95000 | 0.13760 |
| 1.00000 | 0.19933 |
| 1.05000 | 0.28580 |
| 1.10000 | 0.40646 |
| 1.15000 | 0.58179 |
| 1.19736 | 1.00000 |

ZONE 6, X=0.8750

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00316 |
| 0.30000 | 0.00504 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02495 |
| 0.80000 | 0.05493 |
| 0.90000 | 0.11847 |
| 0.95000 | 0.17180 |
| 1.00000 | 0.24642 |
| 1.05000 | 0.34950 |
| 1.10000 | 0.49306 |
| 1.15000 | 0.71707 |
| 1.17267 | 1.00000 |

ZONE 6, X=0.9167

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00386 |
| 0.30000 | 0.00616 |
| 0.40000 | 0.00885 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01658 |
| 0.70000 | 0.03155 |
| 0.80000 | 0.06936 |
| 0.90000 | 0.14855 |
| 0.95000 | 0.21407 |
| 1.00000 | 0.30467 |
| 1.05000 | 0.42912 |
| 1.10000 | 0.60760 |
| 1.14436 | 1.00000 |

ZONE 6, X=0.9533

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01400 |
| 0.60000 | 0.01918 |
| 0.70000 | 0.03750 |
| 0.80000 | 0.08203 |
| 0.90000 | 0.17616 |
| 0.95000 | 0.25273 |
| 1.00000 | 0.35791 |
| 1.05000 | 0.50326 |
| 1.10000 | 0.72895 |
| 1.12152 | 1.00000 |

ZONE 6, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00466 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04009 |
| 0.80000 | 0.08823 |
| 0.90000 | 0.18779 |
| 0.95000 | 0.26897 |
| 1.00000 | 0.38031 |
| 1.05000 | 0.53515 |
| 1.10000 | 0.79244 |
| 1.11271 | 1.00000 |

ZONE 7, X=0.0

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00220 |
| 0.20000 | 0.00465 |
| 0.30000 | 0.00744 |
| 0.40000 | 0.01071 |
| 0.50000 | 0.01474 |
| 0.60000 | 0.02022 |
| 0.70000 | 0.04007 |
| 0.80000 | 0.08819 |
| 0.90000 | 0.18771 |
| 0.95000 | 0.26886 |
| 1.00000 | 0.38016 |
| 1.05000 | 0.53493 |
| 1.10000 | 0.79196 |
| 1.11277 | 1.00000 |

ZONE 7, X=0.2500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00210 |
| 0.20000 | 0.00443 |
| 0.30000 | 0.00708 |
| 0.40000 | 0.01018 |
| 0.50000 | 0.01399 |
| 0.60000 | 0.01917 |
| 0.70000 | 0.03754 |
| 0.80000 | 0.08258 |
| 0.90000 | 0.17607 |
| 0.95000 | 0.25260 |
| 1.00000 | 0.35772 |
| 1.05000 | 0.50300 |
| 1.10000 | 0.72850 |
| 1.12159 | 1.00000 |

ZONE 7, X=0.5000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00183 |
| 0.20000 | 0.00365 |
| 0.30000 | 0.00610 |
| 0.40000 | 0.00864 |
| 0.50000 | 0.01214 |
| 0.60000 | 0.01657 |
| 0.70000 | 0.03153 |
| 0.80000 | 0.06933 |
| 0.90000 | 0.14848 |
| 0.95000 | 0.21397 |
| 1.00000 | 0.30453 |
| 1.05000 | 0.42593 |
| 1.10000 | 0.60731 |
| 1.14442 | 1.00000 |

ZONE 7, X=0.7500

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00149 |
| 0.20000 | 0.00315 |
| 0.30000 | 0.00503 |
| 0.40000 | 0.00723 |
| 0.50000 | 0.00990 |
| 0.60000 | 0.01347 |
| 0.70000 | 0.02496 |
| 0.80000 | 0.05494 |
| 0.90000 | 0.11849 |
| 0.95000 | 0.17184 |
| 1.00000 | 0.24648 |
| 1.05000 | 0.34959 |
| 1.10000 | 0.49320 |
| 1.15000 | 0.71735 |
| 1.17262 | 1.00000 |

ZONE 7, X=1.0000

| U/UB | Y/YM |
|---|---|
| 0.0 | 0.0 |
| 0.10000 | 0.00118 |
| 0.20000 | 0.00250 |
| 0.30000 | 0.00398 |
| 0.40000 | 0.00571 |
| 0.50000 | 0.00783 |
| 0.60000 | 0.01063 |
| 0.70000 | 0.01953 |
| 0.80000 | 0.04324 |
| 0.90000 | 0.09422 |
| 0.95000 | 0.13773 |
| 1.00000 | 0.19950 |
| 1.05000 | 0.28603 |
| 1.10000 | 0.40676 |
| 1.15000 | 0.58223 |
| 1.19727 | 1.00000 |

TOTAL TIME (SEC) 12.41

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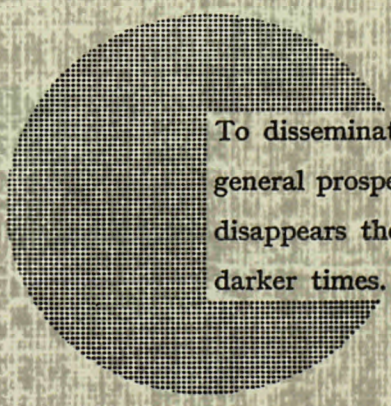

To disseminate knowledge is to disseminate prosperity — I mean general prosperity and not individual riches — and with prosperity disappears the greater part of the evil which is our heritage from darker times.

Alfred Nobel

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