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SMITE - A SECOND ORDER EULERIAN CODE FOR
HYDRODYNAMIC AND ELASTIC-PLASTIC PROBLEMS

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Mathematical Applications Group, Incorporated

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August 1975

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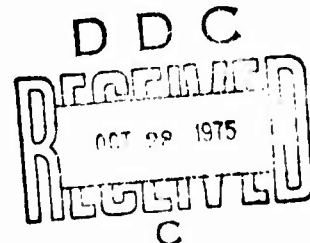
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HYDRODYNAMIC AND ELASTIC-PLASTIC PROBLEMS

Prepared by

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August 1975

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INTRODUCTION

This manual describes the SMITE (Second order Moving Interface Two dimensional Eulerian) code for hydrodynamic and elastic-perfectly plastic problems. The code is based on an Eulerian formulation for the numerical model. Eulerian methods are characterized by a mesh which is fixed in space for all times. The materials are allowed to move freely through this grid. In the SMITE code, each material has its own independent grid. Thus, the mesh spacing and number of mesh grids in one material is in no way affected by that in another material. The equations are also solved in a transformed plane. This allows for transformations to be used which concentrate the mesh points in regions of greatest interest.

The extent of each domain is determined by particles or material points which define the domain boundary. These points are moved in a Lagrangian sense by integrating the ordinary differential equations relating their positions and velocities. The values at the boundary points are subject to free surface and interface conditions. The interface conditions provide the only communication between the various material domains.

The model upon which the SMITE code is based is fully described in the report "A Second Order Numerical Model for High Velocity Impact Phenomena" by the same authors. All references in this manual are to sections of the above report.

II.

SUBROUTINE LOGIC

2.1 Main Program

The main program controls the overall logical flow of the code. INITIAL is called to read input and initialize the run. All time increments are added to the starting time to determine when the processes dependent on these increments will next occur. The cycle count is incremented to start the main loop. The time step is set to the minimum of the CFL time step determined for all materials. If this time step is less than the minimum allowed, a message is printed and the run aborted. The time is incremented and MVBND called to move all material boundaries. ADJINT is then called to determine the new interface locations and adjust the boundary positions accordingly. Initial boundary values for each material are extrapolated from the interior by calling BONDY. DENSB is then called to satisfy boundary conditions. The routine now loops through the material. GENVAL sets the proper material dependent mesh and array bound values. FDIFF is called next to solve the finite difference equations. FINISH is then called to determine if any shifting of the domain or rezoning of its boundary is necessary. The positions where the boundaries cross the mesh lines are determined by calling BPOSN and BVALU is called to calculate the crossing coordinates and the variable values at these crossing points. Values are then interpolated at all interior mesh points for which the finite difference equations could not be used by calling INTRPL. This ends the material loop. The error flag is checked and if it is set the run is aborted. SECOND is called to obtain the elapsed running time. If the running time or problem time are greater than their maximum values, the run is ended. The problem time is compared to the time at which the next printer plot is desired. If this time has been exceeded PRNPLT is called and the printer plot increment is added to the printer plot time. The same is done with PLTOUT for plotter output, OUTPUT for printed output and SAVE for restart output. The next time cycle is then started. At the end of a run all desired output is generated regardless of the respective time increments.

2.2 ADJINT

Subroutine ADJINT determines the locations of material interfaces and adjusts boundary positions accordingly. In its present state, it is a rather ad hoc routine which makes strong assumptions regarding material orientation and relative position. If a particular problem does not meet these conditions, ADJINT will have to be modified or rewritten for that problem. It is assumed that all interfaces exist at the start of the problem. If the boundaries of the two materials penetrate each other, it is assumed that the first material (material A) that appears in the interface specification is the predominant material. The interface points of the second material (material B) will be replaced by those of material A. The task of ADJINT is to determine the exact extent of the interface. All boundaries consist of three segments which are divided by the boundary points into linear sub-segments. It is assumed that the interface starts with the first point of material A and the last point of material B and hence that material A is on the right of material B. In order to find the end of the interface, the logic is to find a point on each boundary not on the interface and then trace the boundaries toward the interface until they first intersect. It is further assumed that the interface lies entirely within the third segment of material B. The maximum z coordinate of material B

is found and then the last point of material A whose z coordinate is less than this maximum value. The next point on material A is the endpoint of the last material A sub-segment that can intersect the boundary of material B so that no additional points on the material A boundary are considered. The maximum r coordinate of the valid material A points is determined and then the first material B point less than this value. This point defines the endpoint of the first material B sub-segment that can intersect the boundary of material A. A box is drawn around the material B sub-segment and the first and last material A sub-segments that enter this box are determined. Only those sub-segments of material A between these end segments can possibly intersect the sub-segment of material B. Starting with the last material A sub-segment, each sub-segment is tested for an intersection. If an intersection is found then the lower sub-segment endpoints define the end of the respective interface segments. If an intersection is not found, a box is drawn around the next material B sub-segment and the search continues. Once an intersection is found, the material B interface segment is replaced by the material A interface segment. Since this replacement may add to the total number of material B boundary points a test is made to see if the number of points on the material B boundary exceeds the maximum allowable. If so, a message is printed and a flag is set to abort the run at the end of the cycle.

If material B represents material domain 3 special logic is provided. In this case, the interface segments as defined upon entering ADJINT are used. The points of the material B segment are simply replaced by the points of the material A segment. No assumptions are made about the segment location or boundary orientations.

2.3 BONDRY

This subroutine obtains values for all variables on the boundaries of the material domains. The boundary point coordinates, which upon entering BONDRY are in z-r space, are first transformed to α - β space. The arc length along the boundary at each point is then computed. Boundary values are extrapolated from the interior by choosing the closest interior mesh point to a boundary point and assigning the dependent variable values at this mesh point to the boundary point (5.a). The four mesh points surrounding a boundary point are examined. If the closest mesh point is interior to the domain it is chosen; if it is not interior, the next closest is selected, etc. If none of the four points are interior to the domain, the boundary point retains the values associated with it from the previous time step. These extrapolated values are then smoothed to prevent a step function appearance. The smoothing formula used is

$$b_i = a_i + \frac{1}{4} r (a_{i+1} - 2a_i + a_{i-1})$$

where r is the ratio of the time step used to the time step calculated for the material. This ratio prevents the smoothing operation from propagating signals through a material at a rate greater than the CFL stability condition would allow.

2.4 BPOSN

The positions where the boundaries cross the mesh lines are determined by subroutine BPOSN. Two similar arrays are defined, one for the mesh lines in each coordinate direction. These arrays are computed by systematically following the boundary. The logic for both sets is identical, so that only the computation of the crossings of the lines $z=\text{constant}$ will be described. Let $\text{Int}(a)$ be the largest integer less than or equal to a and Δz be the mesh spacing. Then $i=\text{Int}(z_m/\Delta z)$ implies that the boundary point p_m with axial coordinate z_m lies between mesh lines i and $i+1$. Starting with $n=\text{Int}(z_1/\Delta z)$ values of i are determined for succeeding boundary points until i is not equal to n . If i is less than n , mesh line n has been crossed; if i is greater than n , mesh line $n+1$ has been crossed. Let p_{m+1} be the boundary point where i changed value. Then the boundary crossed a mesh line between point m and $m+1$. The integer m is entered into the array for the mesh line that was crossed and all entries for that mesh line are ordered according to increasing radial coordinate values. A total of $|n-1|$ mesh lines may have been crossed and an entry is made for each of them. The integer n is then reset to $n=\text{Int}(z_{m+1}/\Delta z)$ and the procedure continues until the entire boundary has been traced.

2.5 BVALU

BVALU determines the coordinates of the points where the boundaries cross mesh lines and the values of the dependent variables at these points. The coordinates of a crossing are defined as the intersection of a mesh line with the straight line segment between the boundary points on either side of it. The dependent variable values are then obtained by interpolating along this line segment.

2.6 DENSEB

Boundary conditions are satisfied by subroutine DENSEB. INFACE is called to satisfy conditions on all interfaces. All non-interface, i.e. free surface, points are then determined. The normal stress at these points is then set to zero (5.b).

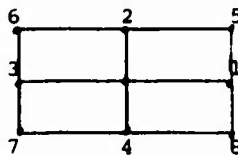
All interfaces are examined and an array is created which specifies, for each material, the first and last points of all boundary segments that are interfaces. These segment endpoints are arranged in ascending order with a zero after the last endpoint to signal the end of the array. Each material is then processed. The boundary coordinates are transformed from α - β to z - r space and the transformed values are stored in a temporary array. Each free surface segment, if any, will be all those boundary points lying between the high endpoint of one interface segment and the low endpoint of the next interface segment. The local slope at a point (z_i, r_i) is obtained from $\tan \psi = (z_{i+1} - z_{i-1}) / (r_{i+1} - r_{i-1})$. For the normal stress to vanish, we must have

$$p = S_{11} \sin^2 \psi + 2 S_{12} \sin \psi \cos \psi + S_{22} \cos^2 \psi$$

This condition on pressure is satisfied by finding the internal energy and using Newton-Raphson iteration to solve the equation of state for the proper density. The density at the free surface boundary point is then set to this value. If the iteration does not converge, a message is printed and a flag is set to abort the run at the end of the cycle.

2.7 FDIFF

The finite difference equations at interior mesh points are evaluated in subroutine FDIFF (4.a). The entire mesh is shifted in memory two radial lines to the right (toward higher index of the axial mesh). It should be noted that the solution at any mesh point depends only on the mesh lines through that point and on either side of it. Hence, if the solution proceeds along radial mesh lines and the answers are stored back two lines to the left, only room for two additional mesh lines need be added to the memory arrays to allow the old solution to be overwritten by the new solution. The eight nearest neighbors of a mesh point are examined to determine if any lie outside the domain. The neighbors are ordered and if the n th neighbor is missing 2^{n-1} is added to a code word. The neighbors are ordered counterclockwise with the four nearest neighbors first starting with the right and then the four outer neighbors starting with the upper-right. If the code used is non zero, all neighbors are not interior to the domain and ONESTP is called. If all neighbors are present, the two



step solution may be used.

At each mesh point in the nine point solution lattice, the transformed seven component vector w and its vector functions f , g and h are computed and stored in 3×3 matrices. In both steps of the two step method, the difference equations for the first four components of w are evaluated first and then the difference equations for the three stress components are evaluated. Predicted values at the four midpoints of the boxes shown in the above figure are obtained. That portion of the second step which depends on values at time t is also obtained. The artificial viscosity is included in the partial second step evaluation.

The predicted values are used to define the f , g and h vectors at the lattice midpoint. The remainder of the second step of the solution that depends on the predicted values is then obtained. This solution is transformed back to its non-conservative form and stored in the solution array. A test is then made to determine if the stress components satisfy the yield condition. If they do not satisfy the yield criteria the stresses are modified to force them back on to the yield surface (3.b). Finally, the CFL stability parameter at the mesh point is evaluated. If the solution appears to be going unstable, ONESTP is called in an attempt to obtain a more stable value. After all mesh points have been evaluated, the L array is shifted back to its original locations. The CFL stable stepsize for the material is then computed.

2.8 FINISH

This subroutine checks the position of each domain relative to storage and of the boundary points of a domain relative to each other. As a domain moves through its mesh it may cover some mesh points and uncover others. The algorithm requires at least one line of exterior mesh points in all directions at the start of a time step. This ensures the existence of mesh points to allow the domain to expand in any direction. The boundary is checked to see if any point on it has exceeded the mesh. If the mesh is exceeded in one direction, the opposite direction is checked. If the opposite direction has more than two exterior mesh lines, the domain is shifted as far as possible in that direction. This is done by shifting all interior arrays in storage and performing a linear translation on the proper α - β coordinate. If a shift is not possible, a flag is set to abort the run at the end of the cycle. A message is printed together with the domain limits and the boundary coordinates in α - β space.

The arc length of each boundary segment is compared with the length of that segment when it first contained its present number of points. If the arc length more than doubled, the number of points is increased by fifty percent. All boundary points above the segment are shifted up to make room for the additional points. Tracer point and interface endpoint information that refers to the shifted boundary points is also adjusted. If the arclength has not doubled the segment is also checked for relative distance between adjacent points. If the deviation from the average is too large the points in the segment are redistributed. The actual redistribution of points, whether the total number remain the same or has been increased, is performed by subroutine RELABL.

2.9 GENVAL

Values of various variables that depend on material properties and mesh geometry and which vary from one material domain to the next are set by subroutine GENVAL.

2.10 INFACE

The boundary conditions on interfaces are satisfied by subroutine INFACE. These conditions are the continuity of normal velocity and stress (5.c.). The local slope at a point (z_i, r_i) is obtained from $\tan \psi = (z_{i+1} - z_{i-1}) / (r_{i+1} - r_{i-1})$. The boundary values obtained from the interior on each side of the interface are used to calculate a normal and tangential velocity and a normal stress. A weighted average of the normal velocities and another weighted average of the normal stresses are used to define a common normal velocity and a common normal stress. The common normal velocity together with the previously calculated tangential velocities on both sides of the interface are used to obtain the adjusted axial and radial velocities. The common normal stress provides a condition for pressure on both sides of the interface. Fixing the internal energy, a Newton-Raphson iteration is used to solve the equation of state for the proper density. If the iteration does not converge a message is printed and a flag is set to abort the run at the end of the cycle.

2.11 INITAL

All input data is read in subroutine INITAL. General run parameters are read first and the interfaces are defined. If the run is a continuation of a previous run, the interface parameters are overwritten by those on the restart tape. Input is then read for each material domain in turn. The domains are numbered according to the order in which they are input. The bounds of the array segments associated with the material are calculated and these segments are then zeroed out. Non-dimensionalization factors are then generated. Length is non-dimensionalized by mesh size so that the mesh size is unity. The scaling factor used for time is set to that for length so that velocity is non-dimensionalized by a speed of unity; hence non-dimensional velocity numerically remains the same as dimensional velocity. The initial material density is used to non-dimensionalize density. The constants needed in the coordinate transformations are calculated and the input boundary coordinates are transformed to α - β space. The transformed mesh size is unity for both coordinates so that the arc length of a boundary segment is an approximate measure of the number of mesh segments it traverses. Thus setting the number of points in each boundary segment to twice its arc length will result in approximately two boundary points per mesh segment. Values of r and its derivatives are calculated for each radial mesh point and mid-point. RELABJ is called to generate the proper number of equally spaced boundary points from the input values. These points are then set to their initial values. The points where the boundary crossed the mesh lines and values at these points are determined by calling BPOSN and BVALU. The interior points are set to their initial values and IPOSN is called to determine which points are interior and which exterior to the domain. A line of reflected points below the axis of symmetry is then set. The CFL stepsize for the material is calculated as is the initial arc length of each boundary segment. If this run is a continuation of a previous run, the initial values are read from the restart tape. The restart domain is then shifted to the positions required by the first axial and radial mesh point interior to the domain as specified by the input. For a restarted problem those portions of INITAL that initialize domain values are skipped. After all materials have been input and initialized the time increments for the various types of output are examined. If the increment is negative it is set to a large number so that it will never be reached and its corresponding type of output will never occur. Otherwise the associated output subroutine is called to output the initial data.

2.12 INTRPL

The solution at mesh points that were too near to the domain boundary, that have just become interior to the domain or where the finite difference solution appeared to be going unstable is evaluated by interpolation from neighboring interior and boundary crossing points in subroutine INTRPL. First subroutine IPOSN is called to determine which points are interior to the domain. An axial mesh line below the axis of symmetry is reflected from the mesh line above the axis of symmetry. The mesh is then swept to determine which points remain to be computed by interpolation. Linear interpolation from adjacent interior or boundary crossing points is used. The four nearest neighbors to the mesh point are examined. Each may be a boundary crossing point, an interior point that was obtained from the finite difference equations or an in-

terior point that must be interpolated. These three possibilities at the four neighbors represent 81 possible configurations. Each configuration is accounted for and a point on either side of the mesh point is selected, if possible, for the interpolation process. Points that themselves must be interpolated are not selected since they may not as yet have been evaluated. After the entire mesh has been swept the points that were interpolated are redefined as normal interior points. A line of reflected values is again generated below the axis of symmetry to account for any recently interpolated values. The 81 possible configurations are represented by the codes in the following table. A 0 represents a boundary crossing point; a 1 represents an interior point that was obtained from the finite difference equations and a 2 represents an interior point that must be interpolated. Reading the numbers from right to left, the digits represent the point below, above, to the left and to the right of the mesh point. The points that were selected for use in the interpolation are underlined. In some cases only one point was used. Here the interpolated values were set directly to the values at that point.

1. 00 <u>00</u>	22. 02 <u>10</u>	42. <u>11</u> 12	62. 202 <u>1</u>
2. 00 <u>01</u>	23. 02 <u>11</u>	43. <u>11</u> 20	63. 202 <u>2</u>
3. 00 <u>02</u>	24. 02 <u>12</u>	44. <u>11</u> 21	64. 2 <u>1</u> 00
4. 00 <u>10</u>	25. 02 <u>20</u>	45. <u>11</u> 22	65. 210 <u>1</u>
5. 00 <u>11</u>	26. 02 <u>21</u>	46. <u>12</u> 00	66. 210 <u>2</u>
6. 00 <u>12</u>	27. 02 <u>22</u>	47. <u>12</u> 01	67. 21 <u>1</u> 0
7. 00 <u>20</u>	28. <u>10</u> 00	48. <u>12</u> 02	68. 21 <u>11</u>
8. 00 <u>21</u>	29. <u>10</u> 01	49. <u>12</u> 10	69. 21 <u>12</u>
9. 00 <u>22</u>	30. <u>10</u> 02	50. <u>12</u> 11	70. 2 <u>1</u> 20
10. 0 <u>1</u> 00	31. <u>10</u> 10	51. <u>12</u> 12	71. 212 <u>1</u>
11. 0 <u>1</u> 01	32. <u>10</u> 11	52. <u>12</u> 20	72. 212 <u>2</u>
12. 0 <u>1</u> 02	33. <u>10</u> 12	53. <u>12</u> 21	73. 220 <u>0</u>
13. 0 <u>1</u> 10	34. <u>10</u> 20	54. <u>12</u> 22	74. 220 <u>1</u>
14. 0 <u>1</u> 11	35. <u>10</u> 21	55. 200 <u>0</u>	75. 220 <u>2</u>
15. 0 <u>1</u> 12	36. <u>10</u> 22	56. 200 <u>1</u>	76. 22 <u>1</u> 0
16. 0 <u>1</u> 20	37. <u>11</u> 00	57. 200 <u>2</u>	77. 22 <u>11</u>
17. 0 <u>1</u> 21	38. <u>11</u> 01	58. 20 <u>1</u> 0	78. 22 <u>12</u>
18. 0 <u>1</u> 22	39. <u>11</u> 02	59. 20 <u>11</u>	79. 222 <u>0</u>
19. 020 <u>0</u>	40. <u>11</u> 10	60. 20 <u>12</u>	80. 222 <u>1</u>
20. 020 <u>1</u>	41. <u>11</u> 11	61. 202 <u>0</u>	81. 222 <u>2</u>
21. 020 <u>2</u>			

2.13 IPOSN

The L array, which specifies whether a mesh point is in a domain or not, is set in subroutine IPOSN. The crossing points of the boundary with the mesh lines are used to determine what is exterior and what is interior to the domain. The mesh is first swept along the lines $r = \text{constant}$. All mesh points along such a line up to the first boundary crossing are outside the domain. All points from the first crossing to the second crossing are inside. The next set of points are outside, then inside, etc. If a point is outside the domain, L is set to 0. If a mesh point is inside and L has been set to 2 because the point could not be calculated from the finite difference equations, it remains set at 2. Otherwise L is set to $2-L$. Thus for all exterior points L is 0, for all interior points that were calculated from the finite difference equations L is 1 and for all interior points that have not yet been calculated L is 2. Interpolation errors in obtaining the boundary crossings may cause a mesh point to appear interior when one coordinate direction is considered, yet exterior when the other coordinate direction is considered. The algorithms require a mesh point to be interior no matter which coordinate direction is considered. To allow for this the boundary crossings of the mesh lines $z = \text{constant}$ are also considered. The crossings are followed as before except that only exterior points need be considered. L is set to 0 for these points so that L will be non zero only for those mesh points which appear interior no matter which way the mesh is swept. For the $z = \text{constant}$ mesh crossings the assumption that all mesh points until the first crossing are exterior is valid only if the lines are swept from above the domain toward the axis of symmetry.

2.14 MVBND

In this subroutine the domain boundaries are moved in time by using a simple Euler integration (5.a). The coordinates of the boundary points are transformed from α - β space to z - r space and the velocities are integrated with respect to time to find the new boundary positions. These new positions are then in the z - r coordinate system.

2.15 ONESTP

The one step finite difference equations for mesh points whose nine point solution stencil does not lie entirely in the domain are evaluated in subroutine ONESTP (4.b). As described in FDIFF, a code word is generated to specify which neighbors of the mesh point are missing. If this word is divided by 16 the result will refer to the four outer neighbors while the remainder refers to the four nearest neighbors. First derivatives and non mixed second derivatives may be approximated to second order by using the two points on either side of the mesh point in the required direction. These two points will be either mesh points or boundary crossing points. The four outer neighbors are required only for approximating the second mixed partial derivatives. Each of these outer points may be represented by a Taylor's series about the central mesh point. Combinations of these series will yield formulas for the mixed derivative in terms of the outer points and the first and non mixed second derivatives. Depending upon the combinations used, these formulas may be first or second order accurate. However, first order accuracy in the second space derivatives is all that is required for the overall difference scheme to remain second order accurate. By thus splitting the four outer neighbors from the four nearest neighbors the 256 possible combinations of missing points may be dealt with by first considering the 16 possibilities relating to the four nearest neighbors and then the 16 possibilities relating to the four outer neighbors.

The derivatives are evaluated first in the axial and then in the radial direction. In either case there are four possibilities to consider. There may be mesh points on both sides, a mesh point on either side and a boundary crossing on the opposite side or boundary crossings on both sides. When there is a boundary crossing, the distance to the boundary is calculated. If this distance is less than the allowable distance the point is skipped to be later evaluated by interpolation in subroutine INTRPL. After the derivatives in each direction are obtained the mixed derivatives are evaluated. These space derivatives are combined into the expressions appearing in the one step equations and these equations are computed. The artificial viscosity is then added. A test is made to determine if the stress components satisfy the yield condition. If they do not satisfy the yield criteria the stresses are modified to force them back onto the yield surface (3.b). Finally, the CFL stability parameter at the mesh point is evaluated. If the solution appears to be going unstable it is discarded to be later evaluated by interpolation in subroutine INTRPL.

The following table will illustrate the code used for missing points.

<u>Code</u>	<u>Date Used for Derivative Approximation</u>
1. 0000	use all points
2. 0001	use lower right and lower left
3. 0010	use lower right and upper right
4. 0011	use lower right and lower left
5. 0100	use upper left and upper right
6. 0101	use lower right and upper left
7. 0110	use lower right and upper right
8. 0111	use lower right
9. 1000	use lower left and upper left
10. 1001	use lower left and upper left
11. 1010	use lower left and upper right
12. 1011	use lower left
13. 1100	use upper left and upper right
14. 1101	use upper left
15. 1110	use upper right
16. 1111	skip and interpolate

A 0 represents the presence of a point while a 1 means it is outside of the domain. The codes may represent the ordering of the 16 possibilities for both the four nearest neighbors and the four outer neighbors. Reading from right to left the digits represent, for the nearest neighbors, the points to the right, above, left and below. For the four outer neighbors the order is upper right, upper left, lower left and lower right. In representing the outer neighbors the codes are followed by an indication of which of the points are used in evaluating the mixed derivatives.

2.16 OUTPUT

This routine prepares all printed output. All output is of dimensioned variables and in z-r space. The output proceeds according to material domains. The boundary points appear first. If both IPRINT and JPRINT are not zero, the interior mesh points appear next. They are numbered along axial lines with the line nearest to the axis of symmetry first. Only those interior points which are also interior to a box of size IPRINT times JPRINT are printed. This box starts at the left boundary if IPRINT is positive or ends at the right boundary if IPRINT is negative. It starts at the bottom boundary if JPRINT is positive or ends at the top boundary if JPRINT is negative. The tracer particles are output next. Their values are obtained by interpolation from the proper boundary points. After all domains have been printed the boundary points that are interfaces are identified.

2.17 PLTOUT

Information is prepared in PLTOUT for processing by separate plot programs. The z-r space boundary coordinates, the tracer particle coordinates and the tracer particle velocities are calculated and then written out. All mesh points which are in a plastic region are then obtained. The coordinates of these points are then written out in blocks of 100 points.

2.18 PRNPLT

This subroutine prepares printer plots of the domain boundaries. The boundary points are transformed to z-r space and then scaled to inches of plot. The printer plot routine PRNT is then called for each point to plot the arrays.

2.19 PRS

PRS is a function subroutine to evaluate the equation of state. If the logical variable PDER is true it must also evaluate the partial derivatives of pressure with respect to density and internal energy. The routine supplied uses the Tillotson equation of state but may be replaced by any user written routine.

2.20 RELABL

The points defining a boundary segment are redistributed over that segment in subroutine RELABL. The positions of tracer particles and interface end points are also redefined in relation to the new boundary points. The point coordinates and function values are considered to be functions of arc length along the boundary. The total arc length is divided into evenly spaced intervals by the number of points in the new set. At the end points of the evenly spaced intervals, new point coordinates and function values are interpolated from the old coordinates and values. The arc length value at a tracer particle is also used to find the exact new interval in which that particle lies and its relative position in that interval is then calculated. The new boundary points which define interface endpoints will be those points bounding the largest segment wholly contained in the old interface segment.

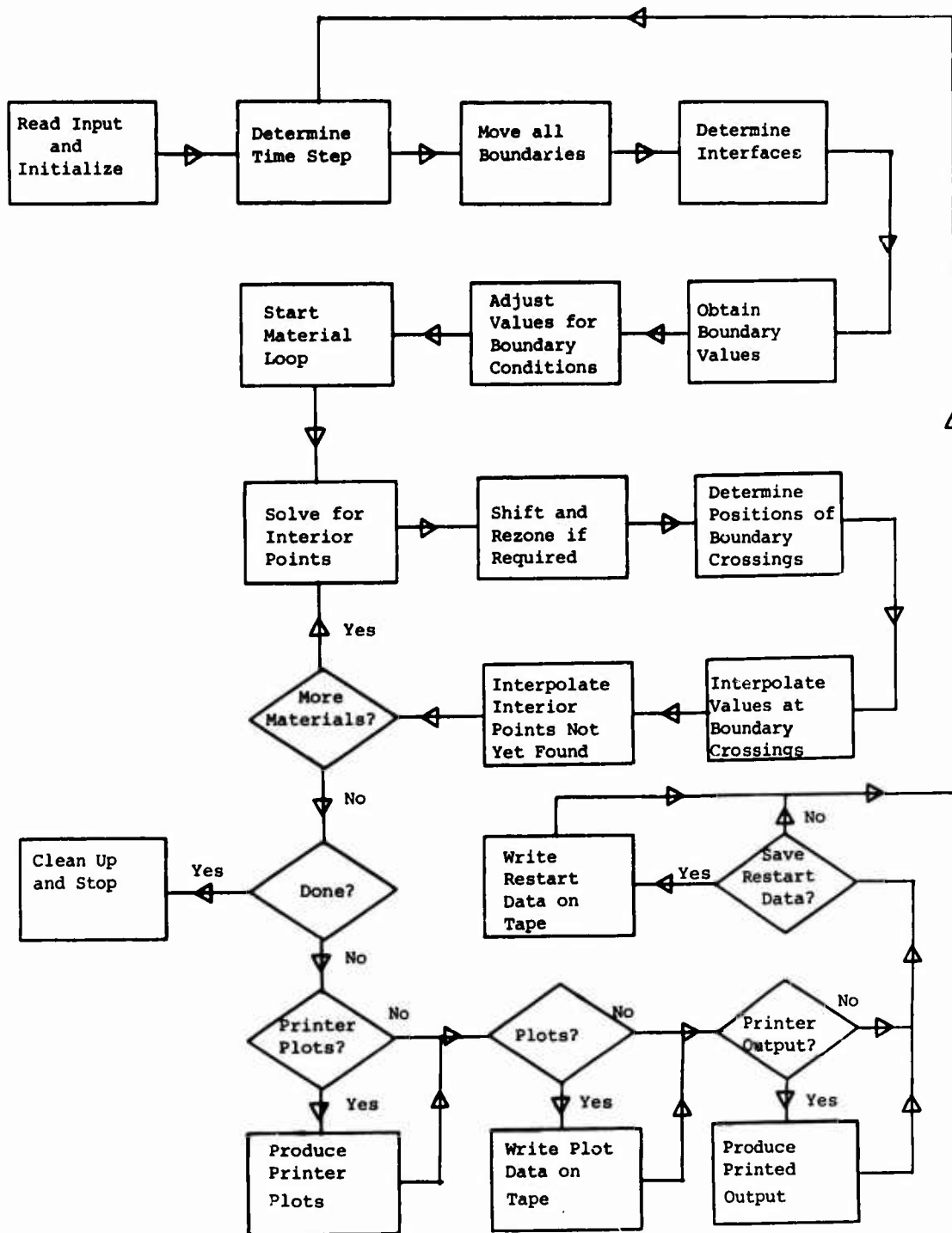
2.21 SAVE

Information needed to continue the calculation in a subsequent run is output by subroutine SAVE. Before being output, all domains are shifted as far to the left and bottom as possible. Only those mesh points interior to the smallest mesh rectangle containing the domain are then output. This allows for the possibility of the restarted problem being run using smaller arrays and less computer memory.

III.

GENERAL PROGRAM DESCRIPTION

3.1 Flow Chart



3.2 Subroutine References

NAME	CALLER FROM	CALLS
MAIN PROGRAM		
ADJINT	MAIN	ADJINT, BONDY, BPOSN, BVALU, DENSB, FDIFF, FINISH, GENVAL, INITIAL, INTRPL, MVEND, OUTPUT, PLTOUT, PRNPLT, SAVE
BONDY	MAIN	GENVAL
BPOSN	MAIN, INITIAL	
BVALU	MAIN, INITIAL	
DENSB	MAIN	GENVAL, INFACE, PRS
FDIFF	MAIN	ONESTP, PRS
FINISH	MAIN	RELABEL
GENVAL	MAIN, BONDY, DENSB, INITIAL, MVEND, OUTPUT, PLTOUT	
INFACE	DENSB	PRS
INITIAL	MAIN	BPOSN, BVALU, GENVAL, IPOSN, OUTPUT, PLTOUT, PRNPLT, PRS, RELABEL
INTRPL	MAIN	IPOSN
IPOSN	INITIAL, INTRPL	
MVEND	MAIN	GENVAL
ONESTP	FDIFF	PRS
OUTPUT	MAIN, INITIAL	GENVAL, PRS
PLTOUT	MAIN, INITIAL	
PRNPLT	MAIN, INITIAL	
PRS	DENSB, FDIFF, INFACE	
RELABEL	INITIAL, ONESTP, OUTPUT	
SAVE	FINISH, INITIAL	
	MAIN	

3.3 Common Block References

NAME

REFERENCES

BLANK	BONDY, FDIFF, FINISH, INITIAL, INTRPL, IPOSN, ONESTP, OUTPUT, PLTOUT, SAVE
BNDERS	BONDY, BPOSN, BVALU, FINISH, INITIAL, INTRPL, IPOSN, ONESTP, OUTPUT
BNDVAL	ADJINT, BONDY, BPOSN, BVALU, DENSB, FINISH, INFACE, INITIAL, MVBND, OUTPUT, PLTOUT, PRNPLT, RELABL, SAVE
COMVAL	MAIN, ADJINT, BONDY, BPOSN, BVALU, DENSB, FDIFF, FINISH, GENVAL, INFACE, INITIAL, INTRPL, MVBND, ONESTP, OUTPUT, PLTOUT, PRNPLT, RELABL, SAVE
EPSTP	INITAL, PRS
INTFC	ADJINT, BONDY, DENSB, FINISH, GENVAL, INFACE, INITIAL, OUTPUT, RELABL, SAVE
MATARR	MAIN, ADJINT, BONDY, BPOSN, DENSB, FDIFF, FINISH, GENVAL, INFACE, INITIAL, MVBND, ONESTP, OUTPUT, PLTOUT, PRNPLT, RELABL, SAVE
MATVAL	BONDY, BPOSN, BVALU, DENSB, FDIFF, FINISH, GENVAL, INITIAL, INTRPL, IPOSN, MVBND, ONESTP, OUTPUT, PLTOUT, RELABL
MSHFCN	FDIFF, INITIAL, ONESTP
PRESS	BONDY, DENSB, FDIFF, GENVAL, INFACE, INITIAL, ONESTP, OUTPUT, PRS
SCRCH	ADJINT, BONDY, DENSB, INFACE, INITIAL, PLTOUT, PRNPLT, RELABL, SAVE
TRCPRT	BONDY, FINISH, GENVAL, INITIAL, OUTPUT, PLTOUT, RELABL, SAVE
TVALS	MAIN, INITIAL, OUTPUT
ZONES	ADJINT, BONDY, DENSB, FINISH, GENVAL, INFACE, INITIAL, PLTOUT, PRNPLT, RELABL, SAVE

3.4 Storage Arrangement

The number of mesh points in each coordinate direction and the number of boundary points may vary from run to run and from material to material. In order to efficiently utilize computer memory the storage arrays have no fixed dimensions for these quantities. All materials are stored consecutively. The area reserved for each material is computed from input parameters. The index of any point in a material is computed relative to a reference value for that material. If KS is the reference value for a material then the point in that material with index K would be referred to in the array with index KS+K. The axial arrays are those in common BNDCRS whose name contains I and their reference is IS. The radial arrays are those in common BNDCRS whose name contains J and all arrays in common MSHFCN. The radial reference is JS. The first dimension of these arrays controls the maximum number of points for all materials and the second dimension controls the maximum number of boundary crossings in these directions. Thus, if IMAX and JMAX are the axial and radial dimensions, respectively, and for each material the maximum number of axial points is NI and the maximum number of radial points is NJ, then the requirement is

$$\sum NI \leq IMAX \quad \sum (NJ+1) \leq JMAX$$

where the summation is over all materials. The addition of 1 to the NJ is to take account of the reflected line of data points below the axis of symmetry. The arrays for interior mesh points are in blank common and have reference IJS. A mesh point of axial index I and radial index J is referred to in the arrays with the single index IJS + (J-1)(NI+2) + I. If the array dimension is IJMAX then the requirement on the materials is

$$\sum (NI+2)(NJ+1) \leq IJMAX$$

The 2 that is added to NI allows for shifting as stated in the description of subroutine FDIFF. The boundary arrays are in common BNDVAL and have reference IBS. For dimensions BMAX and maximum per material of NB the storage requirement is again

$$\sum NB \leq BMAX$$

Temporary arrays for boundary points that are used separately for each material are in common SCRTCH. The storage requirement here is just that the maximum number of boundary points for any material be less than the array dimension. The maximum number of materials is the first dimension of the arrays in common ZONES, the second dimension in MATARR, the first dimension in TRCPRT and the second dimensions of the array NONIN in common INTFC. The maximum number of tracer particles per material is the second dimension of the arrays in common TRCPRT. The maximum number of interfaces is controlled by the array INFC in common INTFC which has six entries per interface while the maximum number of interfaces one material may have with all other materials is controlled by the first dimension of NONIN. NONIN must have storage for two entries per interface plus one additional entry to signal the last interface for the material.

3.5 Major Variables

NAME	COMMON	DEFINITION
A	MATVAL	Constant in β transformation
ABL	MATVAL	Constant in β transformation
AF	MATVAL	Constant in α transformation
AK	MATVAL	Time step (non-dimensional)
AKT	COMVAL	Total problem time
AL	MATVAL	$\Delta t / \Delta \alpha$
PLPH	EQSTP	α in Tillotson equation of state
ANG	MATVAL	Constant in α transformation
APB	EQSTP	A in Tillotson equation of state
APL	EQSTP	a in Tillotson equation of state
ARCSIZ	ZONES	Arcsize of boundary segments after adding points
AS	MATVAL	$\Delta t / \Delta \beta$
ASY	MSHFCN	α_r
ASYA	MSHFCN	$(\alpha_r)_\beta$ at $\beta + \frac{1}{2} \Delta \beta$
AX	MATVAL	α mesh spacing
AY	MATVAL	β mesh spacing
AYY	MSHFCN	$(\alpha_r)_\beta$
B	MATVAL	Constant in β transformation
BETA	EQSTP	β in Tillotson equation of state
BMAX	MATVAL	Constant in β transformation

NAME	COMMON	DEFINITION
BPB	EQSTP	B in Tillotson equation of state
BPL	EQSTP	b in Tillotson equation of state
CFL	MATVAL	Constant in stability equation
CHAN	MATVAL	Constant in inverse β transformation
DABL	MATVAL	Constant in inverse β transformation
DAL	COMVAL	Maximum deviation of distance between boundary points from average
DAX	MATVAL	$1/\Delta\alpha$
DAX2	MATVAL	$(1/\Delta\alpha)^2$
DAY	MATVAL	$1/\Delta\beta$
DAY2	MATVAL	$(1/\Delta\beta)^2$
DISMAX	ZONES	Maximum distance between points in boundary segments
DISMIN	ZONES	Minimum distance between points in boundary segments
DT	COMVAL	Time step (dimensional)
DTHIN	COMVAL	Minimum allowable time step
DTR	MATVAL	Ratio of time step to material time step
DY	MSHFCN	r_β/r
DYA	MSHFCN	r_β/r at $\beta + \frac{1}{2} \Delta\beta$
EIGF	MSHFCN	$(\alpha^2 + 1)^{1/2}$
EPS	COMVAL	Tolerance
EPSI	COMVAL	Tolerance
ERR	COMVAL	Error flag

NAME	COMMON	DEFINITION
ES	EQSTP	E_s in Tillotson equation of state
ESPRM	EQSTP	E'_s in Tillotson equation of state
ESY	MSHFCN	β_r
ESYA	MSHFCN	β_r at $\beta + \frac{1}{2} \Delta\beta$
ESYE	MSHFCN	$(\beta_r)_\beta$
EZERO	EQSTP	E_0 in Tillotson equation of state
FACT	MATVAL	Constant in α transformation
FMAT(1)	MATARR	α mesh spacing
FMAT(2)		β mesh spacing
FMAT(3)		Constant in stability equation
FMAT(4)		Onestep viscosity coefficient
FMAT(5)		Twostep viscosity coefficient
FMAT(6)		Shear modulus
FMAT(7)		Yield condition
FMAT(8)		Initial density
FMAT(9)		Length non-dimensionalizing factor
FMAT(10)		Pressure non-dimensionalizing factor
FMAT(11)		r origin in α - β coordinate system
FMAT(12)		z origin in α - β coordinate system
FMAT(13)		Constant in β transformation
FMAT(14)		Constant in β transformation

NAME	COMMON	DEFINITION
FMAT(15)		Constant in β transformation
FMAT(16)		Constant in inverse β transformation
FMAT(17)		Constant in inverse β transformation
FMAT(18)		Constant in β transformation
FMAT(19)		Constant in α transformation
FMAT(20)		Constant in α transformation
FMAT(21)		Constant in α transformation
FMAT(22)		Material time step
FMAT(23)		Ratio of time step to material time step
FRS	BNDVAL	Arcsize at boundary point
FRIDMU	MATVAL	$\frac{4}{3}\mu$
FRX	BNDVAL	z or α coordinate of boundary point
FRY	BNDVAL	r or β coordinate of boundary point
HAK	MATVAL	$\frac{1}{2} \Delta t$
HAL	MATVAL	$\frac{1}{2} \Delta t / \Delta \alpha$
HALFMU	MATVAL	$\frac{1}{2}\mu$
HAS	MATVAL	$\frac{1}{2} \Delta t / \Delta \beta$
HDAX	MATVAL	$1 / (2\Delta \alpha)$
HDAXY	MATVAL	$1 / (2\Delta \alpha \cdot \Delta \beta)$
HDAY	MATVAL	$1 / (2\Delta \beta)$

<u>NAME</u>	<u>COMMON</u>	<u>DEFINITION</u>
IBS	MATVAL	Material reference in boundary arrays
IJS	MATVAL	Material reference in two-dimensional arrays
IMAT(1)	MATARR	Maximum number of axial mesh points
IMAT(2)		Maximum number of radial mesh points
IMAT(3)		Maximum number of boundary points
IMAT(4)		Material reference in axial arrays
IMAT(5)		Material reference in radial arrays
IMAT(6)		Material reference in two-dimensional arrays
IMAT(7)		Material reference in boundary arrays
IMAT(8)		Axial index of mesh point leading to minimum step size
IMAT(9)		Radial index of mesh point leading to minimum step size
IMAT(10)		Material property index
IMAT(11)		Maximum lines printed in axial direction
IMAT(12)		Maximum lines printed in radial direction
IND	BNDCRS	Indicator of boundary crossings with constant α mesh line
INFC	INTFC	Interface definitions
IS	MATVAL	Material reference in axial arrays
ISB	MATVAL	Axial index of mesh point leading to minimum step size
ISTART	TVALS	Restart flag
ITR	TRC RT	Index of boundary segment containing tracer particle
JND	BNDCRS	Indicator of boundary crossings with constant β mesh line

<u>NAME</u>	<u>COMMON</u>	<u>DEFINITION</u>
JS	MATVAL	Material reference in radial arrays
JSB	MATVAL	Radial index of mesh point leading to minimum step size
KMAX	COMVAL	Number of equations
KT	COMVAL	Cycle count
L	BLANK	Interior mesh point flag
LB	COMVAL	Start of boundary segment to be rezoned
LF	COMVAL	End of boundary segment to be rezoned
MAT	MATARR	Material index
MATNO	PRESS	Material property index
MU	MATVAL	Shear modulus
NBEG	ZONES	Index of first point of boundary segment
ND	MATVAL	Index of last point of first boundary segment
ND1	MATVAL	ND+1
NE	MATVAL	Index of last point of second boundary segment
NEIBR	COMVAL	Code word describing intersection of boundary and nine point lattice
NEND	ZONES	Index of last point of boundary segment
NE1	MATVAL	NE+1
NF	MATVAL	Index of last point of boundary
NFMAX	MATVAL	Maximum number of boundary points
NI	MATVAL	Maximum number of axial mesh points

NAME	COMMON	DEFINITION
NIM1	MATVAL	NI-1
NINFC	INTFC	Number of material interfaces
NIP2	MATVAL	NI+2
NJ	MATVAL	Maximum number of radial mesh points
NJML	MATVAL	NJ-1
NMAT	MATARR	Number of materials
NONIN	INTFC	Array of interface endpoints for each material
NTR	MATVAL	Number of tracer particles
NTRS	TRCPRT	Number of tracer particles array
OOVMU	MATVAL	$1/\mu$
PBI	BNDERS	Radial coordinate of intersection of boundary and line $z=\text{constant}$
PBJ	BNDERS	Axial coordinate of intersection of boundary and line $r=\text{constant}$
PDER	PRESS	Flag for computing pressure derivatives
PE	PRESS	Derivative of pressure with respect to energy
PMIN	EQSTP	Minimum pressure
PORG	COMVAL	Value in centimeters corresponding to start of printer plot
PR	PRESS	Derivative of pressure with respect to density
PSCL	COMVAL	Scale of printer plot in centimeters per inch
PO	MATVAL	Pressure non-dimensionalizing factor
QAK	MATVAL	$\frac{1}{4} \Delta t$
QAL	MATVAL	$\frac{1}{4} \Delta t / \Delta \alpha$

NAME	COMMON	DEFINITION
QAS	MATVAL	$\frac{1}{4} \Delta t / \Delta \beta$
QDXY	MATVAL	$1 / (4 \Delta \alpha \cdot \Delta \beta)$
RDIS	COMVAL	Minimum fractional mesh allowed in onestep equations
RHOZRO	EQSTP	Initial density array in equation of state
RHO	MATVAL	Initial density
SBM	MATVAL	CFL stability parameter
TCOMP	TVALS	Maximum computation time in seconds
TFRX	SCRATCH	Scratch array for axial boundary points
TFRY	SCRATCH	Scratch array for radial boundary points
TMAX	TVALS	Maximum problem time in microseconds
TOP	COMVAL	$2/\pi$
TPLOT	TVALS	Plot tape output increment
TPRIN	TVALS	Printed output increment
TPRPL	TVALS	Printer plot increment
TREOTM	MATVAL	$3/(2\mu)$
TBS	TRCPRT	Relative position of tracer particle in boundary segment
TSAVE	TVALS	Save tape output increment
TWB	SCRATCH	Scratch array for dependent variables on boundary
TWDMU	MATVAL	$2\mu/3$

NAME	COMMON	DEFINITION
TZ	TVALS	Real computation time at start of first cycle
TO	MATVAL	r origin in α - β coordinate system
VIS	MATVAL	Onestep viscosity coefficient
VIST	MATVAL	Twostep viscosity coefficient
W	BLANK	Array of dependent variables
WB	BNDVAL	Array of dependent variables on boundary
WBI	BNDCRS	Dependent variables at intersection of boundary and line z=constant
WBJ	BNDCRS	Dependent variables at intersection of boundary and line r=constant
XZ	MATVAL	z origin in α - β coordinate system
XO	MATVAL	Length non-dimensionalizing factor
Y	MSHFCN	$r(\beta)$
YC	MATVAL	Yield condition
YSE	MSHFCN	r_{β}
YSEA	MSHFCN	r_{β} at $\beta + \frac{1}{2} \Delta\beta$

IV.

PROGRAM USAGE

4.1 Input

There are three types of input data, integer (I), real (R) and alphanumeric (A). An integer is a number without a decimal point which must be right justified in its field. A real number has a decimal point which may be followed by an exponent of the form $E+N$. The $+N$ represents the power of 10 by which the number is to be multiplied. The $+$ may be omitted if N is positive and the E need not appear if either the $+$ or $-$ is present. If an exponent is present it must be right justified in the field. Alphanumeric input consists of exactly the punched characters and blanks appearing in the field. A description of the necessary input data for SMITE follows. The card number refers to the type of input. If more than one card is necessary for this input, there may be several cards of the same type number. A number in parenthesis indicates an optional card.

CARD	COLS.	TYPE	NAME	DESCRIPTION
1	1-80	A	TITLE	Any alphanumeric information to be printed at the beginning of the output
2	1-10	R	TMAX	Maximum problem time in microseconds
	11-20	R	TPRIN	Print output increment in microseconds
	21-30	R	TPRPL	Printer plot output increment in microseconds
	31-40	R	TPLOT	Plot tape output increment in microseconds
	41-50	R	TSAVE	Restart tape output increment in microseconds. If any output increment is negative that output is suppressed
	51-60	R	TCOMP	Maximum computation time in seconds
	61-70	R	PORG	Value in centimeters of axial coordinate at left center of printer plot. The radial coordinate is set to zero
	71-80	R	PSCL	Scale of printer plot in centimeters per inch.
3	1-10	R	RDIS	Minimum fractional mesh allowed in onestep equations. If a point is closer to the boundary than this fraction of mesh size, interpolation will be used.
4	1-5	I	NMAT	Number of materials.
	6-10	I	ISTART	Restart flag. Zero for initial run, otherwise non zero.
5	1-5	I	NINFC	Number of material interfaces
6	1-5	I	INFC(1)	Index of dominant material of interface. Boundary of this material defines interface.
	6-10	I	INFC(2)	Index of first boundary point on interface.
	11-15	I	INFC(3)	Index of last boundary point on interface.
	16-20	I	INFC(4)	Index of second material of interface. Interface boundary of this material replaced by interface boundary of first material.
	21-25	I	INFC(5)	Index of last boundary point on interface.
	26-30	I	INFC(6)	Index of first boundary point on interface.
	31-35	I	INFC(7)	Index of dominant material of next interface, etc.
	36-40	I	INFC(8)	
	41-45	I	INFC(9)	
	46-50	I	INFC(10)	This sequence is repeated, six entries per interface, two interfaces per card until all interfaces have been defined. The boundary point indices refer to the points defining the material boundaries in the order in which they are input with the repeated points neglected.
	51-55	I	INFC(11)	
	56-60	I	INFC(12)	

CARD	COLS.	TYPE	NAME	DESCRIPTION
The set of cards containing the input parameters for the individual materials follows. This entire set is repeated for each material until all materials have been defined.				
7	1-5	I	NI	Maximum number of mesh lines allowed in axial direction.
	6-10	I	NJ	Maximum number of mesh lines allowed in radial direction.
	11-15	I	IF	First axial index interior to domain.
	16-20	I	IL	Last axial index interior to domain.
	21-25	I	JF	First radial index interior to domain. Must be 1 if domain touches axis and greater than 1 otherwise.
	26-30	I	JL	Last radial index interior to domain. At least one mesh line must be exterior to the material on all sides (except at axis). Additional exterior mesh lines should be allowed in the directions that the material will move. If the material reaches the end of the allowed mesh in one direction and there is exterior mesh in the opposite direction, it will be automatically shifted.
	31-35	I	NLF	Number of points in first boundary segment.
	36-40	I	NTP	Number of points in second boundary segment.
	41-45	I	NRT	Number of points in third boundary segment.
	46-50	I	NFMX	Maximum number of boundary points allowed.
	51-55	I	NTR	Number of tracer particles.
	56-60	I	MATNO	Material property number. If positive equation of state constants set in program, if negative they are input.
	61-65	I	IPRINT	Maximum number of interior points printed in axial direction. If positive count from leftmost interior point, if negative count from rightmost interior point.
	66-70	I	JPRINT	Maximum number of interior points printed in radial direction. If positive count from lowest interior point, if negative count from highest interior point. If either IPRINT or JPRINT is zero no interior points will be printed.
8	1-10	R	ZLEN	Initial axial length in centimeters.
	11-20	R	YMAX	Initial radial length in centimeters.
	21-30	R	THETA	89.5
	31-40	R	CAP	1.0E4
	41-50	R	D	Radial length of densest mesh spacing. Radial mesh will be fairly uniform for this length and will then increase in size.
	51-60	R	VIS	Viscosity coefficient for onestep equations. These coefficients should be
	61-70	R	VIST	Viscosity coefficient for twostep equations! between zero and two.
	71-80	R	CFL	Fraction of computed time step used. A safety factor usually between 0.5 and 0.8.
9	1-10	R	MU	Shear modulus in 10^{12} dynes/cm ²
	11-20	R	YC	Yield strength in tension in 10^{12} dynes/cm ² .
	21-30	R	RHO	Initial density in grams/cm ³ .
	31-40	R	UI	Initial axial velocity in centimeters/microsecond.

CARD	COLS.	TYPE	NAME	DESCRIPTION
				The following card is optional to input the Tillotson equation of state parameters.
10	1-10	R	APL	a
	11-20	R	BPL	b
	21-30	R	APB	A in 10^{12} dynes/cm ²
	31-40	R	BPB	B in 10^{12} dynes/cm ²
	41-50	R	ALPH	α
	51-60	R	BETA	β
	61-70	R	ES	E _s in 10^{12} ergs/gm
	71-80	R	EZERO	E ₀ in 10^{12} ergs/gm
10a	1-10	R	ESPRM	E _s in 10^{12} ergs/gm
	11-20	R	PMIN	Minimum allowable pressure in 10^{12} dynes/cm ²
11	1-10	R	FRX(I)	Axial coordinate in centimeters of first point of first boundary segment.
	11-20	R	FRY(I)	Radial coordinate in centimeters of first point of first boundary segment.
	21-30	R	FRX(I)	Axial coordinate of second point.
	31-40	R	FRY(I)	Radial coordinate of second point.
	41-50	R	FRX(I)	
	51-60	R	FRY(I)	This sequence is repeated, four points per card, until the entire segment has been input.
	61-70	R	FRX(I)	
	71-80	R	FRY(I)	
12	1-10	R	FRX(I)	Axial coordinate in centimeters of first point of second boundary segment.
	11-20	R	FRY(I)	Radial coordinate in centimeters of first point of second boundary segment.
	21-30	R	FRX(I)	
	31-40	R	FRY(I)	This sequence is repeated, four points per card, until the entire segment has been input.
	41-50	R	FRX(I)	
	51-60	R	FRY(I)	The first point of this segment should repeat the last point of the first segment and the last point should agree with the first point of the third segment.
	61-70	R	FRX(I)	
	71-80	R	FRY(I)	
13	1-10	R	FRX(I)	Axial coordinate in centimeters of first point of third boundary segment.
	11-20	R	FRY(I)	Radial coordinate in centimeters of first point of third boundary segment.
	21-30	R	FRX(I)	
	31-40	R	FRY(I)	This sequence is repeated, four points per card, until the entire segment has been input. If the boundary touches the axis of symmetry, the defining points must start and end on the axis of symmetry. If the boundary does not touch the axis, the first and last points should be the same and should be on a part of the boundary that will never become a material interface.
	41-50	R	FRX(I)	
	51-60	R	FRY(I)	
	61-70	R	FRX(I)	
	71-80	R	FRY(I)	

<u>CARD</u>	<u>COLS.</u>	<u>TYPE</u>	<u>NAME</u>	<u>DESCRIPTION</u>
14	1-5	I	ITR	Index of first boundary point selected as tracer.
	6-10	I	ITR	Index of second boundary point selected.
	11-15	I		
	16-20	I		
	21-25	I		
	25-30	I		
	31-35	I		
	36-40	I		
	41-45	I		
	46-50	I		
	51-55	I		
	56-60	I		
	61-65	I		
	66-70	I		
	71-75	I		
	76-80	I		

This sequence is repeated, sixteen indices per card until all tracer particles are selected. The boundary point indices refer to the points defining the material boundary in the order in which they are input with the repeated points neglected. These tracer points will be tagged with their input number on this card and their position in time will be traced throughout the run.

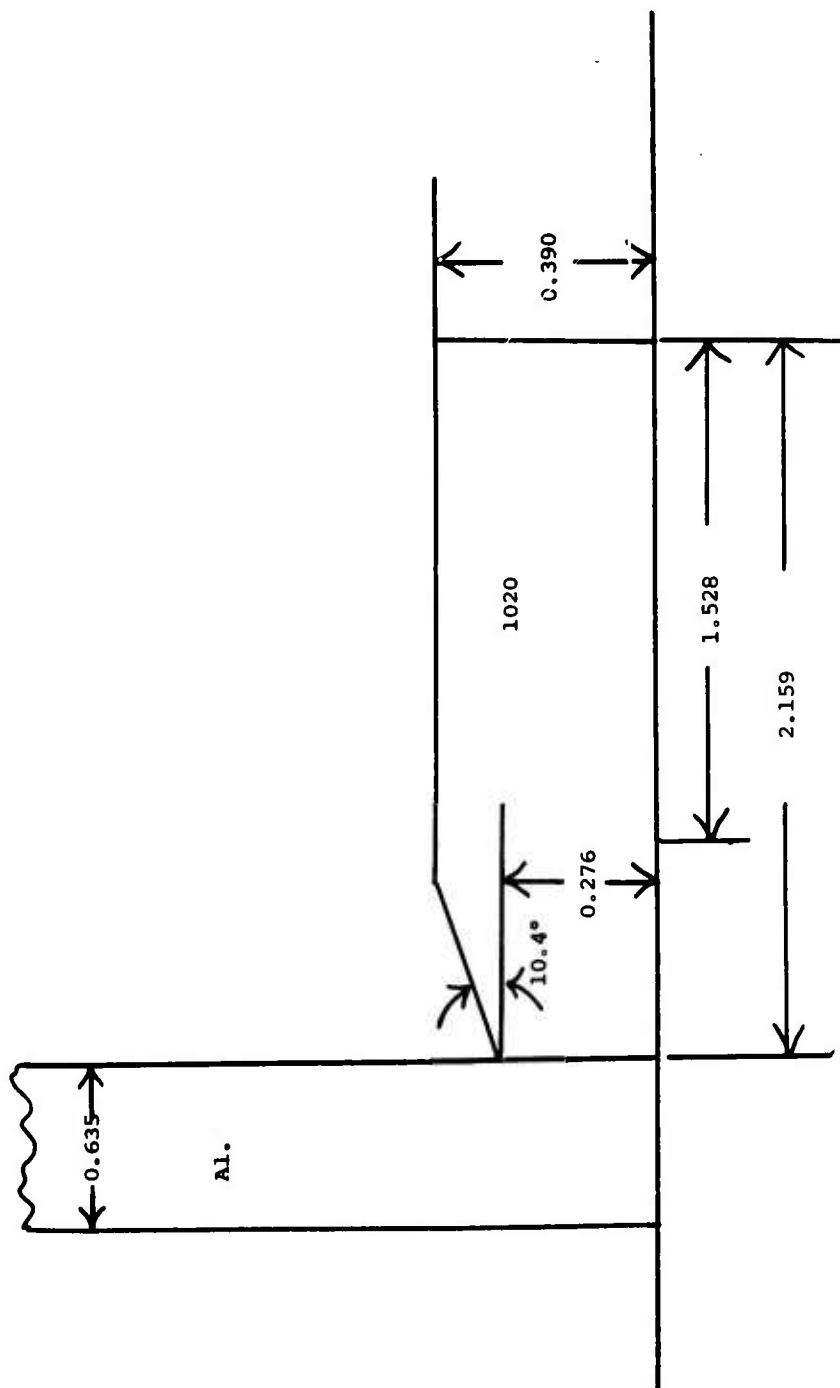
4.2 Sample Input

Complete listings of the input decks for the two Silver Bullet computations (without and with a sheath) (6.0) appear on the following pages. In addition, listings of sample input decks for the following five geometric and material combinations are given. These five cases have not actually been run. They are presented only as illustrations of various possible input configurations.

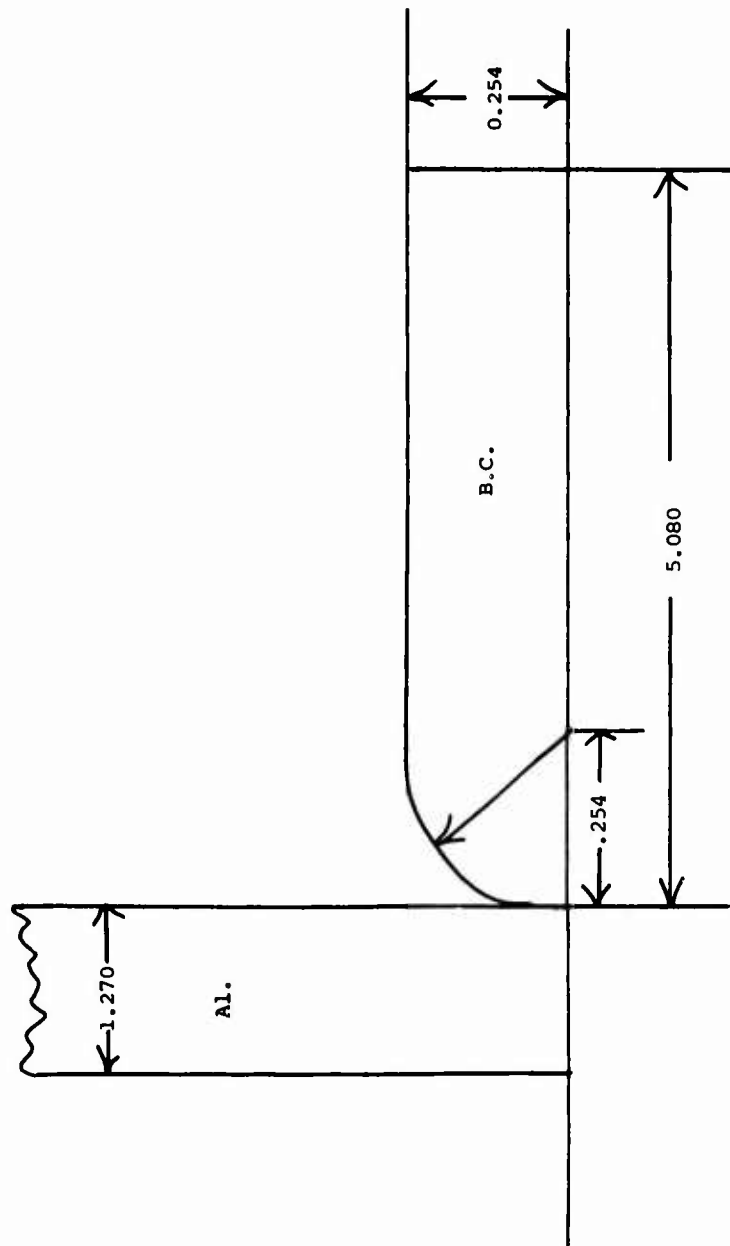
- Case 1. A blunt truncated mild steel rod (1020) impacting a 0.635 cm (1/4") aluminum target at a striking velocity of .371 km/sec (1220 ft/sec).
- Case 2. A Bearcat rod with a hemispherical nose impacting a 1.27 cm (1/2") aluminum target at a striking velocity of .343 km/sec (1125 ft/sec).
- Case 3. A hollow Bearcat cylinder impacting a 1.905 cm (3/4" aluminum target at a striking velocity of 1.22 km/sec (4000 ft/sec).
- Case 4. An ogival projectile with an aluminum core and a tungsten carbide sheath impacting a 2.54 cm (1") target of rolled homogeneous armor at a striking velocity of 1.372 km/sec (4500 ft/sec).
- Case 5. A hemispherical cap projectile with a tungsten alloy core and a maraging-300 steel sheath impacting a .9525 cm (3/8") target of rolled homogeneous armor at a striking velocity of 1.524 km/sec (5000 ft/sec).

Target-projectile configurations are shown for each case. Sketches are not to scale and all dimensions are in centimeters.

CASE #1

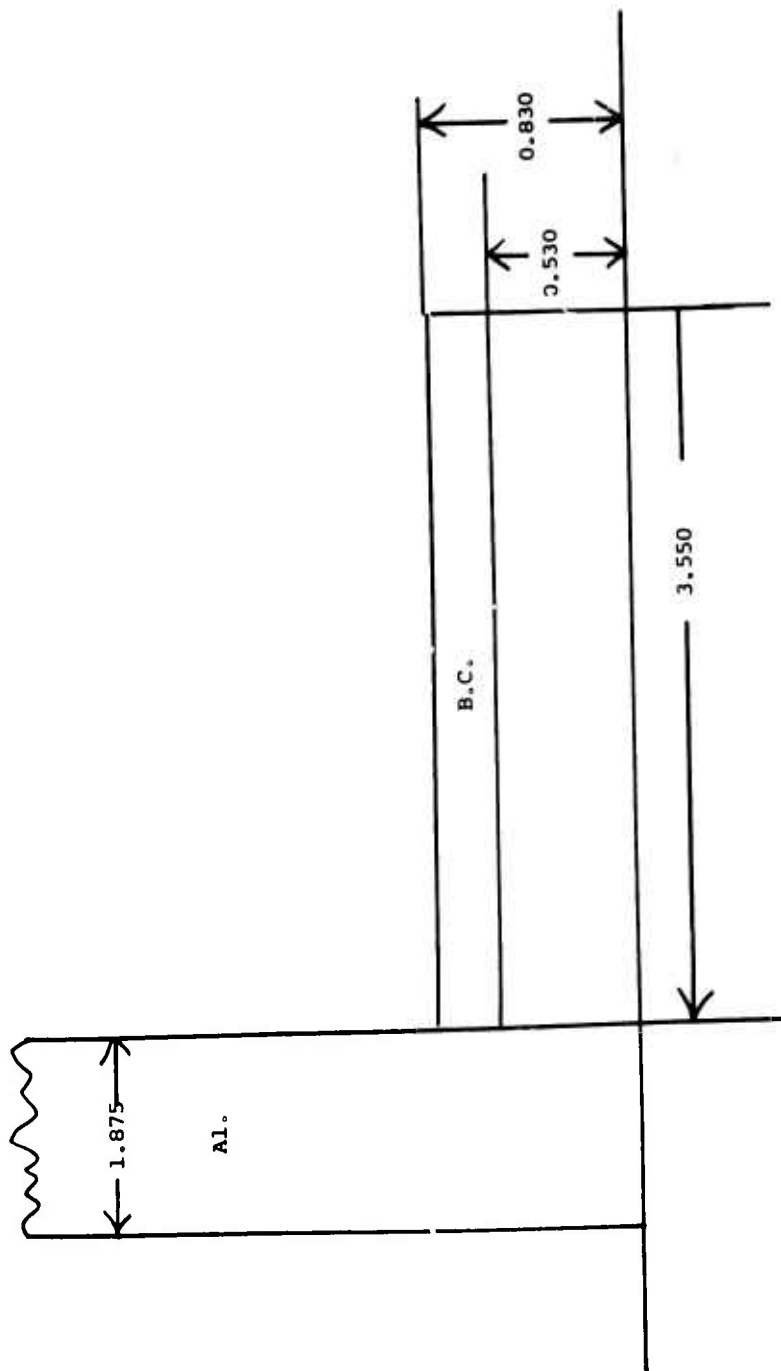


CASE #2

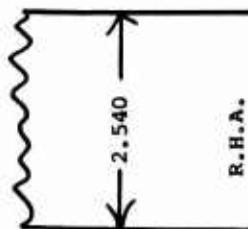


Dimension: cm.

CASE #3

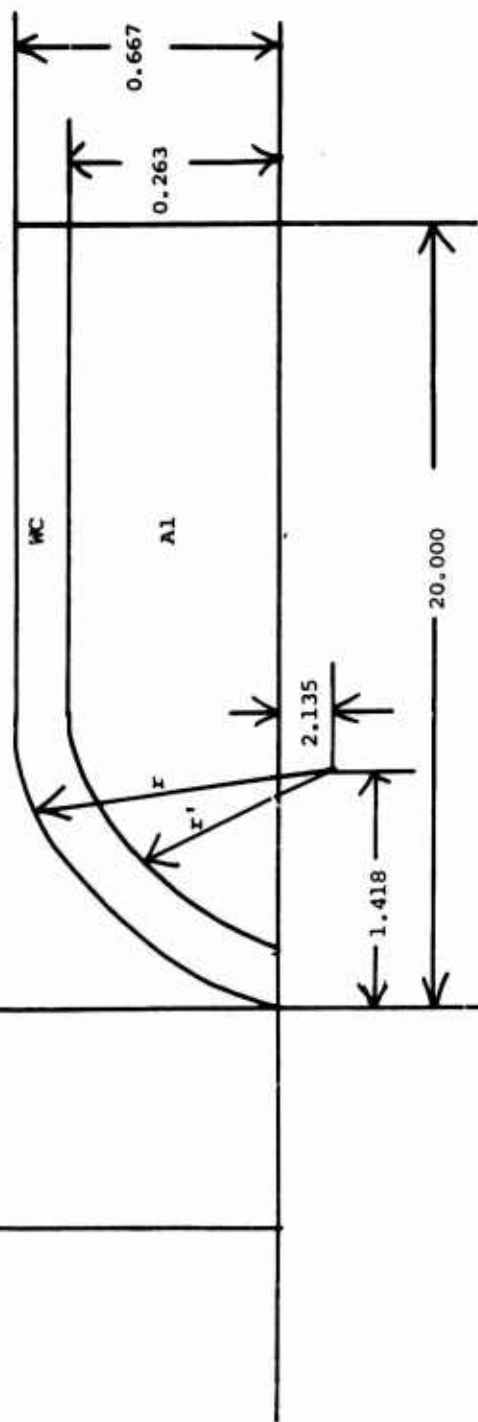


CASE #4



Ellipse Axes

	a	b
r	2.802	2.193
r'	2.398	1.789



Dimension: cm.

Technical drawing of a mechanical part, likely a bracket or arm, showing dimensions in inches. The drawing includes a wavy line on the left representing a threaded section, labeled "R.H.A." (Right Hand Arm) and ".9525". The main body of the part has a curved end with a radius of ".150R". The overall length of the part is "29.398". The width of the base is "4.898". The height of the base is "1.633". The height of the curved section is "1.189". The height of the straight section is "1.633". The overall height of the part is "18.620". The part is labeled "MAR 300" and "90-25".

40

SILVER BULLET-NO SWEATH

35.00	9.0	5.0	5.0	5.0	2500.0	5.0	5.0
0.5							
2	0						
1							
2	1	1	1	6	6		
31	25	16	25	1	24	3	300
2.54	9.0		89.5	1	1000.0	0.5	1.8
0.8077	0.01219		7.80		0.0		1.8
0.0	0.0		0.0		1.75	0.0	9.0
0.0	9.0		2.54		9.0		
2.54	9.0		2.54		1.75	2.54	0.0
1	2	5					
121	20	21	120	1	17	10	20
40.82	1.75		89.5		1000.0	1.75	1.8
1.2967	0.0111		17.04		-0.142		1.8
2.5400000	0.0000000		2.6502360		.4805076	2.7604720	.6614160
2.9809440	.8818880		3.0911800		.9546718	3.2014160	1.0103296
3.4218880	1.0800878		3.5321240		1.0968344		
3.5321240	1.0968344		3.6423600		1.1088027	4.3889612	1.1866521
5.8821637	1.3271450		6.6287650		1.3898077	7.3753662	1.4874263
8.8685687	1.5475615		9.6151700		1.5900917	10.3617712	1.6276048
11.8549737	1.6875997		12.6015750		1.7100894	13.3481762	1.7275783
14.8413787	1.7475623		15.5879800		1.7500600	22.8269800	1.7500600
43.3578000	1.0331080		43.3578000		0.0000030		
1	3	5	7	9	10	12	14
						16	18
						20	22
						24	26
						28	30

SILVER HULLEY-WITH SHEATH

35.00	5.0	5.0	5.0	5.0	2500.0	-5.0	5.0
0.50							
3	0						
2							
2	1	1	1	6	6	2	23
31	25	16	25	1	24	3	25
2.54	9.0		89.5		1000.0	0.5	3
0.8377	0.01219		7.80		0.0		300
-2.54	0.0		-2.54		1.75	-2.54	9.0
-2.54	9.0		0.0		9.0		
0.0	9.0		0.0		1.75	0.0	0.0
1	2	5					
121	20	21	120	1	17	21	4
40.35	1.65		89.5		1000.0	1.75	2
1.2467	0.0111		17.04		-0.142		300
0.000000	0.000000		.1102360		.4805076	.2204720	.6614160
.4409440	.8818880		.5511800		.9546718	.6614160	1.0103296
.6818880	1.0800078		.9921240		1.0969344	1.1023600	1.1088027
2.5955625	1.2594295		3.3421637		1.3271450	4.0887650	1.3898077
5.5819675	1.5000085		6.3285687		1.5475615	7.0751700	1.5900917
8.5683725	1.6367822						
8.5683725	1.6367822		8.5683725		1.5307012	9.0763725	1.5173987
40.348525	.6985000		40.348525		0.0000000		
1	3	5	7	9	11	13	15
61	20	11	60	1	17	4	12
41.40	1.75		89.5		1000.0	1.75	1.8
0.796	0.0192		8.00		-0.142		1.8
40.348525	0.0000000		40.348525		.6985000	9.0763725	1.5173987
9.0763725	1.6585302		9.5282385		1.6759266	9.9801045	1.6914896
10.8838365	1.7171179		11.3357025		1.7271846	11.7475685	1.7354203
12.6913005	1.7464002		13.1431665		1.7491451	13.5950325	1.7500600
41.3648525	1.0685780		41.3648525		0.0000000		
1	2	3	4	6	8	10	12
						14	15
							16

[illegible]

CASE 3

20.0	2.0	2.0	2.0	2.0	600.0	-3.0	1.0
0.50							
2	0						
1							
2	6	8	1	10	9		
31	31	11	25	1	20	6	300
1.875	8.0		89.5		1000.0	1.0	1.8
0.274	0.0052		2.79		0.0		
-1.875	0.0		-1.875		0.250	-1.875	0.5
-1.875	1.0		-1.875		8.0		
-1.875	8.0		0.0		8.0		
0.0	8.0		0.0		1.0	0.0	0.530
0.0	0.25		0.0		0.0		
1	2	3	4	5	6	6	11
70	15	20	69	3	13	6	3
3.550	0.30		89.5		1000.0	0.30	1.8
0.837	0.01541		7.8		-0.122		
3.550	0.68		3.550		0.530	3.0	0.530
1.0	0.530		0.0		0.530		
0.0	0.530		0.0		0.680	0.0	0.830
0.0	0.830		1.0		0.830	2.0	0.830
3.550	0.830		3.550		0.680		
1	2	3	4	5	6	7	8
							9
							10
							11
							12

CASE 4	5,0	5,0	5,0	5,0	600,0	5,0	2,5
40,0							
0,50							
3	0						
2							
2	1	1	1	10	10	2	27
41	21	16	35	1	20	6	51
2,540	6,0		89,5		1000,0		0,8
0,8077	0,01219		7,8		0,0		1,8
-2,540	0,0		-2,540		0,2		-2,540
-2,540	0,8		-2,540		6,0		0,4
-2,540	6,0		0,0		6,0		0,6
0,0	6,0		0,0		0,8		0,0
1	2	3	4	5	8	9	
55	11	4	54	1	10	25	3
20,0	0,667		89,5		1000,0		0,667
2,387	0,00379		14,5		-0,1372		1,8
0,5	1,04		3,08		2,5		10,0
0,056	=0,00126						10,0
0,00000	0,00000		0,07090		0,07604		1,4180
0,28360	0,26299		0,35450		0,31546		1,4367
0,56/20	0,44753		0,63810		0,48382		1,36355
0,85080	0,57166		0,92170		0,59430		1,51652
1,13440	0,64347		1,20530		0,65379		1,61378
1,418	0,667	5,0		0,667	10,0		1,66114
20,0	0,667						1,34710
20,0	0,667	20,0		0,46	20,0		15,0
20,0	0,263	15,0		0,263	10,0		0,263
1,41800	0,26300		1,38045		0,26247		1,26089
1,26/80	0,25453		1,23025		0,24976		1,24391
1,11/60	0,22895		1,08005		0,21983		1,20958
0,96/40	0,18569		0,92985		0,17200		1,15713
0,81/20	0,12373		0,77965		0,10515		1,08527
0,66/00	0,00000						0,70455
1	5	9	13	17	21	23	25
51	9	10	50	1	8	21	5
20,0	0,263		89,5		1000,0		0,263
0,274	0,0052		2,79		-0,1372		1,8
0,66/00	0,00000		0,70455		0,66406		1,74210
0,81/20	0,12373		0,85475		0,14105		1,15713
0,96/40	0,18569		1,00495		0,19821		1,20958
1,11/60	0,22895		1,15515		0,23698		1,24391
1,26/80	0,25453		1,30535		0,25824		1,26089
1,41800	0,26300						1,38045
1,418	0,263	5,0		0,263	10,0		0,263
20,0	0,263						15,0
20,0	0,263	20,0		0,13	20,0		0,0
22	23	24	25	26	27		

CASE 5	2.0	2.0	2.0	2.0	600.0	-3.0	5.0
20.0	2.0	2.0	2.0	2.0	600.0	-3.0	5.0
0.750	2.0	2.0	2.0	2.0	600.0	-3.0	5.0
3	0						
2							
2	1	1	1	1	21	59	3
31	21	16	25	1	20	4	200
0.9525	16.0	89.5	1000.0	2.0	1.8	1.8	0.45
0.0077	0.01219	7.8	0.0	-0.9525	2.0	-0.9525	16.0
-0.9525	0.0	-0.9525	1.0	0.0	1.8	0.0	0.0
-0.9525	16.0	0.0	16.0	0.0	1.8	0.0	0.0
0.0	16.0	0.0	2.0	0.0	1.8	0.0	0.0
1	2	3	4	5	6	7	
59	11	8	58	1	10	21	4
23.5	1.633	89.5	1000.0	1.633	1.8	1.8	0.65
1.72967	0.0111	17.04	-0.1524				
0.00000	0.00000	0.0165	0.50990	1.6330	0.71181	0.24495	0.86074
0.32660	0.97980	0.40825	1.08013	0.48990	1.16620	0.57155	1.24097
0.65320	1.30640	0.73485	1.36382	0.81650	1.41422	0.89815	1.45832
0.97980	1.49667	1.06145	1.52971	1.14310	1.55778	1.22475	1.58115
1.30640	1.60001	1.38805	1.61452	1.46970	1.62481	1.55135	1.63096
1.63300	1.63300						
1.633	1.633	3.0	1.633	4.0	1.633	4.898	1.633
4.69800	1.63300	4.89800	1.33900	4.92800	1.24900	4.94300	1.23188
4.95800	1.21900	4.97300	1.20910	4.98800	1.20152	5.00300	1.19591
5.01800	1.19200	5.03300	1.18975	5.04800	1.18900	6.00000	1.18900
10.0	1.189	13.0	1.189	16.0	1.189	19.0	1.189
22.23900	1.18900	22.30295	1.18728	22.36690	1.18210	22.43085	1.17342
22.49480	1.16116	22.55875	1.14520	22.62270	1.12539	22.68665	1.10151
22.75060	1.07331	22.81455	1.04041	22.87850	1.00238	22.94245	0.95858
23.00640	0.90820	23.07035	0.85005	23.13430	0.78241	23.19825	0.70254
23.26220	0.60563	23.32615	0.48148	23.39010	0.29781	23.45405	0.00000
23.51800	0.00000						
1	3	5	7	9	11	13	15
31	34	35	36	37	38	39	40
59	11	8	58	1	10	36	4
24.5	1.633	89.5	1000.0	1.633	1.8	1.8	0.65
0.796	0.0192	8.07	-0.1524				
23.51800	0.00000	23.45405	0.00000	23.39010	0.29781	23.32615	0.48148
23.26220	0.60563	23.19825	0.70254	23.13430	0.78241	23.07035	0.85005
23.00640	0.90820	22.94245	0.95858	22.87850	1.00238	22.81455	1.04041
22.75060	1.07331	22.68665	1.10151	22.62270	1.12539	22.55875	1.14520
22.49480	1.16116	22.43085	1.17342	22.36690	1.18210	22.30295	1.18728
22.239	1.189	17.0	1.189	13.0	1.189	9.0	1.189
5.04800	1.18900	5.03300	1.18975	5.01800	1.19203	5.00300	1.19591
4.98800	1.20152	4.97300	1.20910	4.95800	1.21900	4.94300	1.23188
4.92800	1.24900	4.91300	1.27382	4.89800	1.33900	4.88000	1.63300
4.998	1.633	10.0	1.633	20.0	1.633	29.398	1.633
29.398	1.633	29.398	0.8	29.398	0.0		
36	37	38	39	40	41		

4.3 Diagnostics

TOO MANY POINTS ON INTERFACE OF MATERIAL XX WITH MATERIAL XX -
In subroutine ADJINT when attempting to replace the interface boundary points of material 2 with those of material 1, the material 2 boundary would exceed it's maximum allowable size. Rerun allowing for more points on material two boundary.

AT POINT (XX,XX) IN FDIFF AT T=XX.XXXXX STAB=XX.XXXXX MAT=XX -
Solution may be going unstable at this point. If it does not correct itself try larger artificial viscosity coefficient.

AT POINT (XX,XX) IMAGINARY SOUND SPEED IN FDIFF MAT=XX ESY=XX.XXXXX
T=XX.XXXXX - Solution unstable at this point and will be recomputed in ONESTP. If it does not correct itself try larger artificial viscosity coefficient.

AT POINT (XX,XX) IN ONESTP AT T=XX.XXXXX IPOINT=XX STAB=XX.XXXXX RHO=XX.XXXXX
U=XX.XXXXX V=XX.XXXXX DELA=XX.XXXXX DELB=XX.XXXXX B SUB R=XX.XXXXX MAT=XX -
Solution may be going unstable at this point. If it does not correct itself try larger artificial viscosity coefficient.

AT POINT (XX,XX) IMAGINARY SOUND SPEED IN ONESTP RHO=XX.XXXXX U=XX.XXXXX
V=XX.XXXXX T=XX.XXXXX MAT=XX - Solution unstable at this point and will be recomputed by interpolation. If it does not correct itself try larger artificial viscosity coefficient.

AT T=XX.XXXXX DENSITY DOES NOT CONVERGE ON MATERIAL X BOUNDARY AT POINT XX -
In subroutine DENSX or subroutine INFAC iteration for density to obtain pressure that satisfies proper normal stress boundary condition does not converge. This is usually a sign of an instability in the solution.

MATERIAL X BOUNDARY EXCEEDS DOMAIN - RUN ABORTED (ZMAX,RMAX)/(Z(I),R(I)) -
A shift was attempted in subroutine FINISH but there was no room. The boundary coordinates are printed in α - β space. The minimum is zero and the maximum is the printed value. Rerun allowing more points in the proper coordinate direction.

AT X=XX MATERIAL X BOUNDARY CROSSED MORE THAN X TIMES T=XX.XXXXX - The
boundary crossed a mesh line more than the maximum number of times allowed in subroutine BPOSN. The boundary points should be examined to see if this indicates an instability or if more crossings should be allowed.

4.4 Sample Output

A sample of the output for the two Silver Bullet runs (6.0) follows. The input data for all materials appears first. Printer plot and printed output at each selected time interval will appear next. The printed output is described in the writeup for subroutine OUTPUT in Section 2. A listing of the complete output for the two problems at time $t=0$ is given.

MAXIMUM ALPHA MESH= 31
 INITIAL RIGHTMOST ALPHA LINE= 25
 INITIAL MATERIAL WEIGHT= 9.000
 BOUNDARY LAYER THICKNESS= .500
 TIME STEP FACTOR= .650
 INITIAL MATERIAL DENSITY= 7.400
 MAXIMUM BETA MESH= 26
 INITIAL TOPMOST BETA LINE= 24
 MATERIAL ANGLE= 89.50
 CHESTSTEP VISCOSITY COEFFICIENT=1.0000
 SHEAR MODULUS= .80770
 INITIAL MATERIAL VELOCITY= 0.000000
 INITIAL LEFTMOST ALPHA LINE= 36
 INITIAL MATERIAL THICKNESS= 2.540
 CAP LENGTH=0.000000
 TWO STEP VISCOSITY COEFFICIENT=1.0000
 YIELD CONDITION= .01219

INITIAL (Z,R) COORDINATES OF LEFT MATERIAL FACE

0.00000 0.00000 1.75000 0.00000 9.00000

INITIAL (Z,R) COORDINATES OF TOP MATERIAL FACE

0.00000 9.00000 2.54000 9.00000

INITIAL (Z,R) COORDINATES OF RIGHT MATERIAL FACE

2.54000 1.75000 2.54000 0.00000

INITIAL (Z,R) COORDINATES OF TRACER PARTICLES

1) 0.00000 0.00000 2) 0.00000 1.75000 3) 2.54000 1.75000

MAXIMUM ALPHA MESH= 121
 INITIAL RIGHTMOST ALPHA LINE= 120
 INITIAL MATERIAL WEIGHT= 1.750
 BOUNDARY LAYER THICKNESS= 1.750
 TIME STEP FACTOR= .650
 INITIAL MATERIAL DENSITY= 17.040
 MAXIMUM BETA MESH= 20
 INITIAL TOPMOST BETA LINE= 17
 MATERIAL ANGLE= 89.50
 CHESTSTEP VISCOSITY COEFFICIENT=1.0000
 SHEAR MODULUS= 1.29670
 INITIAL MATERIAL VELOCITY= -.042000
 INITIAL LEFTMOST ALPHA LINE= 21
 INITIAL MATERIAL THICKNESS= 40.020
 CAP LENGTH=0.000000
 TWO STEP VISCOSITY COEFFICIENT=1.0000
 YIELD CONDITION= .0110

INITIAL (Z,R) COORDINATES OF LEFT MATERIAL FACE

2.54000 0.00000 3.00110 .95467 2.65024 .48051 2.76047 .66182 3.51105 1.05154

2.98094 .88189 3.53212 1.09083

INITIAL (Z,R) COORDINATES OF TOP MATERIAL FACE

3.53212 1.09083 6.02877 1.38981 10.36177 1.82765 14.09478 3.74007

3.04236 1.10680 7.37537 1.44743 11.10437 1.63011 14.04138 1.74756

INITIAL (Z,R) COORDINATES OF RIGHT MATERIAL FACE

5.09216 1.32715 9.01517 1.59080 35.34818 1.72758 43.35780 1.83311

5.09216 1.32715 9.01517 1.59080 35.34818 1.72758 43.35780 1.83311

INITIAL (Z,R) COORDINATES OF RIGHT MATERIAL FACE

43.35780 1.83311

INITIAL (Z,R) COORDINATES OF TRACER PARTICLES

2) 2.76047 .66182 3) 2.99024 .44182 4) 3.20142 1.01033

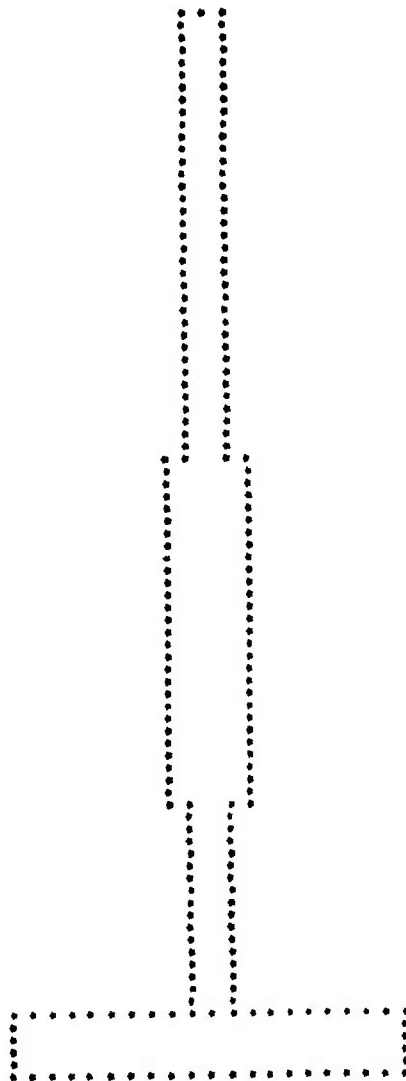
5) 3.42184 1.08089

7) 4.30896 1.18665 8) 5.08226 1.32715 9) 7.37537 1.44743

10) 8.86857 1.54758

12) 11.05497 1.60740 13) 13.34378 1.72758 14) 14.34138 1.74756

15) 22.82698 1.75006



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7-0.

INTERIOR POINTS									
119	2.25404	.3410	.7490000000	0.	0.	0.	0.	0.	0.
120	2.25400	.2618	.7500000000	0.	0.	0.	0.	0.	0.
121	2.25400	.2264	.7500000000	0.	0.	0.	0.	0.	0.
122	2.25406	.1747	.7500000000	0.	0.	0.	0.	0.	0.
123	2.25400	.1264	.7500000000	0.	0.	0.	0.	0.	0.
124	2.25400	.0813	.7500000000	0.	0.	0.	0.	0.	0.
125	2.25406	.0343	.7500000000	0.	0.	0.	0.	0.	0.
126	2.25400	.0000	.7500000000	0.	0.	0.	0.	0.	0.
16	.1270	.0000	.7500000000	0.	0.	0.	0.	0.	0.
17	.3810	.0000	.7500000000	0.	0.	0.	0.	0.	0.
18	.6350	.0000	.7500000000	0.	0.	0.	0.	0.	0.
19	.8890	.0000	.7500000000	0.	0.	0.	0.	0.	0.
20	1.1430	.0000	.7500000000	0.	0.	0.	0.	0.	0.
21	1.3970	.0000	.7500000000	0.	0.	0.	0.	0.	0.
22	1.6510	.0000	.7500000000	0.	0.	0.	0.	0.	0.
23	1.9050	.0000	.7500000000	0.	0.	0.	0.	0.	0.
24	2.1590	.0000	.7500000000	0.	0.	0.	0.	0.	0.
25	2.4130	.0000	.7500000000	0.	0.	0.	0.	0.	0.
16	.1270	.0823	.7500000000	0.	0.	0.	0.	0.	0.
17	.3810	.0823	.7500000000	0.	0.	0.	0.	0.	0.
18	.6350	.0823	.7500000000	0.	0.	0.	0.	0.	0.
19	.8890	.0823	.7500000000	0.	0.	0.	0.	0.	0.
20	1.1430	.0823	.7500000000	0.	0.	0.	0.	0.	0.
21	1.3970	.0823	.7500000000	0.	0.	0.	0.	0.	0.
22	1.6510	.0823	.7500000000	0.	0.	0.	0.	0.	0.
23	1.9050	.0823	.7500000000	0.	0.	0.	0.	0.	0.
24	2.1590	.0823	.7500000000	0.	0.	0.	0.	0.	0.
25	2.4130	.0823	.7500000000	0.	0.	0.	0.	0.	0.
16	.1270	.1770	.7500000000	0.	0.	0.	0.	0.	0.
17	.3810	.1770	.7500000000	0.	0.	0.	0.	0.	0.
18	.6350	.1770	.7500000000	0.	0.	0.	0.	0.	0.
19	.8890	.1770	.7500000000	0.	0.	0.	0.	0.	0.
20	1.1430	.1770	.7500000000	0.	0.	0.	0.	0.	0.
21	1.3970	.1770	.7500000000	0.	0.	0.	0.	0.	0.
22	1.6510	.1770	.7500000000	0.	0.	0.	0.	0.	0.
23	1.9050	.1770	.7500000000	0.	0.	0.	0.	0.	0.
24	2.1590	.1770	.7500000000	0.	0.	0.	0.	0.	0.
25	2.4130	.1770	.7500000000	0.	0.	0.	0.	0.	0.
16	.1270	.2854	.7500000000	0.	0.	0.	0.	0.	0.
17	.3810	.2854	.7500000000	0.	0.	0.	0.	0.	0.
18	.6350	.2854	.7500000000	0.	0.	0.	0.	0.	0.
19	.8890	.2854	.7500000000	0.	0.	0.	0.	0.	0.
20	1.1430	.2854	.7500000000	0.	0.	0.	0.	0.	0.
21	1.3970	.2854	.7500000000	0.	0.	0.	0.	0.	0.
22	1.6510	.2854	.7500000000	0.	0.	0.	0.	0.	0.
23	1.9050	.2854	.7500000000	0.	0.	0.	0.	0.	0.
24	2.1590	.2854	.7500000000	0.	0.	0.	0.		

[illegible]

19	1.8300	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
20	1.1330	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
21	1.3370	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
22	1.5510	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
23	1.7020	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
24	2.1090	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
25	2.4230	1.3491	.75000E+01	0.	0.	0.	0.	0.	0.
12									
19	1.1270	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
20	1.5410	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
21	1.8420	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
22	2.0490	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
23	1.1430	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
24	1.3770	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
25	1.5110	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
26	1.7020	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
27	2.1590	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
28	2.4130	1.6176	.75000E+01	0.	0.	0.	0.	0.	0.
TRACED PARTICLES									
1	1.0000	.0000	.75000E+01	0.	0.	0.	0.	0.	0.
2	1.0000	1.7500	.75000E+01	0.	0.	0.	0.	0.	0.
3	2.5000	1.7500	.75000E+01	0.	0.	0.	0.	0.	0.

MATERIAL 2

PT.	Z	CHS	R	CHS	GRAIN	CHS	CHS	10+12 BYTES	SZ	SZ	10+12 BYTES	SZ	P
					CHS	CHS	CHS	10+12 BYTES	CHS	CHS	10+12 BYTES	CHS	
					CHS	CHS	CHS	10+12 BYTES	CHS	CHS	10+12 BYTES	CHS	
1	2.5400	.0000	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
2	2.5520	.0525	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
3	2.5641	.1050	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
4	2.5761	.1574	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
5	2.5882	.2099	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
6	2.6002	.2624	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
7	2.6123	.3149	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
8	2.6243	.3674	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
9	2.6363	.4199	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
10	2.6484	.4724	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
11	2.6604	.5249	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
12	2.6720	.5764	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
13	2.6833	.6283	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
14	2.6948	.6800	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
15	2.7061	.7313	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
16	2.7177	.7826	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
17	2.7291	.8331	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
18	2.7403	.8834	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
19	2.7517	.9323	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
20	2.7631	.9801	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
21	2.7742	1.0256	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
22	2.7859	1.0664	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
23	2.7971	1.0968	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
24	2.8086	1.1170	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
25	2.8198	1.1367	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
26	2.8309	1.1564	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
27	2.8420	1.1761	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
28	2.8531	1.1953	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
29	2.8644	1.2139	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
30	2.8756	1.2325	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
31	2.8868	1.2511	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
32	2.8980	1.2691	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
33	2.9091	1.2865	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
34	2.9203	1.3040	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
35	2.9314	1.3214	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
36	2.9426	1.3381	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
37	2.9537	1.3544	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
38	2.9648	1.3707	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
39	2.9759	1.3869	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
40	2.9870	1.4022	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
41	2.9981	1.4173	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
42	3.0092	1.4324	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
43	3.0203	1.4474	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
44	3.0314	1.4613	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
45	3.0425	1.4752	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
46	3.0536	1.4890	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
47	3.0647	1.5028	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
48	3.0758	1.5155	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
49	3.0869	1.5287	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	
50	3.0980	1.5404	.17040E+02	-14200E+00	0.	0.	0.	0.	0.	0.	0.	0.	

1	8.4521	1.5628	17641111	-14200E+00	0
2	9.4541	1.5634	17641111	-14200E+00	0
3	9.4551	1.5632	17641111	-14200E+00	0
4	9.4522	1.5628	17641111	-14200E+00	0
5	9.4520	1.5626	17641111	-14200E+00	0
6	9.4521	1.6079	17641111	-14200E+00	0
7	10.4522	1.6171	17641111	-14200E+00	0
8	10.4523	1.6271	17641111	-14200E+00	0
9	10.4531	1.6357	17641111	-14200E+00	0
10	10.4542	1.6447	17641111	-14200E+00	0
11	10.4552	1.6534	17641111	-14200E+00	0
12	11.4564	1.6619	17641111	-14200E+00	0
13	11.4582	1.6694	17641111	-14200E+00	0
14	11.4599	1.6767	17641111	-14200E+00	0
15	11.4617	1.6842	17641111	-14200E+00	0
16	11.4638	1.6909	17641111	-14200E+00	0
17	12.4653	1.6979	17641111	-14200E+00	0
18	12.4687	1.7031	17641111	-14200E+00	0
19	12.4712	1.7092	17641111	-14200E+00	0
20	12.4740	1.7141	17641111	-14200E+00	0
21	12.4774	1.7183	17641111	-14200E+00	0
22	13.4800	1.7236	17641111	-14200E+00	0
23	13.4830	1.7280	17641111	-14200E+00	0
24	13.4864	1.7316	17641111	-14200E+00	0
25	13.4898	1.7352	17641111	-14200E+00	0
26	13.4931	1.7384	17641111	-14200E+00	0
27	14.4967	1.7411	17641111	-14200E+00	0
28	14.4993	1.7431	17641111	-14200E+00	0
29	14.5039	1.7452	17641111	-14200E+00	0
30	14.5076	1.7472	17641111	-14200E+00	0
31	15.5113	1.7481	17641111	-14200E+00	0
32	15.5151	1.7489	17641111	-14200E+00	0
33	15.5180	1.7495	17641111	-14200E+00	0
34	15.5227	1.7501	17641111	-14200E+00	0
35	15.5265	1.7501	17641111	-14200E+00	0
36	16.5312	1.7501	17641111	-14200E+00	0
37	16.5340	1.7501	17641111	-14200E+00	0
38	16.5378	1.7501	17641111	-14200E+00	0
39	16.5416	1.7501	17641111	-14200E+00	0
40	16.5454	1.7501	17641111	-14200E+00	0
41	17.5492	1.7501	17641111	-14200E+00	0
42	17.5530	1.7501	17641111	-14200E+00	0
43	17.5568	1.7501	17641111	-14200E+00	0
44	17.5606	1.7501	17641111	-14200E+00	0
45	17.5644	1.7501	17641111	-14200E+00	0
46	18.5682	1.7501	17641111	-14200E+00	0
47	18.5720	1.7501	17641111	-14200E+00	0
48	18.5758	1.7501	17641111	-14200E+00	0
49	18.5796	1.7501	17641111	-14200E+00	0
50	18.5834	1.7501	17641111	-14200E+00	0
51	18.5871	1.7501	17641111	-14200E+00	0
52	18.5909	1.7501	17641111	-14200E+00	0
53	18.5947	1.7501	17641111	-14200E+00	0
54	18.5984	1.7501	17641111	-14200E+00	0
55	18.6023	1.7501	17641111	-14200E+00	0
56	18.6061	1.7501	17641111	-14200E+00	0
57	18.6099	1.7501	17641111	-14200E+00	0
58	18.6137	1.7501	17641111	-14200E+00	0
59	18.6175	1.7501	17641111	-14200E+00	0
60	18.6213	1.7501	17641111	-14200E+00	0
61	18.6251	1.7501	17641111	-14200E+00	0
62	18.6289	1.7501	17641111	-14200E+00	0
63	18.6327	1.7501	17641111	-14200E+00	0
64	18.6365	1.7501	17641111	-14200E+00	0
65	18.6403	1.7501	17641111	-14200E+00	0
66	18.6441	1.7501	17641111	-14200E+00	0
67	18.6479	1.7501	17641111	-14200E+00	0
68	18.6517	1.7501	17641111	-14200E+00	0
69	18.6555	1.7501	17641111	-14200E+00	0
70	18.6593	1.7501	17641111	-14200E+00	0
71	18.6631	1.7501	17641111	-14200E+00	0
72	18.6669	1.7501	17641111	-14200E+00	0
73	18.6707	1.7501	17641111	-14200E+00	0
74	18.6745	1.7501	17641111	-14200E+00	0
75	18.6783	1.7501	17641111	-14200E+00	0
76	18.6821	1.7501	17641111	-14200E+00	0
77	18.6859	1.7501	17641111	-14200E+00	0
78	18.6897	1.7501	17641111	-14200E+00	0
79	18.6935	1.7501	17641111	-14200E+00	0
80	18.6973	1.7501	17641111	-14200E+00	0
81	18.7011	1.7501	17641111	-14200E+00	0
82	18.7049	1.7501	17641111	-14200E+00	0
83	18.7087	1.7501	17641111	-14200E+00	0
84	18.7125	1.7501	17641111	-14200E+00	0
85	18.7163	1.7501	17641111	-14200E+00	0
86	18.7201	1.7501	17641111	-14200E+00	0
87	18.7239	1.7501	17641111	-14200E+00	0
88	18.7277	1.7501	17641111	-14200E+00	0
89	18.7315	1.7501	17641111	-14200E+00	0
90	18.7353	1.7501	17641111	-14200E+00	0
91	18.7391	1.7501	17641111	-14200E+00	0
92	18.7429	1.7501	17641111	-14200E+00	0
93	18.7467	1.7501	17641111	-14200E+00	0
94	18.7505	1.7501	17641111	-14200E+00	0
95	18.7543	1.7501	17641111	-14200E+00	0
96	18.7581	1.7501	17641111	-14200E+00	0
97	18.7619	1.7501	17641111	-14200E+00	0
98	18.7657	1.7501	17641111	-14200E+00	0
99	18.7695	1.7501	17641111	-14200E+00	0
100	18.7733	1.7501	17641111	-14200E+00	0

175	31.0667	1.3475	17.000000	-142.000000	0
176	31.2500	1.3405	17.000000	-142.000000	0
177	31.4375	1.3335	17.000000	-142.000000	0
178	31.6250	1.3265	17.000000	-142.000000	0
179	31.8125	1.3195	17.000000	-142.000000	0
180	32.0000	1.3125	17.000000	-142.000000	0
181	32.1875	1.3055	17.000000	-142.000000	0
182	32.3750	1.2985	17.000000	-142.000000	0
183	32.5625	1.2915	17.000000	-142.000000	0
184	32.7500	1.2845	17.000000	-142.000000	0
185	32.9375	1.2775	17.000000	-142.000000	0
186	33.1250	1.2705	17.000000	-142.000000	0
187	33.3125	1.2635	17.000000	-142.000000	0
188	33.5000	1.2565	17.000000	-142.000000	0
189	33.6875	1.2495	17.000000	-142.000000	0
190	33.8750	1.2425	17.000000	-142.000000	0
191	34.0625	1.2355	17.000000	-142.000000	0
192	34.2500	1.2285	17.000000	-142.000000	0
193	34.4375	1.2215	17.000000	-142.000000	0
194	34.6250	1.2145	17.000000	-142.000000	0
195	34.8125	1.2075	17.000000	-142.000000	0
196	35.0000	1.2005	17.000000	-142.000000	0
197	35.1875	1.1935	17.000000	-142.000000	0
198	35.3750	1.1865	17.000000	-142.000000	0
199	35.5625	1.1795	17.000000	-142.000000	0
200	35.7500	1.1725	17.000000	-142.000000	0
201	35.9375	1.1655	17.000000	-142.000000	0
202	36.1250	1.1585	17.000000	-142.000000	0
203	36.3125	1.1515	17.000000	-142.000000	0
204	36.5000	1.1445	17.000000	-142.000000	0
205	36.6875	1.1375	17.000000	-142.000000	0
206	36.8750	1.1305	17.000000	-142.000000	0
207	37.0625	1.1235	17.000000	-142.000000	0
208	37.2500	1.1165	17.000000	-142.000000	0
209	37.4375	1.1095	17.000000	-142.000000	0
210	37.6250	1.1025	17.000000	-142.000000	0
211	37.8125	1.0955	17.000000	-142.000000	0
212	38.0000	1.0885	17.000000	-142.000000	0
213	38.1875	1.0815	17.000000	-142.000000	0
214	38.3750	1.0745	17.000000	-142.000000	0
215	38.5625	1.0675	17.000000	-142.000000	0
216	38.7500	1.0605	17.000000	-142.000000	0
217	38.9375	1.0535	17.000000	-142.000000	0
218	39.1250	1.0465	17.000000	-142.000000	0
219	39.3125	1.0395	17.000000	-142.000000	0
220	39.5000	1.0325	17.000000	-142.000000	0
221	39.6875	1.0255	17.000000	-142.000000	0
222	39.8750	1.0185	17.000000	-142.000000	0
223	40.0625	1.0115	17.000000	-142.000000	0
224	40.2500	1.0045	17.000000	-142.000000	0
225	40.4375	0.9975	17.000000	-142.000000	0
226	40.6250	0.9905	17.000000	-142.000000	0
227	40.8125	0.9835	17.000000	-142.000000	0
228	41.0000	0.9765	17.000000	-142.000000	0
229	41.1875	0.9695	17.000000	-142.000000	0
230	41.3750	0.9625	17.000000	-142.000000	0
231	41.5625	0.9555	17.000000	-142.000000	0
232	41.7500	0.9485	17.000000	-142.000000	0
233	41.9375	0.9415	17.000000	-142.000000	0
234	42.1250	0.9345	17.000000	-142.000000	0
235	42.3125	0.9275	17.000000	-142.000000	0
236	42.5000	0.9205	17.000000	-142.000000	0

237	43.3578	1065	17041002	-14200E+00	0.
238	43.3578	1067	17041002	-14200E+00	0.
239	43.3578	1068	17041002	-14200E+00	0.
240	43.3578	1069	17041002	-14200E+00	0.

17041002

21	2.7441	1070	17041002	-14200E+00	0.
22	3.1523	1071	17041002	-14200E+00	0.
23	3.5605	1072	17041002	-14200E+00	0.
24	3.9687	1073	17041002	-14200E+00	0.
25	4.3769	1074	17041002	-14200E+00	0.
26	4.7851	1075	17041002	-14200E+00	0.
27	5.1933	1076	17041002	-14200E+00	0.
28	5.6015	1077	17041002	-14200E+00	0.
29	6.0097	1078	17041002	-14200E+00	0.
30	6.4179	1079	17041002	-14200E+00	0.
31	6.8261	1080	17041002	-14200E+00	0.
32	7.2343	1081	17041002	-14200E+00	0.
33	7.6425	1082	17041002	-14200E+00	0.
34	8.0507	1083	17041002	-14200E+00	0.
35	8.4589	1084	17041002	-14200E+00	0.
36	8.8671	1085	17041002	-14200E+00	0.
37	9.2753	1086	17041002	-14200E+00	0.
38	9.6835	1087	17041002	-14200E+00	0.
39	10.0917	1088	17041002	-14200E+00	0.
40	10.4999	1089	17041002	-14200E+00	0.

3

21	2.7441	1090	17041002	-14200E+00	0.
22	3.1523	1091	17041002	-14200E+00	0.
23	3.5605	1092	17041002	-14200E+00	0.
24	3.9687	1093	17041002	-14200E+00	0.
25	4.3769	1094	17041002	-14200E+00	0.
26	4.7851	1095	17041002	-14200E+00	0.
27	5.1933	1096	17041002	-14200E+00	0.
28	5.6015	1097	17041002	-14200E+00	0.
29	6.0097	1098	17041002	-14200E+00	0.
30	6.4179	1099	17041002	-14200E+00	0.
31	6.8261	1100	17041002	-14200E+00	0.
32	7.2343	1101	17041002	-14200E+00	0.
33	7.6425	1102	17041002	-14200E+00	0.
34	8.0507	1103	17041002	-14200E+00	0.
35	8.4589	1104	17041002	-14200E+00	0.
36	8.8671	1105	17041002	-14200E+00	0.
37	9.2753	1106	17041002	-14200E+00	0.
38	9.6835	1107	17041002	-14200E+00	0.
39	10.0917	1108	17041002	-14200E+00	0.
40	10.4999	1109	17041002	-14200E+00	0.

4

21	2.7441	1110	17041002	-14200E+00	0.
22	3.1523	1111	17041002	-14200E+00	0.
23	3.5605	1112	17041002	-14200E+00	0.
24	3.9687	1113	17041002	-14200E+00	0.
25	4.3769	1114	17041002	-14200E+00	0.
26	4.7851	1115	17041002	-14200E+00	0.
27	5.1933	1116	17041002	-14200E+00	0.
28	5.6015	1117	17041002	-14200E+00	0.
29	6.0097	1118	17041002	-14200E+00	0.

30	6.4174	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
31	6.4261	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
32	7.2343	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
33	7.3445	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
34	8.0507	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
35	8.3549	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
36	8.6671	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
37	9.2753	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
38	9.8825	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
39	10.0917	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
40	10.4099	.2120	.1704F002	--1420E+00	0.	0.	0.	0.	0.
5									
41	2.7441	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
42	3.1523	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
43	3.5605	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
44	3.9687	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
45	4.3769	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
46	4.7851	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
47	5.1933	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
48	5.6015	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
49	6.0097	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
50	6.4179	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
51	6.8261	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
52	7.2343	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
53	7.6425	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
54	8.0507	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
55	8.4589	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
56	8.8671	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
57	9.2753	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
58	9.6835	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
59	10.0917	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
60	10.4999	.3160	.1704F002	--1420E+00	0.	0.	0.	0.	0.
6									
61	2.7441	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
62	3.1523	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
63	3.5605	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
64	3.9687	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
65	4.3769	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
66	4.7851	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
67	5.1933	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
68	5.6015	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
69	6.0097	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
70	6.4179	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
71	6.8261	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
72	7.2343	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
73	7.6425	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
74	8.0507	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
75	8.4589	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
76	8.8671	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
77	9.2753	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
78	9.6835	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
79	10.0917	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
80	10.4999	.4241	.1704F002	--1420E+00	0.	0.	0.	0.	0.
7									
81	2.7441	.5301	.1704F002	--1420E+00	0.	0.	0.	0.	0.
82	3.1523	.5301	.1704F002	--1420E+00	0.	0.	0.	0.	0.
83	3.5605	.5301	.1704F002	--1420E+00	0.	0.	0.	0.	0.
84	3.9687	.5301	.1704F002	--1420E+00	0.	0.	0.	0.	0.
85	4.3769	.5301	.1704F002	--1420E+00	0.	0.	0.	0.	0.

24	4.7851	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
27	5.1933	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
28	5.6015	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
29	6.1097	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
30	6.4179	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
31	6.6261	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
32	7.2443	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
33	7.6425	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
34	8.0507	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
35	8.4589	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
36	8.8671	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
37	9.2753	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
38	9.6835	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
39	10.0917	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
40	10.4999	.5301	17040E+02	-14200E+00	0.	0.	0.	0.	0.
22	3.1523	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
23	3.5605	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
24	3.9687	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
25	4.3769	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
26	4.7851	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
27	5.1933	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
28	5.6015	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
29	6.0097	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
30	6.4179	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
31	6.8261	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
32	7.2343	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
33	7.6425	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
34	8.0507	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
35	8.4589	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
36	8.8671	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
37	9.2753	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
38	9.6835	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
39	10.0917	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
40	10.4999	.6362	17040E+02	-14200E+00	0.	0.	0.	0.	0.
22	3.1523	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
23	3.5605	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
24	3.9687	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
25	4.3769	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
26	4.7851	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
27	5.1933	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
28	5.6015	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
29	6.0097	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
30	6.4179	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
31	6.8261	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
32	7.2343	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
33	7.6425	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
34	8.0507	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
35	8.4589	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
36	8.8671	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
37	9.2753	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
38	9.6835	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
39	10.0917	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
40	10.4999	.7422	17040E+02	-14200E+00	0.	0.	0.	0.	0.
22	3.1523	.8483	17040E+02	-14200E+00	0.	0.	0.	0.	0.
23	3.5605	.8483	17040E+02	-14200E+00	0.	0.	0.	0.	0.
24	3.9687	.8483	17040E+02	-14200E+00	0.	0.	0.	0.	0.

25	4.3769	.8483	.170411802	-.142001800	0.	0.	0.	0.	0.
26	4.7151	.8463	.170401802	-.142001800	0.	0.	0.	0.	0.
27	5.1533	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
28	5.6115	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
29	6.1097	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
30	6.6479	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
31	7.2261	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
32	7.8423	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
33	8.4987	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
34	9.1969	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
35	9.9351	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
36	10.7133	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
37	11.5315	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
38	12.3897	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
39	13.2879	.8483	.170401802	-.142001800	0.	0.	0.	0.	0.
40	14.2261	.8463	.170411802	-.142001800	0.	0.	0.	0.	0.
11									
22	3.1523	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
23	3.5605	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
24	3.9687	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
25	4.3769	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
26	4.7851	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
27	5.1933	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
28	5.6015	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
29	6.0097	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
30	6.4179	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
31	6.8261	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
32	7.2343	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
33	7.6425	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
34	8.0507	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
35	8.4589	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
36	8.8671	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
37	9.2753	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
38	9.6835	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
39	10.0917	.9544	.170411802	-.142001800	0.	0.	0.	0.	0.
40	10.4999	.9544	.170401802	-.142001800	0.	0.	0.	0.	0.
12									
23	3.2605	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
24	3.6687	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
25	4.0769	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
26	4.4851	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
27	4.8933	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
28	5.3015	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
29	5.7097	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
30	6.1179	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
31	6.5261	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
32	6.9343	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
33	7.3425	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
34	7.7507	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
35	8.1589	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
36	8.5671	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
37	8.9753	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
38	9.3835	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
39	9.7917	1.0604	.170411802	-.142001800	0.	0.	0.	0.	0.
40	10.1999	1.0604	.170401802	-.142001800	0.	0.	0.	0.	0.
13									
25	4.3769	1.1665	.170401802	-.142001800	0.	0.	0.	0.	0.
26	4.7851	1.1665	.170401802	-.142001800	0.	0.	0.	0.	0.
27	5.1933	1.1665	.170411802	-.142001800	0.	0.	0.	0.	0.

[illegible]

4	3.2046	1.0095	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
5	3.3292	1.0776	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
6	3.5321	1.0968	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
7	4.3694	1.1864	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
8	5.8825	1.3269	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
9	7.3754	1.4474	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
10	8.8688	1.5473	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
11	10.3618	1.6275	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
12	11.8531	1.6873	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
13	13.3482	1.7274	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
14	14.8414	1.7474	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
15	22.8266	1.7485	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.
16	43.3578	.0000	.17040E+02	-.14200E+00	0.	0.	0.	0.	0.

MATERIAL 2 FROM POINT 1 TO POINT 1 HAS AN INTERFACE WITH MATERIAL 1 FROM POINT 115 TO POINT 116

[illegible]

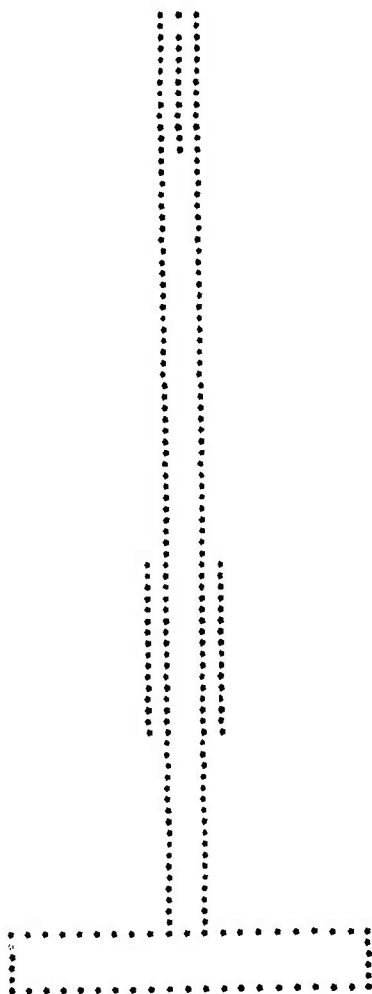


Table 1.1

[illegible]

1 TENTH POINTS									
109	-1.0000	.3410	.7800000001	0.	0.	0.	0.	0.	0.
110	-1.0000	.2614	.7800000001	0.	0.	0.	0.	0.	0.
111	-1.0000	.2264	.7800000001	0.	0.	0.	0.	0.	0.
112	-1.0000	.1747	.7800000001	0.	0.	0.	0.	0.	0.
113	-1.0000	.1264	.7800000001	0.	0.	0.	0.	0.	0.
114	-1.0000	.0811	.7800000001	0.	0.	0.	0.	0.	0.
115	-1.0000	.0394	.7800000001	0.	0.	0.	0.	0.	0.
116	.0000	.0000	.7800000001	0.	0.	0.	0.	0.	0.
16	-2.4130	.0000	.7800000001	0.	0.	0.	0.	0.	0.
17	-2.1590	.0000	.7800000001	0.	0.	0.	0.	0.	0.
18	-1.9050	.0000	.7800000001	0.	0.	0.	0.	0.	0.
19	-1.6510	.0000	.7800000001	0.	0.	0.	0.	0.	0.
20	-1.3970	.0000	.7800000001	0.	0.	0.	0.	0.	0.
21	-1.1430	.0000	.7800000001	0.	0.	0.	0.	0.	0.
22	-.8890	.0000	.7800000001	0.	0.	0.	0.	0.	0.
23	-.6350	.0000	.7800000001	0.	0.	0.	0.	0.	0.
24	-.3810	.0000	.7800000001	0.	0.	0.	0.	0.	0.
25	-.1270	.0000	.7800000001	0.	0.	0.	0.	0.	0.
16	-2.4130	.0823	.7800000001	0.	0.	0.	0.	0.	0.
17	-2.1590	.0823	.7800000001	0.	0.	0.	0.	0.	0.
18	-1.9050	.0823	.7800000001	0.	0.	0.	0.	0.	0.
19	-1.6510	.0823	.7800000001	0.	0.	0.	0.	0.	0.
20	-1.3970	.0823	.7800000001	0.	0.	0.	0.	0.	0.
21	-1.1430	.0823	.7800000001	0.	0.	0.	0.	0.	0.
22	-.8890	.0823	.7800000001	0.	0.	0.	0.	0.	0.
23	-.6350	.0823	.7800000001	0.	0.	0.	0.	0.	0.
24	-.3810	.0823	.7800000001	0.	0.	0.	0.	0.	0.
25	-.1270	.0823	.7800000001	0.	0.	0.	0.	0.	0.
16	-2.4130	.1770	.7800000001	0.	0.	0.	0.	0.	0.
17	-2.1590	.1770	.7800000001	0.	0.	0.	0.	0.	0.
18	-1.9050	.1770	.7800000001	0.	0.	0.	0.	0.	0.
19	-1.6510	.1770	.7800000001	0.	0.	0.	0.	0.	0.
20	-1.3970	.1770	.7800000001	0.	0.	0.	0.	0.	0.
21	-1.1430	.1770	.7800000001	0.	0.	0.	0.	0.	0.
22	-.8890	.1770	.7800000001	0.	0.	0.	0.	0.	0.
23	-.6350	.1770	.7800000001	0.	0.	0.	0.	0.	0.
24	-.3810	.1770	.7800000001	0.	0.	0.	0.	0.	0.
25	-.1270	.1770	.7800000001	0.	0.	0.	0.	0.	0.
16	-2.4130	.2554	.7800000001	0.	0.	0.	0.	0.	0.
17	-2.1590	.2554	.7800000001	0.	0.	0.	0.	0.	0.
18	-1.9050	.2554	.7800000001	0.	0.	0.	0.	0.	0.
19	-1.6510	.2554	.7800000001	0.	0.	0.	0.	0.	0.
20	-1.3970	.2554	.7800000001	0.	0.	0.	0.	0.	0.
21	-1.1430	.2554	.7800000001	0.	0.	0.	0.	0.	0.
22	-.8890	.2554	.7800000001	0.	0.	0.	0.	0.	0.
23	-.6350	.2554	.7800000001	0.	0.	0.	0.	0.	0.
24	-.3810	.2554	.7800000001	0.	0.	0.	0.	0.	0.
25	-.1270	.2554	.7800000001	0.	0.	0.	0.	0.	0.
16	-2.4130	.4100	.7800000001	0.	0.	0.	0.	0.	0.

[illegible]

APPENDIX 2

PT.	Z	CHS	CHS	CHS	E	5/2	5/2	5/2	P
			MINUS	MINUS	10-12 E-56	10-12 BYTES 10-12	10-12 BYTES 10-12	10-12 BYTES 10-12	
					31AN	CH-2	CH-2	CH-2	
1	0000	-0000	17040E+02	-17040E+00	0.	0.	0.	0.	0.
2	0115	0501	17040E+02	-17040E+00	0.	0.	0.	0.	0.
3	1230	1003	17040E+02	-17040E+00	0.	0.	0.	0.	0.
4	0345	1504	17040E+02	-17040E+00	0.	0.	0.	0.	0.
5	0460	2006	17040E+02	-17040E+00	0.	0.	0.	0.	0.
6	0575	2507	17040E+02	-17040E+00	0.	0.	0.	0.	0.
7	0690	3009	17040E+02	-17040E+00	0.	0.	0.	0.	0.
8	0805	3510	17040E+02	-17040E+00	0.	0.	0.	0.	0.
9	0920	4012	17040E+02	-17040E+00	0.	0.	0.	0.	0.
10	1035	4513	17040E+02	-17040E+00	0.	0.	0.	0.	0.
11	1129	5013	17040E+02	-17040E+00	0.	0.	0.	0.	0.
12	1532	5513	17040E+02	-17040E+00	0.	0.	0.	0.	0.
13	1834	6004	17040E+02	-17040E+00	0.	0.	0.	0.	0.
14	2137	6503	17040E+02	-17040E+00	0.	0.	0.	0.	0.
15	2539	6995	17040E+02	-17040E+00	0.	0.	0.	0.	0.
16	2969	7486	17040E+02	-17040E+00	0.	0.	0.	0.	0.
17	3427	7974	17040E+02	-17040E+00	0.	0.	0.	0.	0.
18	3994	8459	17040E+02	-17040E+00	0.	0.	0.	0.	0.
19	4590	8938	17040E+02	-17040E+00	0.	0.	0.	0.	0.
20	5203	9409	17040E+02	-17040E+00	0.	0.	0.	0.	0.
21	5843	9865	17040E+02	-17040E+00	0.	0.	0.	0.	0.
22	6541	10301	17040E+02	-17040E+00	0.	0.	0.	0.	0.
23	7298	10993	17040E+02	-17040E+00	0.	0.	0.	0.	0.
24	8104	11681	17040E+02	-17040E+00	0.	0.	0.	0.	0.
25	8964	12373	17040E+02	-17040E+00	0.	0.	0.	0.	0.
26	9884	13064	17040E+02	-17040E+00	0.	0.	0.	0.	0.
27	10841	13753	17040E+02	-17040E+00	0.	0.	0.	0.	0.
28	11841	14441	17040E+02	-17040E+00	0.	0.	0.	0.	0.
29	12841	15134	17040E+02	-17040E+00	0.	0.	0.	0.	0.
30	13841	15822	17040E+02	-17040E+00	0.	0.	0.	0.	0.
31	14841	16514	17040E+02	-17040E+00	0.	0.	0.	0.	0.
32	15841	17204	17040E+02	-17040E+00	0.	0.	0.	0.	0.
33	16841	17894	17040E+02	-17040E+00	0.	0.	0.	0.	0.
34	17841	18584	17040E+02	-17040E+00	0.	0.	0.	0.	0.
35	18841	19274	17040E+02	-17040E+00	0.	0.	0.	0.	0.
36	19841	19964	17040E+02	-17040E+00	0.	0.	0.	0.	0.
37	20841	20654	17040E+02	-17040E+00	0.	0.	0.	0.	0.
38	21841	21344	17040E+02	-17040E+00	0.	0.	0.	0.	0.
39	22841	22034	17040E+02	-17040E+00	0.	0.	0.	0.	0.
40	23841	22724	17040E+02	-17040E+00	0.	0.	0.	0.	0.
41	24841	23414	17040E+02	-17040E+00	0.	0.	0.	0.	0.
42	25841	24104	17040E+02	-17040E+00	0.	0.	0.	0.	0.
43	26841	24794	17040E+02	-17040E+00	0.	0.	0.	0.	0.
44	27841	25484	17040E+02	-17040E+00	0.	0.	0.	0.	0.
45	28841	26174	17040E+02	-17040E+00	0.	0.	0.	0.	0.
46	29841	26864	17040E+02	-17040E+00	0.	0.	0.	0.	0.
47	30841	27554	17040E+02	-17040E+00	0.	0.	0.	0.	0.
48	31841	28244	17040E+02	-17040E+00	0.	0.	0.	0.	0.
49	32841	28934	17040E+02	-17040E+00	0.	0.	0.	0.	0.
50	33841	29624	17040E+02	-17040E+00	0.	0.	0.	0.	0.

113	18.1447	1.2727	1764.5002	-14200E00	0
114	18.1447	1.2747	1764.5002	-14200E00	0
115	18.1449	1.2694	1764.5002	-14200E00	0
116	18.1448	1.2647	1764.5002	-14200E00	0
117	18.1448	1.2590	1764.5002	-14200E00	0
118	19.1449	1.2537	1764.5002	-14200E00	0
119	19.1449	1.2485	1764.5002	-14200E00	0
120	19.1450	1.2430	1764.5002	-14200E00	0
121	19.1450	1.2371	1764.5002	-14200E00	0
122	19.1450	1.2318	1764.5002	-14200E00	0
123	20.1451	1.2275	1764.5002	-14200E00	0
124	20.1451	1.2223	1764.5002	-14200E00	0
125	20.1451	1.2171	1764.5002	-14200E00	0
126	20.1452	1.2114	1764.5002	-14200E00	0
127	20.1452	1.2066	1764.5002	-14200E00	0
128	21.1453	1.2013	1764.5002	-14200E00	0
129	21.1453	1.1961	1764.5002	-14200E00	0
130	21.1453	1.1909	1764.5002	-14200E00	0
131	21.1454	1.1854	1764.5002	-14200E00	0
132	21.1454	1.1801	1764.5002	-14200E00	0
133	22.1454	1.1751	1764.5002	-14200E00	0
134	22.1455	1.1699	1764.5002	-14200E00	0
135	22.1455	1.1647	1764.5002	-14200E00	0
136	22.1456	1.1594	1764.5002	-14200E00	0
137	22.1456	1.1542	1764.5002	-14200E00	0
138	23.1459	1.1497	1764.5002	-14200E00	0
139	23.1457	1.1457	1764.5002	-14200E00	0
140	23.1457	1.1395	1764.5002	-14200E00	0
141	23.1457	1.1352	1764.5002	-14200E00	0
142	23.1458	1.1280	1764.5002	-14200E00	0
143	24.1458	1.1228	1764.5002	-14200E00	0
144	24.1459	1.1175	1764.5002	-14200E00	0
145	24.1459	1.1123	1764.5002	-14200E00	0
146	24.1459	1.1070	1764.5002	-14200E00	0
147	24.1460	1.1018	1764.5002	-14200E00	0
148	25.1460	1.0965	1764.5002	-14200E00	0
149	25.1460	1.0913	1764.5002	-14200E00	0
150	25.1461	1.0861	1764.5002	-14200E00	0
151	25.1461	1.0809	1764.5002	-14200E00	0
152	26.1462	1.0754	1764.5002	-14200E00	0
153	26.1462	1.0704	1764.5002	-14200E00	0
154	26.1462	1.0651	1764.5002	-14200E00	0
155	26.1463	1.0599	1764.5002	-14200E00	0
156	26.1463	1.0547	1764.5002	-14200E00	0
157	26.1463	1.0494	1764.5002	-14200E00	0
158	27.1464	1.0442	1764.5002	-14200E00	0
159	27.1464	1.0390	1764.5002	-14200E00	0
160	27.1465	1.0337	1764.5002	-14200E00	0
161	27.1465	1.0285	1764.5002	-14200E00	0
162	27.1465	1.0232	1764.5002	-14200E00	0
163	28.1466	1.0180	1764.5002	-14200E00	0
164	28.1466	1.0128	1764.5002	-14200E00	0
165	28.1466	1.0075	1764.5002	-14200E00	0
166	28.1467	1.0023	1764.5002	-14200E00	0
167	28.1467	0.9970	1764.5002	-14200E00	0
168	29.1468	0.9918	1764.5002	-14200E00	0
169	29.1468	0.9864	1764.5002	-14200E00	0
170	29.1468	0.9811	1764.5002	-14200E00	0
171	29.1469	0.9758	1764.5002	-14200E00	0
172	29.1469	0.9704	1764.5002	-14200E00	0
173	30.1469	0.9651	1764.5002	-14200E00	0
174	30.1470	0.9597	1764.5002	-14200E00	0

175	30.5570	.9551	.17540E+02	-.14200E+00	0.
176	30.7471	.9400	.17640E+02	-.14200E+00	0.
177	30.9471	.9447	.17740E+02	-.14200E+00	0.
178	31.1471	.9394	.17840E+02	-.14200E+00	0.
179	31.3472	.9342	.17940E+02	-.14200E+00	0.
180	31.5472	.9290	.18040E+02	-.14200E+00	0.
181	31.7472	.9237	.18140E+02	-.14200E+00	0.
182	31.9473	.9185	.18240E+02	-.14200E+00	0.
183	32.1473	.9132	.18340E+02	-.14200E+00	0.
184	32.3474	.9080	.18440E+02	-.14200E+00	0.
185	32.5474	.9028	.18540E+02	-.14200E+00	0.
186	32.7474	.8975	.18640E+02	-.14200E+00	0.
187	32.9475	.8923	.18740E+02	-.14200E+00	0.
188	33.1475	.8871	.18840E+02	-.14200E+00	0.
189	33.3475	.8818	.18940E+02	-.14200E+00	0.
190	33.5475	.8765	.19040E+02	-.14200E+00	0.
191	33.7476	.8713	.19140E+02	-.14200E+00	0.
192	33.9477	.8661	.19240E+02	-.14200E+00	0.
193	34.1477	.8609	.19340E+02	-.14200E+00	0.
194	34.3477	.8556	.19440E+02	-.14200E+00	0.
195	34.5478	.8504	.19540E+02	-.14200E+00	0.
196	34.7478	.8451	.19640E+02	-.14200E+00	0.
197	34.9479	.8399	.19740E+02	-.14200E+00	0.
198	35.1479	.8347	.19840E+02	-.14200E+00	0.
199	35.3479	.8294	.19940E+02	-.14200E+00	0.
200	35.5480	.8242	.20040E+02	-.14200E+00	0.
201	35.7480	.8190	.20140E+02	-.14200E+00	0.
202	35.9480	.8137	.20240E+02	-.14200E+00	0.
203	36.1481	.8085	.20340E+02	-.14200E+00	0.
204	36.3481	.8032	.20440E+02	-.14200E+00	0.
205	36.5481	.7980	.20540E+02	-.14200E+00	0.
206	36.7482	.7928	.20640E+02	-.14200E+00	0.
207	36.9482	.7875	.20740E+02	-.14200E+00	0.
208	37.1483	.7823	.20840E+02	-.14200E+00	0.
209	37.3483	.7771	.20940E+02	-.14200E+00	0.
210	37.5483	.7718	.21040E+02	-.14200E+00	0.
211	37.7484	.7665	.21140E+02	-.14200E+00	0.
212	37.9484	.7613	.21240E+02	-.14200E+00	0.
213	38.1484	.7561	.21340E+02	-.14200E+00	0.
214	38.3485	.7509	.21440E+02	-.14200E+00	0.
215	38.5485	.7456	.21540E+02	-.14200E+00	0.
216	38.7486	.7404	.21640E+02	-.14200E+00	0.
217	38.9486	.7352	.21740E+02	-.14200E+00	0.
218	39.1486	.7299	.21840E+02	-.14200E+00	0.
219	39.3487	.7247	.21940E+02	-.14200E+00	0.
220	39.5487	.7194	.22040E+02	-.14200E+00	0.
221	39.7487	.7142	.22140E+02	-.14200E+00	0.
222	39.9488	.7091	.22240E+02	-.14200E+00	0.
223	40.1488	.7037	.22340E+02	-.14200E+00	0.
224	40.3489	.6985	.22440E+02	-.14200E+00	0.
225	40.5489	.6934	.22540E+02	-.14200E+00	0.
226	40.7489	.6882	.22640E+02	-.14200E+00	0.
227	40.9489	.6830	.22740E+02	-.14200E+00	0.
228	41.1489	.6778	.22840E+02	-.14200E+00	0.
229	41.3489	.6726	.22940E+02	-.14200E+00	0.
230	41.5489	.6674	.23040E+02	-.14200E+00	0.
231	41.7489	.6622	.23140E+02	-.14200E+00	0.
232	41.9489	.6570	.23240E+02	-.14200E+00	0.
233	42.1489	.6518	.23340E+02	-.14200E+00	0.
234	42.3489	.6466	.23440E+02	-.14200E+00	0.
235	42.5489	.6414	.23540E+02	-.14200E+00	0.
236	42.7489	.6362	.23640E+02	-.14200E+00	0.

[illegible]

39	7.4-4	1.496	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
40	7.5-3	1.496	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
39	7.4-4	1.600	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
40	7.5-3	1.600	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
TRACER PARTICLES									
1	0.0	-1.000	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
2	.2227	.6613	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
3	.4424	.6617	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
4	.6571	1.0095	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
5	.8909	1.0079	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
6	1.1127	1.1084	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
7	2.5601	1.2691	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
8	4.0039	1.5204	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
9	5.5282	1.5206	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
10	7.0024	1.5393	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
11	8.5084	1.6368	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
12	9.9764	1.6397	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
13	9.9764	1.5174	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
14	40.3469	.6665	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.
15	40.3469	-1.0000	.170-01-02	-1.4200E+00	0.	0.	0.	0.	0.

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112	15.013	1.0730	80000001	-14200000	00000000	00000000	00000000
113	17.4504	1.0710	80000001	-14200000	00000000	00000000	00000000
114	17.6522	1.0710	80000001	-14200000	00000000	00000000	00000000
115	16.4212	1.0641	80000001	-14200000	00000000	00000000	00000000
116	18.4925	1.0641	80000001	-14200000	00000000	00000000	00000000
117	18.9247	1.0641	80000001	-14200000	00000000	00000000	00000000
118	19.2927	1.0611	80000001	-14200000	00000000	00000000	00000000
119	19.4864	1.0610	80000001	-14200000	00000000	00000000	00000000
120	20.1109	1.0590	80000001	-14200000	00000000	00000000	00000000
121	20.1225	1.0590	80000001	-14200000	00000000	00000000	00000000
122	20.9341	1.0590	80000001	-14200000	00000000	00000000	00000000
123	21.3424	1.0590	80000001	-14200000	00000000	00000000	00000000
124	21.7514	1.0540	80000001	-14200000	00000000	00000000	00000000
125	21.7614	1.0530	80000001	-14200000	00000000	00000000	00000000
126	22.1620	1.0530	80000001	-14200000	00000000	00000000	00000000
127	22.5604	1.0530	80000001	-14200000	00000000	00000000	00000000
128	22.9772	1.0510	80000001	-14200000	00000000	00000000	00000000
129	23.3858	1.0510	80000001	-14200000	00000000	00000000	00000000
130	23.7644	1.0490	80000001	-14200000	00000000	00000000	00000000
131	24.2031	1.0490	80000001	-14200000	00000000	00000000	00000000
132	24.6117	1.0490	80000001	-14200000	00000000	00000000	00000000
133	25.0203	1.0460	80000001	-14200000	00000000	00000000	00000000
134	25.4289	1.0490	80000001	-14200000	00000000	00000000	00000000
135	25.8375	1.0490	80000001	-14200000	00000000	00000000	00000000
136	26.2461	1.0490	80000001	-14200000	00000000	00000000	00000000
137	26.6547	1.0490	80000001	-14200000	00000000	00000000	00000000
138	27.0634	1.0490	80000001	-14200000	00000000	00000000	00000000
139	27.4720	1.0490	80000001	-14200000	00000000	00000000	00000000
140	27.8806	1.0490	80000001	-14200000	00000000	00000000	00000000
141	28.2892	1.0490	80000001	-14200000	00000000	00000000	00000000
142	28.6978	1.0490	80000001	-14200000	00000000	00000000	00000000
143	29.1064	1.0490	80000001	-14200000	00000000	00000000	00000000
144	29.5150	1.0490	80000001	-14200000	00000000	00000000	00000000
145	29.9237	1.0490	80000001	-14200000	00000000	00000000	00000000
146	30.3323	1.0490	80000001	-14200000	00000000	00000000	00000000
147	30.7409	1.0490	80000001	-14200000	00000000	00000000	00000000
148	31.1495	1.0490	80000001	-14200000	00000000	00000000	00000000
149	31.5581	1.0490	80000001	-14200000	00000000	00000000	00000000
150	31.9667	1.0490	80000001	-14200000	00000000	00000000	00000000
151	32.3753	1.0490	80000001	-14200000	00000000	00000000	00000000
152	32.7840	1.0490	80000001	-14200000	00000000	00000000	00000000
153	33.1926	1.0490	80000001	-14200000	00000000	00000000	00000000
154	33.6012	1.0490	80000001	-14200000	00000000	00000000	00000000
155	34.0098	1.0490	80000001	-14200000	00000000	00000000	00000000
156	34.4184	1.0490	80000001	-14200000	00000000	00000000	00000000
157	34.8270	1.0490	80000001	-14200000	00000000	00000000	00000000
158	35.2356	1.0490	80000001	-14200000	00000000	00000000	00000000
159	35.6443	1.0490	80000001	-14200000	00000000	00000000	00000000
160	36.0529	1.0490	80000001	-14200000	00000000	00000000	00000000
161	36.4615	1.0490	80000001	-14200000	00000000	00000000	00000000
162	36.8701	1.0490	80000001	-14200000	00000000	00000000	00000000
163	37.2787	1.0490	80000001	-14200000	00000000	00000000	00000000
164	37.6873	1.0490	80000001	-14200000	00000000	00000000	00000000
165	38.0959	1.0490	80000001	-14200000	00000000	00000000	00000000
166	38.5044	1.0490	80000001	-14200000	00000000	00000000	00000000
167	38.9132	1.0490	80000001	-14200000	00000000	00000000	00000000
168	39.3218	1.0490	80000001	-14200000	00000000	00000000	00000000
169	39.7304	1.0490	80000001	-14200000	00000000	00000000	00000000
170	40.1390	1.0490	80000001	-14200000	00000000	00000000	00000000
171	40.5476	1.0490	80000001	-14200000	00000000	00000000	00000000
172	40.9562	1.0490	80000001	-14200000	00000000	00000000	00000000
173	41.3649	1.0490	80000001	-14200000	00000000	00000000	00000000
174	41.7734	1.0490	80000001	-14200000	00000000	00000000	00000000

[illegible]

[illegible]

V.

PROGRAM LISTING

PROGRAM SMITE(INPUT,OUTPUT,TAPE1,TAPE2,TAPE5 = INPUT,TAPE6 = OUTPUT)	SMITE 2
17)	SMITE 3
COMMON /COMVAL/ KT,AKT,DT,DTMIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDI	COMVAL 2
18, TOP,DAL,KMAX,PORG,PSCL,LE,LF	COMVAL 3
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /TVALS/ ISTART,TMAX,TPRIN,TERPL,TPLT,TSAVE,TCOMP,TZ	TVALS 2
LOGICAL ERR	SMITE 7
CALL INITAL	SMITE 8
TPRN = AKT+TPRIN	SMITE 9
TPRT = AKT+TPRPL	SMITE 10
TPLT = AKT+TPLUT	SMITE 11
TSVE = AKT+TSAVE	SMITE 12
10 KT = KT+1	SMITE 13
DT = 1.0E6	SMITE 14
DO 20 MAT = 1,NMAT	SMITE 15
IF (FMAT(22,MAT),GE,DT) GO TO 20	SMITE 16
DT = FMAT(22,MAT)	SMITE 17
MT = MAT	SMITE 18
20 CONTINUE	SMITE 19
IF (DT,GT,DTMIN) GO TO 30	SMITE 20
ZZ = FLOAT(IMAT(8,MT)-1)*FMAT(1,MT)	SMITE 21
RR = FLOAT(IMAT(9,MT)-2)*FMAT(2,MT)	SMITE 22
WRITE (6,120) AKT,MT,ZZ,RR,DT	SMITE 23
GO TO 100	SMITE 24
30 AKT = AKT+DT	SMITE 25
CALL MVRNC	SMITE 26
CALL ADJINT	SMITE 27
CALL BONDRY	SMITE 28
CALL DENS8	SMITE 29
DO 40 MAT = 1,NMAT	SMITE 30
CALL GENVAL	SMITE 31
CALL FDIFF	SMITE 32
CALL FINISH	SMITE 33
CALL RPOSN	SMITE 34
CALL BVALU	SMITE 35
CALL INTRPL	SMITE 36
40 CONTINUE	SMITE 37
IF (ERR) GO TO 100	SMITE 38
CALL SECOND (T)	SMITE 39
IF (T,GE,TCOMP,OR,AKT,GE,TMAX) GO TO 90	SMITE 40
IF (AKT,LT,TPRT) GO TO 50	SMITE 41
CALL PRNPLT	SMITE 42
TPRT = TPRT+TPRPL	SMITE 43
50 IF (AKT,LT,TPLT) GO TO 60	SMITE 44
CALL PLTOUT	SMITE 45
TPLT = TPLT+TPLUT	SMITE 46
60 IF (AKT,LT,TPRN) GO TO 70	SMITE 47
CALL OUTPUT	SMITE 48
TPRN = TPRN+TPRIN	SMITE 49
70 IF (AKT,LT,TSVE) GO TO 80	SMITE 50
CALL SAVE	SMITE 51
TSVE = TSVE+TSAVE	SMITE 52
80 GO TO 10	SMITE 53
90 IF (TSVE,LT,1.0E8) CALL SAVE	SMITE 54
100 IF (TPLT,GE,1.0E8) GO TO 110	SMITE 55
CALL PLTOUT	SMITE 56

END FILE 2	SMITE 57
110 IF (TPRT,LT,1.0E8) CALL PRNPLT	SMITE 58
IF (TPRN,LT,1.0E8) CALL OUTPUT	SMITE 59
STOP	SMITE 60
	SMITE 61
C 120 FORMAT (6H0AT T=FR,3,27H STEP TOO SMALL IN MATERIAL,2,16H AT POINT	SMITE 62
1 (Z,R)=2E11,4,5X3HE7=E11,4)	SMITE 63
END	SMITE 64

95

10) BETA(MATNO), ES(MATNO), EZERO(MATNO), ESPRH(MATNO), RMIN(MATNO)	INITAL48
RHOZRO(MATNO) = RHO	INITAL49
20 CONTINUE	INITAL50
WRITE (6,440) MAT,N1,NJ,IF,IL,JL,ZLEN,YMAX,THETA,CAP,D,VIS,VIST,CF	INITAL51
1L,MU,YC,RHO,UI	INITAL52
DO 30 I = 1,7	INITAL53
30 IMAT(I,MAT) = 0	INITAL54
DC 40 M = 1,MAT	INITAL55
IMAT(4,MAT) = IMAT(4,MAT)+IMAT(1,M)	INITAL56
IMAT(5,MAT) = IMAT(5,MAT)+IMAT(2,M)	INITAL57
IMAT(6,MAT) = IMAT(6,MAT)+(IMAT(1,M)+2)*IMAT(2,M)	INITAL58
40 IMAT(7,MAT) = IMAT(7,MAT)+IMAT(3,M)	INITAL59
IMAT(1,MAT) = N1	INITAL60
NJ=NJ+1	INITAL61
IMAT(2,MAT)=NJ	INITAL62
IMAT(3,MAT) = NEMAX	INITAL63
IMAT(10,MAT) = MATNO	INITAL64
IMAT(11,MAT) = IPRINT	INITAL65
IMAT(12,MAT) = JPRINT	INITAL66
NIP2 = N1+2	INITAL67
IS = IMAT(4,MAT)	INITAL68
JS = IMAT(5,MAT)	INITAL69
IJS = IMAT(6,MAT)	INITAL70
IHS = IMAT(7,MAT)	INITAL71
DC 60 J = 1,NJ	INITAL72
JJ=IJS+(J-1)*NIP2	INITAL73
DC 70 I = 1,N1	INITAL74
IJ=JJ+I	INITAL75
DC 50 KK = 1,KMAX	INITAL76
50 W(IJ,KK) = 0.0	INITAL77
60 L(IJ) = 0	INITAL78
DC 70 I = 1,NEMAX	INITAL79
FRX(IHS+I) = 0.0	INITAL80
FRY(IHS+I) = 0.0	INITAL81
FRS(IHS+I) = 0.0	INITAL82
DC 70 KK = 1,KMAX	INITAL83
70 WB(IHS+I,KK) = 0.0	INITAL84
X0 = ZLEN/FLOAT(I-IF+1)	INITAL85
T0 = X0	INITAL86
U0 = X0/T0	INITAL87
P0 = RHO*U0**2	INITAL88
FACT = 1.0/X0	INITAL89
MU = MU/P0	INITAL90
YC = YC/P0	INITAL91
YC = (YC**2)/3.	INITAL92
IT1=IRS+1	INITC1 1
IT2=IRS+NLF	INITC1 2
READ (5,410) (FRX(I),FRY(I),I=IT1,IT2)	INITC1 3
WRITE(6,450) (FRX(I),FRY(I),I=IT1,IT2)	INITC1 4
N1 = NLF	INITAL95
N2 = NLF*NTP-1	INITAL96
IT1=IRS+N1	INITC1 5
IT2=IRS+N2	INITC1 6
READ (5,410) (FRX(I),FRY(I),I=IT1,IT2)	INITC1 7
WRITE(6,460) (FRX(I),FRY(I),I=IT1,IT2)	INITC1 8
N1 = N2	INITAL99

N2 = N2+NRT-1	INITA100
IT1=IRS+N1	INITC1
IT2=IRS+N2	INITC110
READ (5,410) (FRX(I),FRY(I),I=IT1,IT2)	INITC111
WRITE(6,470) (FRX(I),FRY(I),I=IT1,IT2)	INITC112
READ (5,390) (ITR(MAT,I),I = 1,NTR)	INITA103
DO 80 I = 1,NTR	INITA104
TRX(MAT,I) = 0,0	INITA105
J = ITR(MAT,I)	INITA106
TFRX(I) = FRX(IRS+J)	INITA107
TFRY(I) = FRY(IRS+J)	INITA108
IF (J,NF,N2) GO TO A0	INITA109
ITH(MAT,I) = J-1	INITA110
TRX(MAT,I) = 1,0	INITA111
80 CONTINUE	INITA112
WRITE (6,480) (I,TFRX(I),TFRY(I),I = 1,NTR)	INITA113
IF (ISTART.EQ.0) GO TO 100	INITA114
READ (1) (NBEG(MAT,I),NFEND(MAT,I),ARCSIZ(MAT,I),I = 1,3),XZ,M1,MJ,	INITA115
1NF,YZ	OFAX 4
IT1=IRS+1	INITC113
IT2=IRS+NF	INITC114
READ(1) ((WB(I,KK),KK=1,KMAX),FRS(I),I=IT1,IT2),(FRX(I),FRY(I),	INITC115
1I=IT1,IT2),DTM	INITC116
READ (1) NTR,(ITR(MAT,I),TRX(MAT,I),I = 1,NTR)	INITA119
IDF = IF-1	INITA120
I2 = M1+IDF	INITA121
JDF=JF-1	OFAX 5
J2=MJ+JDF	OFAX 6
DO 85 J=JF,J2	OFAX 7
JJ=IJS+(J-1)*NIP2	INITC118
IT1=JJ+IF	INITC119
IT2=JJ+I2	INITC120
85 READ(1) ((W(I,KK),KK=1,KMAX),I(I),I=IT1,IT2)	INITC121
ND = NEND(MAT,1)	INITA124
NE = NEND(MAT,2)	INITA125
ZDF = FLOAT(IDF)*AX	INITA126
XZ = XZ+ZDF	INITA127
RDF=FLOAT(JDF)*AY	OFAX 8
YZ=YZ+RDF	OFAX 9
DO 90 I = 1,NF	INITA128
FRY(IRS+I)=FRY(IRS+I)+RDF	OFAX 10
90 FRX(IRS+I) = FRX(IRS+I)+ZDF	INITA129
100 CONTINUE	INITA130
THET = THETA*PI/180.	INITA131
BMAX=FLOAT(JL-JF+1)	OFAX 11
Y0 = YMAX/(BMAX-0.5)	INITA133
ANG = 1./TAN(THET)	INITA134
CFL=CFL*X0	OFAX 12
AF = 1,0/CAP	INITA136
TCP = 2./PI	INITA137
A = Y0*BMAX	INITA138
B = A/(1.-D/A)	INITA139
APL = BMAX/ALOG((R+A)/(R-A))	INITA140
DAHL = 1./(2.*B*APL)	INITA141
CMAN = ((B+A)/(R-A))*((1,0/RMAX)	INITA142
IF (ISTART.NF,0) GO TO 115	INITA143

ZMIN = 1.0E10	INITA144
RMIN=ZMIN	OFAX 13
DO 105 I=1,N2	INITA145
ZZ = FRX(IRS+I)	INITA146
RR = FRY(IRS+I)	INITA147
ZMIN = AMIN1(ZMIN,Z7)	INITA148
RMIN=AMIN1(RMIN,RR)	OFAX 14
FRX(IRS+I) = ALP(ZZ,RR)	INITA149
105 FRY(IRS+I) = ETA(RR)	INITA150
XZ = (FLOAT(JF)-1.5)*AX-FACT*ZMIN	INITA151
FRX(IRS+1) = FRX(IRS+1)+XZ	INITA152
YZ=(FLOAT(JF)-1.5)*AY-ETA*RM(1)	OFAX 15
IF(JF,EO.1) YZ=0.0	OFAX 16
FRY(IRS+1)=FRY(IRS+1)+YZ	OFAX 17
DO 110 I=2,N2	INITA153
FRX(IRS+I) = FRX(IRS+I)+XZ	INITA154
FRY(IRS+I)=FRY(IRS+I)+YZ	OFAX 18
110 FRS(IRS+I) = FRS(IRS+I-1)+SQRT((FRY(IRS+I)-FRY(IRS+I-1))**2+	INITA155
1(FHX(IRS+I)-FRX(IRS+I-1))**2)	INITA156
NC = 2.0*FRS(IRS+NLF)+1.5	INITA157
N1 = NLF+NTP-1	INITA158
NE = 2.0*FRS(IRS+N1)+1.5	INITA159
NF = 2.0*FRS(IRS+N2)+1.5	INITA160
NBEG(MAT,1) = 1	INITA161
NBEG(MAT,2) = ND	INITA162
NBEG(MAT,3) = NE	INITA163
NEND(MAT,1) = ND	INITA164
NEND(MAT,2) = NE	INITA165
NEND(MAT,3) = NF	INITA166
115 CONTINUE	INITA167
DO 120 I = 1,21	INITA168
120 FMAT(I,MAT) = AMAT(I)	INITA169
FMAT(22,MAT) = 1.0	INITA170
NTHS(MAT) = NTR	INITA171
CALL GENVAL	INITA172
DO 130 J = 2,NJ	INITA173
AJ=AY*FLOAT(J-2)+YZ	OFAX 19
CH = CHAN** (BMAX-AJ)	INITA175
Y(JS+J) = A-B*(CH-1.)/(CH+1.)	INITA176
YSE(JS+J) = FACT*(B**2-(A-Y(JS+J))**2)*DARL	INITA177
ESY(JS+J) = 1./YSE(JS+J)	INITA178
AFY = AF*Y(JS+J)	INITA179
AFY2 = AFY**2	INITA180
ASY(JS+J) = ANG*TOP*(ATAN(AFY)+AFY/(1.+AFY2))	INITA181
AYY(JS+J) = X0*2.+ANG*TOP*AF*YSE(JS+J)*(1.-AFY2/(1.+AFY2))/(1.+AFY	INITA182
12)	INITA183
ESYE(JS+J) = -2.*DARL*(A-Y(JS+J))*ESY(JS+J)	INITA184
EIGF(JS+J) = SQRT(ASY(JS+J)**2+1.)	INITA185
IF (J,GT,2) DY(JS+J) = X0*YSE(JS+J)/Y(JS+J)	INITA186
IF (J,EO,2) DY(JS+J) = 1.	INITA187
130 CONTINUE	INITA188
Y(JS+1) = -Y(JS+3)	INITA189
YSE(JS+1) = YSE(JS+3)	INITA190
ESY(JS+1) = 1./YSE(JS+1)	INITA191
ASY(JS+1) = -ASY(JS+3)	INITA192
DY(JS+1) = -DY(JS+3)	INITA193

DO 140 J = 2,NJM1	INITA194
AJ=AY*(FLOAT(J)-1,5)-YZ	OFAX 20
CH = CHAN*(BMAX-AJ)	INITA195
YY = A-B*(CH-1,)/(CH+1,)	INITA197
YSEA(JS+J) = .5*(YSF(JS+J)+YSF(JS+J+1))	INITA198
ESYA(JS+J) = 1./YSEA(JS+J)	INITA199
ASYA(JS+J) = ANG*TOP*(ATAN(AF*YY)+AF*YY/(1,+(AF*YY)**2))	INITA200
DYA(JS+J) = X0*YSEA(JS+J)/YY	INITA201
140 CONTINUE	INITA202
YSEA(JS+1) = YSEA(JS+2)	INITA203
ESYA(JS+1) = ESYA(JS+2)	INITA204
ASYA(JS+1) = -ASYA(JS+2)	INITA205
DYA(JS+1) = -DYA(JS+2)	INITA206
IF (ISTART.NE.0) GO TO 260	INITA207
DC 240 M = 1,3	INITA208
LB = NBEQ(MAT,M)	INITA209
GO TO (1/0,180,190), M	INITA210
170 LF = NLF	INITA211
GO TO 200	INITA212
180 LF = LB+NTP-1	INITA213
GO TO 200	INITA214
190 LF = LB+NRT-1	INITA215
200 LADD = NEND(MAT,M)-LF	INITA216
LM = N2-LF	INITA217
IF (LM,EQ.0) GO TO 240	INITA218
DC 210 I = 1,NTR	INITA219
IF (ITR(MAT,I),LT,LF) GO TO 210	INITA220
ITR(MAT,I) = ITR(MAT,I)+LADD	INITA221
210 CONTINUE	INITA222
NIN2 = 2*NINFC	INITA223
DC 220 I = 1,NIN2	INITA224
IF (INFC(3*I-2),NE,MAT) GO TO 220	INITA225
IF (INFC(3*I-1),GE,LF) INFC(3*I-1) = INFC(3*I-1)+LADD	INITA226
IF (INFC(3*I),GE,LF) INFC(3*I) = INFC(3*I)+LADD	INITA227
220 CONTINUE	INITA228
NF1 = N2+1	INITA229
DC 230 LL = 1,LM	INITA230
L1 = NF1-LL	INITA231
L2 = L1+LADD	INITA232
FRX(IRS+L2) = FRX(IRS+L1)	INITA233
FRY(IRS+L2) = FRY(IRS+L1)	INITA234
230 CONTINUE	INITA235
N2 = N2+LADD	INITA236
240 CALL RELABL (M)	INITA237
DC 250 I = 1,NF	INITA238
WB(IRS+I,1) = 1.0	INITA239
WB(IRS+I,4) = 0.0	INITA240
250 WB(IRS+I,2) = UI	INITA241
260 CALL BPOSN	INITA242
CALL RVALU	INITA243
IF (ISTART.NE.0) GO TO 320	INITA244
DC 280 J = 2,NJ	INITA245
JJ=IJS+(J-1)*NIP2	INITA246
DO 280 I = 1,NI	INITA247
IJ=JJ+I	INITA248
W(IJ,1) = 1.0	INITA249

W(IJ,2) = U1	INITA250
DC 270 KK = 3,KMAX	INITA251
270 W(IJ,KK) = 0.0	INITA252
L(IJ) = 1	INITA253
280 CONTINUE	INITA254
CALL IPOSN	INITA255
DC 290 I = 1,N1	INITA256
W(IJS+1,1) = W(IJS+2*NIP2+1,1)	INITA257
W(IJS+1,2) = W(IJS+2*NIP2+1,2)	INITA258
W(IJS+1,3) = -W(IJS+2*NIP2+1,3)	INITA259
290 L(IJS+1) = L(IJS+2*NIP2+1)	INITA260
SBM = 0.0	INITA261
PEER = .TRUE.	INITA262
DC 300 J = 2,NJ	INITA263
JJ=IJS+(J-1)*NIP2	INITA264
DC 300 I = 1,N1	INITA265
IJ=JJ+1	INITA266
IF(L(IJ),EQ,0) GO TO 300	INITC122
RHO = W(IJ,1)	INITA267
E = W(IJ,4)	INITA268
P = PRS(RHO,E)	INITA269
C2 = PR+P*PE/RHO**2	INITA270
C = SQRT(C2)	INITA271
UC = (ABS(W(IJ,2))-ASY(JS+J)*W(IJ,3))*EIGF(JS+J)*C)*MAX	INITA272
VC = (ABS(W(IJ,3))+C)*ESY(JS+J)*DAY	INITA273
SR = AMAX1(UC,VC)	INITA274
IF (SR,LE,SRM) GO TO 300	INITA275
SRM = SR	INITA276
ISB = 1	INITA277
JSB = J	INITA278
300 CONTINUE	INITA279
DC 310 M = 1,3	INITA280
NMB = NBEG(MAT,M)	INITA281
NMF = NEND(MAT,M)	INITA282
310 ARCSIZ(MAT,M) = FRS(IRS+MMF)-FRS(IRS+NNP)	INITA283
DTM = CFL/SBM	INITA284
DTMN = AMIN1(DTM,DTMN)	INITA285
320 FMAT(22,MAT) = DTM	INITA286
IMAT(8,MAT) = ISB	INITA287
IMAT(9,MAT) = JSB	INITA288
330 CONTINUE	INITA289
IF (ISTART,EQ,0) DTMIN = 0.05*DTMN	INITA290
IF (TSAVE,LT,0.0) TSAVE = 1.0E8	INITA291
IF (TPHPL,GE,0.0) GO TO 340	INITA292
TPHPL = 1.0E8	INITA293
GO TO 350	INITA294
340 CALL PRNTP (999,TITLE)	INITA295
CALL PRNPLT	INITA296
350 IF (TPLOT,GE,0.0) GO TO 360	INITA297
TPLOT = 1.0E8	INITA298
GO TO 370	INITA299
360 CALL PLTQUT	INITA300
370 IF (TPHIN,GE,0.0) GO TO 380	INITA301
TPHIN = 1.0E8	INITA302
RETURN	INITA303
380 CALL OUTPUT	INITA304

	RETURN	INITA305
C		INITA306
390	FORMAT (16I5)	INITA307
400	FORMAT (12I5)	INITA308
410	FORMAT (8E10.3)	INITA309
420	FORMAT (20A4)	INITA310
430	FORMAT (1H1/1H020A4)	INITA311
440	FORMAT (1H0//58X8HMATERIAL12/5X19HMAXIMUM ALPHA MESH=14,17X18HMAXI	INITA312
	1H0H BETA MESH=14,18X28HINITIAL LEFTMOST ALPHA LINE=14/5X29HINITIAL	INITA313
	2 RIGHTMOST ALPHA LINE=14,7X26HINITIAL TOPMOST BETA LINE=14,10X27H	INITA314
	3INITIAL MATERIAL THICKNESS=F7,3/5X24HINITIAL MATERIAL HEIGHT=F8,3,8	INITA315
	4X15HMATERIAL ANGLE=F7,2,18X11HCAP LENGTH=F9,5/5X25HBOUNDARY LAYER	INITA316
	5THICKNESS=F8,3,7X30HONESTEP VISCOSITY COEFFICIENT=F8,4,4X30H2OSTE	INITA317
	6P VISCOSITY COEFFICIENT=F6,4/5X17HTIME STEP FACTOR=F5,3,18X14HSHEAR	INITA318
	7R MODULUS=F9,5,17X14HYIELD CONDITION=F9,5/5X25HINITIAL MATERIAL DE	INITA319
	8NSITY=F7,3,8X26HINITIAL MATERIAL VELOCITY=F9,6)	INITA320
450	FORMAT (1H041X47HINITIAL (Z,P) COORDINATES OF LEFT MATERIAL FACE/(	INITA321
	15(/X,2F9.5)))	INITA322
460	FORMAT (1H041X46HINITIAL (Z,P) COORDINATES OF TOP MATERIAL FACE/(5	INITA323
	1(/X,2F9.5)))	INITA324
470	FORMAT (1H040X48HINITIAL (Z,P) COORDINATES OF RIGHT MATERIAL FACE/(	INITA325
	1(/X,2F9.5)))	INITA326
480	FORMAT (1H043X45HINITIAL (Z,P) COORDINATES OF TRACER PARTICLES/(5	INITA327
	14X,12,1H),2F9.5)))	INITA328
	END	INITA329

SUBROUTINE GENVAL	GENVAL 2
COMMON /MATARR/ NMAT, IMAT(12,5), FMAT(23,5), MAT	MATARR 2
COMMON /ZONES/ NBEG(5,3), NEND(5,3), ARCSIZ(5,3), DISMAX(5,3), DISMIN(5,3)	ZONES 2
15,3)	ZONES 3
COMMON /TRCPR/ NTHS(5), ITH(5,25), TRS(5,25)	TRCPR 2
COMMON /COMVAL/ KT, AKT, DT, DTHIN, ITER, NEIBR, IPOINT, ERR, EPS, EPS1, RDICOMVAL	COMVAL 2
18, TOP, DAL, KMAX, PORG, PSCL, LB, LF	COMVAL 3
COMMON /MATVAL/ AX, AY, CFL, VIS, VIST, MU, YC, RHO, XO, PO, TO, XZ, A, T, ABL, DMATVAL	MATVAL 2
1ARL, CHAN, BMAX, FACT, ANG, AF, SHM, AL, AS, AK, HAL, HAS, HAK, QAL, QAS, QAK, DAXMATVAL	MATVAL 3
2, DAY, HDAX, HDAY, DAX2, DAY2, HDAXY, QDAXY, DTR, HALF MU, TWTD MU, FRTD MU, QDVH MATVAL	MATVAL 4
3U, TREETH, NI, NJ, NF MAX, IS, JS, IJS, IRS, JSR, NIH1, NJH1, ND, N71, NF, NE1 MATVAL	MATVAL 5
4, NF, NIP2, NTR	MATVAL 6
COMMON /PRESS/ PDER, PR, PE, MATNO	PRESS 2
COMMON /INTFC/ NINFC, INFC(60), NONIA(20,5)	INTFC 2
DIMENSION AMAT(21), MMAT(7)	GENVAL10
EQUIVALENCE (AMAT, AX), (MMAT, NI)	GENVAL11
REAL MU	GENVAL12
DO 10 I = 1, 21	GENVAL13
10 AMAT(I) = FMAT(I, MAT)	GENVAL14
DO 20 I = 1, 7	GENVAL15
20 MMAT(I) = IMAT(I, MAT)	GENVAL16
MATNO = IMAT(10, MAT)	GENVAL17
DAX = 1.0/AX	GENVAL18
DAY = 1.0/AY	GENVAL19
HDAX = 0.5*DAX	GENVAL20
HDAY = 0.5*DAY	GENVAL21
DAX2 = DAX**2	GENVAL22
DAY2 = DAY**2	GENVAL23
HDAXY = 0.5*DAX*DAY	GENVAL24
QDAXY = 0.5*HDAXY	GENVAL25
HALF MU = 0.5* MU	GENVAL26
TWTD MU = 2.0* MU/3.0	GENVAL27
FRTD MU = 2.0*TWTD MU	GENVAL28
QDVH MU = 1.0/ MU	GENVAL29
TREETH = 3.0/(2.0* MU)	GENVAL30
AK = FACT*DT	OFAX 21
AL = AK*DAX	GENVAL33
AS = AK*DAY	GENVAL34
HAL = 0.5*AL	GENVAL35
HAS = 0.5*AS	GENVAL36
HAK = 0.5*AK	GENVAL37
QAL = 0.25*AL	GENVAL38
QAS = 0.25*AS	GENVAL39
QAK = 0.25*AK	GENVAL40
NIP2 = NI+2	GENVAL41
NIH1 = NI-1	GENVAL42
NJH1 = NJ-1	GENVAL43
ND = NEND(MAT, 1)	GENVAL44
NE = NEND(MAT, 2)	GENVAL45
NF = NEND(MAT, 3)	GENVAL46
ND1 = ND+1	GENVAL47
NE1 = NE+1	GENVAL48
NTR = NTRS(MAT)	GENVAL49
RETURN	GENVAL50
END	GENVAL51

SUBROUTINE MVBND	MVBND 2
COMMON /BNDVAL/ MB(600,7),FRX(600),FRY(600),FR3(600)	BNDVAL 2
COMMON /MATARR/ NMAT,1MAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDI	COMVAL 2
1S, TOP, DAL, KMAX, PURG, PSCL, LB, LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,HU,YC,RHO,XJ,PO,TO,XZ,A,R,ABL,DMATVAL	MATVAL 2
1ARL,CHAN,BMAX,FACT,ANG,AF,SRH,AL,AS,AK,HAL,HAS,HAK,OAL,OAS,TAK,DAX	MATVAL 3
2, DAY, HDAX, HDAY, DAX2, DAY2, HDAXY, QDAXY, DTR, HALFHJ, THTDMU, FHTDMU, UOVH	MATVAL 4
3U, TREETH, NI, NJ, NFMAX, IS, JS, IJS, IBS, ISR, JSR, NIM1, NJM1, ND, ND1, NE, NE1	MATVAL 5
4, NF, NIP2, NTR	MATVAL 6
EQUIVALENCE(YZ,TU)	CFAX 22
DO 10 MAT = 1, NMAT	MVBND 7
CALL GENVAL	MVBND 8
N1 = IBS+1	MVBND 9
N2 = IBS+NF	MVBND 10
DO 10 I = N1, N2	MVBND 11
CH=CHAN+(BMAX-FRY(I)*YZ)	CFAX 23
KH = A-B*(CH-1,0)/(CH+1,0)	MVBND 13
ZR = XU*(FRX(I)-XZ)+ANG*RU*TCP*ATAN(AF*RB)	MVBND 14
FRX(I) = ZB*DT*WB(I,2)	MVBND 15
FRY(I) = A*AX1(RB*CT*WB(I,3),0,0)	MVBND 16
10 CONTINUE	MVBND 17
RETURN	MVBND 18
END	MVBND 19

SLROUTINE ADJINT	ADJINT 2
COMMON /BNDVAL/ WR(400,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /ZONES/ NBEG(5,3),NEND(5,3),AFCS1Z(5,3),DISMAX(5,3),DISMIN(	ZONES 2
15,3)	ZONES 3
COMMON /SCHTCH/ TWR(300,7),TFPX(300),TFRY(300)	SCHTCH 2
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIPD,IPDINT,ERR,EPS,EPS1,RD	COMVAL 2
15,1OP,DAL,KMAX,POPG,PSCL,LB,LF	COMVAL 3
LOGICAL ERR	ADJINT 4
DC 80 I = 1,NINFC	ADJINT10
MAI1 = INFC(6*I-5)	ADJINT11
MAI2 = INFC(6*I-2)	ADJINT12
IBS1 = IMAT(7,MAT1)	ADJINT13
IBS2 = IMAT(7,MAT2)	ADJINT14
IF (MAT2.EQ.3) GO TO 30	ADJINT15
N1 = IBS1+1	ADJINT16
N2 = IBS1+NEND(MAT1,3)	ADJINT17
M1=IBS2+NEND(MAT2,2)	ADJINT18
M2=IBS2+NEND(MAT2,3)	ADJINT19
ZMX2=0.0	ADJINT20
DC 2 J=M1,M2	ADJINT21
2 ZMX2=AMAX1(FRX(J),ZMX2)	ADJINT22
K=N1	ADJINT23
DC 4 J=N1,N2	ADJINT24
IF (FRX(J).GT.ZMX2) GO TO 4	ADJINT25
K=J	ADJINT26
4 CONTINUE	ADJINT27
N2=MIND(K+1,N2)	ADJINT28
RMX1=0.0	ADJINT29
DO 5 J=N1,N2	ADJINT30
5 RMX1=AMAX1(FRY(J),RMX1)	ADJINT31
DC 6 K=M1,M2	ADJINT32
IF (FRY(K).LE.RMX1) GO TO 8	ADJINT33
6 CONTINUE	ADJINT34
7 K=K+1	ADJINT35
8 RMX2=AMAX1(FRY(K+1),FRY(K))	ADJINT36
RMN2=AMIN1(FRY(K+1),FRY(K))	ADJINT37
ZMX2=AMAX1(FRX(K+1),FRX(K))	ADJINT38
ZMN2=AMIN1(FRX(K+1),FRX(K))	ADJINT39
DC 10 J=N1,N2	ADJINT40
IF (FRY(J).GE.RMN2.AND,FRX(J).GE.ZMN2) GO TO 11	ADJINT41
10 CONTINUE	ADJINT42
GO TO 7	ADJINT43
11 J1=MAX0(J,IBS1+2)	ADJINT44
J2=J1-1	ADJINT45
DC 12 J=J1,N2	ADJINT46
IF (FRY(J).LT.RMN2.OR,FRX(J).GT.ZMX2) GO TO 12	ADJINT47
J2=J	ADJINT48
12 CONTINUE	ADJINT49
J2=MIND(J2+1,N2)	ADJINT50
D=FRY(K)-FRY(K-1)	ADJINT51
IF (ABS(D).LE.1.0E-10) D=1.0E-10	ADJINT52
EM2=(FRX(K)-FRX(K-1))/D	ADJINT53
IF (ABS(EM2).LE.1.0) GO TO 14	ADJINT54
EM2=1.0/EM2	ADJINT55

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      B2=FRY(K-1)-EM2*FRX(K-1)
      IEU=2
      GO TO 15
14  B2=FRX(K-1)-EM2*FRY(K-1)
      IEU=1
15  J=J2+1
      DO 24 JJ=J1,J2
      J=J-1
      D=FRX(J)-FRX(J-1)
      IF (ABS(D),LE,1.0E-10) D=1.0E-10
      EM1=(FRY(J)-FRY(J-1))/D
      IF (ABS(EM1),LE,1.0) GO TO 18
      EM1=1.0/EM1
      B1=FRX(J-1)-EM1*FRY(J-1)
      IE=IE0+2
      GO TO 20
18  B1=FRY(J-1)-EM1*FRX(J-1)
      IE=IE0
20  GO TO (21,22,23,24),IE
21  R=(B1+EM1*B2)/(1.0-EM1*EM2)
      GO TO 25
22  R=(EM2*B1-EM1*B2)/(EM2-EM1)
      GO TO 25
23  R=(B1-B2)/(EM2-EM1)
      GO TO 25
24  R=(EM2*B1+B2)/(1.0-EM1*EM2)
25  IF (R,GE,RMN2.AND,R,LE,RMX2) GO TO 40
28  CONTINUE
      GO TO 7
30  N1=IBS1+INFC(6,I=4)
      N2=IBS1+INFC(6,I=3)
      M1=IBS2+INFC(6,I)
      M2=IBS2+INFC(6,I=1)
      M3=INFC(6,I=1)+1
      M4=NEND(MAT2,3)
      LAUD=N2-N1-M2+M1
      NF=M4+LADD
      IF (NF,GT,IMAT(3,MAT2)) GO TO 55
      DO 32 J=M3,M4
      K=IBS2+J
      TFRX(J)=FRX(K)
32  TFRY(J)=FRY(K)
      M5=M2+LADD
      J=N2+1
      DO 34 K=M1,M5
      J=J-1
      FRX(K)=FRX(J)
34  FRY(K)=FRY(J)
      K=M5
      DO 36 J=M3,M4
      K=K+1
      FRX(K)=TFRX(J)
36  FRY(K)=TFRY(J)
      M2=M2-IBS2
      INFC(6,I=1)=M2+LADD
      NEND(MAT2,3)=NF

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ADJINT56
ADJINT57
ADJINT58
ADJINT59
ADJINT60
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ADJINT97
ADJINT98
ADJINT99
ADJIN100
ADJIN101
ADJIN102
ADJIN103
ADJIN104
ADJIN105
ADJIN106
ADJIN107
ADJIN108
ADJIN109
ADJIN110
ADJIN111

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      IF (NEND(MAT2,2).LT,M2) GO TO 80
      NEND(MAT2,2)=NEND(MAT2,2)+LADD
      NBEG(MAT2,3)=NBEG(MAT2,3)+LADD
      IF (NEND(MAT2,1).LT,M2) GO TO 80
      NEND(MAT2,1)=NEND(MAT2,1)+LADD
      NBEG(MAT2,2)=NBEG(MAT2,2)+LADD
      GO TO 80
40  NINT = J-1
50  CONTINUE
      INFC(6*I-3) = NINT-1BS1
      INFC(6*I) = K-1BS2
      NF = INFC(6*I)+INFC(6*I-3)-1
      IF (NF,LE,IMAT(3,MAT2)) GO TO 60
55  CONTINUE
      WRITE (6,90) MAT2,MAT1
      ERK = ,TRUE,
      GO TO 80
60  NEND(MAT2,3) = NF
      INFC(6*I-1) = NF
      K = K+INFC(6*I-3)
      DO 70 J = N1,NINT
      K = K-1
      FRX(K) = FRX(J)
70  FRY(K) = FRY(J)
80  CONTINUE
      RETURN
C
90  FORMAT (41H000 MANY POINTS ON INTERFACE OF MATERIAL2,14H WITH MATERIAL2)
      END

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ADJIN112
ADJIN113
ADJIN114
ADJIN115
ADJIN116
ADJIN117
ADJIN118
ADJIN119
ADJIN120
ADJIN121
ADJIN122
ADJIN123
ADJIN124
ADJIN125
ADJIN126
ADJIN127
ADJIN128
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ADJIN131
ADJIN132
ADJIN133
ADJIN134
ADJIN135
ADJIN136
ADJIN137
ADJIN138
ADJIN139
ADJIN140
ADJIN141

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SUBROUTINE FDIFF	FDIFF 2
COMMON// W(2200,7),L(2200)	INTVAL 2
COMMON/MSHFCN/ Y(78),DY(78),DYA(78),ESY(78),YSE(78),ESYA(78),	MSHFCN 2
1YSEA(78),ESYE(78),EIGF(78),ASY(78),AYY(78),ASYA(78)	MSHFCN 3
COMMON /MATARR/ NHAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RD	COMVAL 2
1S,IOP,DAL,KMAX,PORG,PSCL,LB,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,XO,PO,TO,XZ,A,B,ABL,D	MATVAL 2
1ABL,CHAN,BMAX,FACT,ANG,AF,SBM,AL,AS,AK,HAL,HAS,HAY,CAL,QAS,QAK,D	MATVAL 3
2,DAY,HMAX,HDAY,DAX2,DAY2,HMAXY,QMAXY,DTR,HALFNU,TWTCMU,PRTCMU,OOV	MATVAL 4
3U,IROOTH,NI,NJ,NFMAX,IS,JS,IJS,IBS,ISR,JSR,NIM1,NJM1,ND,ND1,NE,NE	MATVAL 5
4,N,NIP2,NTR	MATVAL 6
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS 2
REAL MU	FDIFF 7
LOGICAL PDER,AXIS	FDIFF 10
DIMENSION WW(3,3,7), F(3,3,7), G(3,3,7), H(3,3,7), T(3,3,3)	FDIFF 11
DIMENSION WP(2,2,7), WN(7)	FDIFF 12
SBM = 0.0	FDIFF 13
NIP1 = N1+1	FDIFF 14
DO 10 J = 1,N1	FDIFF 15
M = NIP1-1	FDIFF 16
DO 10 N = 1,NJ	FDIFF 17
MN = IJS*(N-1)+NIP2+M	FDIFF 18
L(MN+2) = L(MN)	FDIFF 19
DO 10 K = 1,KMAX	FDIFF 20
W(MN+2,K) = W(MN,K)	FDIFF 21
10 CONTINUE	FDIFF 22
DO 260 M = 4,NIP1	FDIFF 23
DO 260 N = 2,NJM1	FDIFF 24
MN = IJS*(N-1)+NIP2+M	FDIFF 25
IF (L(MN),EQ.0) GO TO 260	FDIFF 26
NEIBR = 0	FDIFF 27
IF (L(MN+1),EQ.0) NFIBR = NEIBR+1	FDIFF 28
IF (L(MN+NIP2),EQ.0) NEIBR = NEIBR+2	FDIFF 29
IF (L(MN-1),EQ.0) NEIBR = NEIBR+4	FDIFF 30
IF (L(MN-NIP2),EQ.0) NEIBR = NEIBR+8	FDIFF 31
IF (L(MN+NIP2+1),EQ.0) NEIBR = NEIBR+16	FDIFF 32
IF (L(MN+NIP2-1),EQ.0) NEIBR = NEIBR+32	FDIFF 33
IF (L(MN-NIP2-1),EQ.0) NEIBR = NEIBR+64	FDIFF 34
IF (L(MN-NIP2+1),EQ.0) NEIBR = NEIBR+128	FDIFF 35
IF (NEIBR,NE.0) GO TO 210	FDIFF 36
MP2 = M-2	FDIFF 37
NP2 = N-2	FDIFF 38
AXIS = .FALSE,	FDIFF 39
IF (N,EQ.2) AXIS = .TRUE,	FDIFF 40
ESYN = FSY(JS+N)	FDIFF 41
DJ1 = DY(JS+N)*QAK	FDIFF 42
DJ2 = .5*DJ1	FDIFF 43
PDER = .FALSE,	FDIFF 44
DO 20 J = 1,3	FDIFF 45
MJ = NM2+J	FDIFF 46
YSEJ = YSE(JS+MJ)	FDIFF 47
AR = -ASY(JS+MJ)	FDIFF 48
JJ=IJS*(MJ-1)+NIP2	FDIFF 49
DO 20 I = 1,3	FDIFF 50
MI = MM2+I	FDIFF 51

IJ=JJ+M1	FDIFF 52
RHO = W(I,J,1)	FDIFF 53
U = W(I,J,2)	FDIFF 54
V = W(I,J,3)	FDIFF 55
E = W(I,J,4)	FDIFF 56
S11 = W(I,J,5)	FDIFF 57
S12 = W(I,J,6)	FDIFF 58
S22 = W(I,J,7)	FDIFF 59
P = PRS(RHO,E)	FDIFF 60
WW(I,J,1) = RHO*YSEJ	FDIFF 61
WW(I,J,2) = WW(I,J,1)*U	FDIFF 62
WW(I,J,3) = WW(I,J,1)*V	FDIFF 63
WW(I,J,4) = WW(I,J,1)*(F+0.5*(U*U+V*V))	FDIFF 64
WW(I,J,5) = S11*YSEJ	FDIFF 65
WW(I,J,6) = S12*YSEJ	FDIFF 66
WW(I,J,7) = S22*YSEJ	FDIFF 67
E = WW(I,J,4)/YSEJ	FDIFF 68
F(I,J,1) = WW(I,J,2)+AR*WW(I,J,3)	FDIFF 69
F(I,J,2) = F(I,J,1)+U*YSEJ*(S11-P+AR*S12)	FDIFF 70
F(I,J,3) = F(I,J,1)+V*YSEJ*(P-S22)+AR*S12	FDIFF 71
F(I,J,4) = YSEJ*((E+P)*(U+AR*V)-S12*(V+AR*U)-S11*U-AR*S22*V)	FDIFF 72
F(I,J,5) = TWTDMU*(2,*,U+AR*V)*YSEJ	FDIFF 73
F(I,J,6) = MU*(U+AR*V)*YSEJ	FDIFF 74
F(I,J,7) = TWTDMU*(2,*,AR*V-U)*YSEJ	FDIFF 75
H(I,J,1) = RHO*V	FDIFF 76
H(I,J,2) = H(I,J,1)+U*S12	FDIFF 77
H(I,J,3) = H(I,J,1)+V*S22-S11	FDIFF 78
H(I,J,4) = (E+P-S22)*V-U*S12	FDIFF 79
H(I,J,5) = TWTDMU*V	FDIFF 80
H(I,J,6) = 0.	FDIFF 81
H(I,J,7) = H(I,J,5)	FDIFF 82
G(I,J,1) = H(I,J,1)	FDIFF 83
G(I,J,2) = H(I,J,2)	FDIFF 84
G(I,J,3) = H(I,J,3)+P*S11+S22	FDIFF 85
G(I,J,4) = H(I,J,4)	FDIFF 86
G(I,J,5) = -TWTDMU*V	FDIFF 87
G(I,J,6) = MU*U	FDIFF 88
G(I,J,7) = FR*DMU*V	FDIFF 89
T(I,J,1) = S12	FDIFF 90
T(I,J,2) = -.5*(S11-S22)	FDIFF 91
T(I,J,3) = -S12	FDIFF 92
20 CONTINUE	FDIFF 93
AG1X = AL*ABS(F(3,2,1)/WW(3,2,1)-F(2,2,1)/WW(2,2,1))	FDIFF 94
AG2X = AL*ABS(F(2,2,1)/WW(2,2,1)-F(1,2,1)/WW(1,2,1))	FDIFF 95
AG1Y = AS*ABS(ESY(JS+N+1)*WW(2,3,3)/WW(2,3,1)-ESYN*WW(2,2,3)/WW(2,2,1))	FDIFF 96
AG2Y = AS*ABS(ESYN*WW(2,2,3)/WW(2,2,1)-ESY(JS+N-1)*WW(2,1,3)/WW(2,1,1))	FDIFF 97
DO 60 K = 1,4	FDIFF 98
DO 30 J = 1,2	FDIFF 99
MJ = NM2+J	FDIFF 100
DJ = DYA(JS+MJ)	FDIFF 101
DO 30 I = 1,2	FDIFF 102
30 WP(I,J,K) = 0.25*(WW(I+1,J+1,K)+WW(I+1,J,K)+WW(I,J+1,K)+WW(I,J,K))-WAS*(G(I+1,J+1,K)-G(I+1,J,K)-G(I,J+1,K)-G(I,J,K))-OAK*DJA*(H(I+1,J+1,K)+H(I+1,J,K)+H(I,J+1,K)+H(I,J,K))	FDIFF 103
	FDIFF 104
	FDIFF 105
	FDIFF 106
	FDIFF 107

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3*H(I,J+1,K)+H(I,J,K))                                FDIFF108
IF (,NOT,AXIS) GO TO 40                                  FDIFF109
Q = QAS*(H(2,3,K)-H(2,1,K))                             FDIFF110
GO TO 50                                                  FDIFF111
40 Q = DJ1*(H(2,3,K)+H(2,1,K))                          FDIFF112
50 HN(K) = WW(2,2,K)+QAL*(F(3,2,K)-F(1,2,K))-QAS*(G(2,3,K)+G(2,1,K))-FDIFF113
10*VIST*(AQ1X*(WW(3,2,K)-WW(2,2,K))-AQ2X*(WW(2,2,K)-WW(1,2,K))+AQ1Y*FDIFF114
2*(WW(2,3,K)-WW(2,2,K))-AQ2Y*(WW(2,2,K)-WW(2,1,K)))    FDIFF115
60 CONTINUE                                              FDIFF116
DO 70 J = 1,2                                           FDIFF117
MJ = NM2+J                                              FDIFF118
DJ = DYA(JS+MJ)                                         FDIFF119
DO 70 I = 1,2                                           FDIFF120
MI = MM2+I                                              FDIFF121
DIFF = HAL*(DOVMU*(YSE(JS+MJ+1)*ASY(JS+MJ+1)*(G(I+1,J+1,6)-G(I,J+1,6)))+YSE(JS+MJ)*ASY(JS+MJ)*(G(I+1,J,6)+G(I,J,6))-TREOTM*(YSE(JS+MJ+1,6)))+YSE(JS+MJ)*ASY(JS+MJ)*(G(I+1,J,5)+G(I,J,5))-G(I+1,J,5)+G(I,J,5))) FDIFF122
3HAS=DOVMU*(G(I+1,J+1,6)-G(I+1,J,6)+G(I,J+1,6)-G(I,J,6)) FDIFF123
2J+1)*(G(I+1,J+1,5)-G(I,J+1,5))+YSE(JS+MJ)*(G(I+1,J,5)+G(I,J,5))) FDIFF124
3HAS=DOVMU*(G(I+1,J+1,6)-G(I+1,J,6)+G(I,J+1,6)-G(I,J,6)) FDIFF125
CC1 = .25*TREOTM*(ESY(JS+MJ+1)*(F(I+1,J+1,5)+F(I,J+1,5)+F(I+1,J+1,6)+F(I,J+1,6))+F(I,J+1,7))+ESY(JS+MJ)*(F(I+1,J,5)+F(I,J,5)+F(I+1,J,7)+F(I,J,7))) FDIFF126
2)) FDIFF127
CC2 = -.25*TREOTM*(G(I+1,J+1,5)+G(I+1,J,5)+G(I,J+1,5)+G(I,J,5)) FDIFF128
DO 70 K = 5,7                                           FDIFF129
TAV = .25*(T(I+1,J+1,K-4)+T(I+1,J,K-4)+T(I,J+1,K-4)+T(I,J,K-4)) FDIFF130
DIFS = HAS*(ESY(JS+MJ+1)*(WW(I+1,J+1,K)+WW(I,J+1,K))-ESY(JS+MJ)*(WW(I+1,J,K)+WW(I,J,K))) FDIFF131
DIFSS = HAL*(WW(I+1,J+1,K)-WW(I,J+1,K)+WW(I+1,J,K)-WW(I,J,K)) FDIFF132
WP(I,J,K) = .25*(WW(I+1,J+1,K)+WW(I+1,J,K)+WW(I,J+1,K)+WW(I,J,K))+FDIFF133
1HAL*(F(I+1,J+1,K)-F(I,J+1,K)+F(I+1,J,K)-F(I,J,K))+HAS*(G(I+1,J+1,K)+G(I,J+1,K)-G(I+1,J,K)-G(I,J,K))-CC1*DIFSS-CC2*DIFS-TAV*DIFF-QAK*FDIFF134
2)*G(I+1,J,K)+G(I,J+1,K)-G(I,J,K))-CC1*DIFSS-CC2*DIFS-TAV*DIFF-QAK*FDIFF135
3DJ*(H(I+1,J+1,K)+H(I+1,J,K)+H(I,J+1,K)+H(I,J,K)) FDIFF136
70 CONTINUE                                              FDIFF137
DO 100 K = 5,7                                           FDIFF138
IF (,NOT,AXIS) GO TO 80                                  FDIFF139
Q = QAS*(H(2,3,K)-H(2,1,K))                             FDIFF140
GO TO 90                                                  FDIFF141
80 Q = DJ1*(H(2,3,K)+H(2,1,K))                          FDIFF142
90 HN(K) = WW(2,2,K)+QAL*(F(3,2,K)-F(1,2,K))-H(MN,2)   FDIFF143
1-ASY(JS+N)*W(MN,3))                                     FDIFF144
2E(JS+N)*(ASY(JS+N)+DOVMU*(G(3,2,6)-G(1,2,6))-TREOTM*(G(3,2,5)-G(1,2,5)))+QAS*(G(2,3,K)-G(2,1,K))-H(MN,3)*(ESY(JS+N+1)+FDIFF145
4WW(2,3,K)-ESY(JS+N+1)*WW(2,1,K))+T(2,2,K-4)*(H(MN+NIP2,2)+FDIFF146
5-H(MN+NIP2,2))-Q*VIST*(AQ1X*(WW(3,2,K)-WW(2,2,K))-AQ2X*(WW(2,2,K)-WW(1,2,K))+AQ1Y*(WW(2,3,K)-WW(2,2,K))-AQ2Y*(WW(2,2,K)-WW(2,1,FDIFF147
7,K))) FDIFF148
100 CONTINUE                                              FDIFF149
DO 110 J = 1,2                                           FDIFF150
MJ = NM2+J                                              FDIFF151
AR = -ASYA(JS+MJ)                                         FDIFF152
YSEJ = YSEA(JS+MJ)                                       FDIFF153
ESYJ = ESYA(JS+MJ)                                       FDIFF154
DO 110 I = 1,2                                           FDIFF155
RHU = WP(I,J,1)*ESYJ                                     FDIFF156
U = WP(I,J,2)/WP(I,J,1)                                  FDIFF157
V = WP(I,J,3)/WP(I,J,1)                                  FDIFF158
E = WP(I,J,4)/WP(I,J,1)-0.5*(U+U*V+V)                  FDIFF159

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S11 = WP(1,J,5)*ESYJ	FDIFF164
S12 = WP(1,J,6)*ESYJ	FDIFF165
S22 = WP(1,J,7)*ESYJ	FDIFF166
P = PRS(RHO,E)	FDIFF167
E = WP(1,J,4)*ESYJ	FDIFF168
F(1,J,1) = WP(1,J,2)*AR*WP(1,J,3)	FDIFF169
F(1,J,1) = F(1,J,1)+U*YSEJ*(S11-P*AR*S12)	FDIFF170
F(1,J,3) = F(1,J,1)+V*YSEJ*(P-S22)*AR*S12)	FDIFF171
F(1,J,4) = YSEJ*((E+P)*(U*AR+V)*S12*(V*AR+U)-S11*U*AR*S22*V)	FDIFF172
F(1,J,5) = TWTDMU*(2,*U*AR*V)*YSEJ	FDIFF173
F(1,J,6) = MU*(U*AR*V)*YSEJ	FDIFF174
F(1,J,7) = TWTDMU*(2,*AR*V-U)*YSEJ	FDIFF175
H(1,J,1) = RHO*V	FDIFF176
H(1,J,2) = H(1,J,1)+U*S12	FDIFF177
H(1,J,3) = H(1,J,1)+V*2,*S22-S11	FDIFF178
H(1,J,4) = (E+P-S22)*V-U*S12	FDIFF179
H(1,J,5) = TWTDMU*V	FDIFF180
H(1,J,6) = 0.	FDIFF181
H(1,J,7) = H(1,J,5)	FDIFF182
G(1,J,1) = H(1,J,1)	FDIFF183
G(1,J,2) = H(1,J,2)	FDIFF184
G(1,J,3) = H(1,J,3)+P*S11*S22	FDIFF185
G(1,J,4) = H(1,J,4)	FDIFF186
G(1,J,5) = -TWTDMU*V	FDIFF187
G(1,J,6) = MU*U	FDIFF188
G(1,J,7) = FRTDMU*V	FDIFF189
T(1,J,1) = S12	FDIFF190
T(1,J,2) = -.5*(S11-S22)	FDIFF191
T(1,J,3) = -S12	FDIFF192
110 CONTINUE	FDIFF193
DC 140 K = 1,4	FDIFF194
IF (.NOT.AXIS) GO TO 120	FDIFF195
Q = QAS*(H(2,2,K)-H(2,1,K)+H(1,2,K)-H(1,1,K))	FDIFF196
GO TO 130	FDIFF197
120 Q = DJ2*(H(2,2,K)+H(2,1,K)+H(1,2,K)+H(1,1,K))	FDIFF198
130 WN(K) = WN(K)-QAL*(F(2,2,K)-F(1,2,K)+F(2,1,K)-F(1,1,K))+QAS*(G(2,2,K)-G(2,1,K)+G(1,2,K)-G(1,1,K))-Q	FDIFF199
140 CONTINUE	FDIFF200
DIF = HAL*(OOVMU*(YSEA(JS+N)*ASYA(JS+N)*(G(2,2,6)-G(1,2,6))+YSEA(JS+N-1)*ASYA(JS+N-1)*(G(2,1,6)-G(1,1,6)))-TREOTM*(YSEA(JS+N)*(G(2,2,5)-G(1,2,5))+YSEA(JS+N-1)*(G(2,1,5)-G(1,1,5))))+HAS*OOVMU*(YSEA(JS+N)*(G(2,2,6)+G(1,2,6))-YSEA(JS+N-1)*(G(2,1,6)+G(1,1,6))))	FDIFF201
CC1 = .25*TREOTM*(ESYA(JS+N)*(F(2,2,5)+F(1,2,5)+F(2,2,7)+F(1,2,7))+ESYA(JS+N-1)*(F(2,1,5)+F(1,1,5)+F(2,1,7)+F(1,1,7)))	FDIFF202
CC2 = -.25*TREOTM*(R(2,2,5)+G(2,1,5)+G(1,2,5)+G(1,1,5))	FDIFF203
DO 170 K = 5,7	FDIFF204
TAV = .25*(T(2,2,K-4)+T(1,2,K-4)+T(2,1,K-4)+T(1,1,K-4))	FDIFF205
DIFS = QAS*(ESYA(JS+N)*(WP(2,2,K)+WP(1,2,K))-ESYA(JS+N-1)*(WP(2,1,K)+WP(1,1,K)))	FDIFF206
DIFSS = QAL*(WP(2,2,K)-WP(1,2,K)+WP(2,1,K)-WP(1,1,K))	FDIFF207
IF (.NOT.AXIS) GO TO 150	FDIFF208
Q = QAS*(H(2,2,K)-H(2,1,K)+H(1,2,K)-H(1,1,K))	FDIFF209
GO TO 160	FDIFF210
150 Q = DJ2*(H(2,2,K)+H(2,1,K)+H(1,2,K)+H(1,1,K))	FDIFF211
160 WN(K) = WN(K)+CAL*(F(2,2,K)-F(1,2,K)+F(2,1,K)-F(1,1,K))+QAS*(G(2,2,K)-G(2,1,K)+G(1,2,K)-G(1,1,K))-CC1*DIFSS-CC2*DIFS-TAV*DIF-0	FDIFF212
	FDIFF213
	FDIFF214
	FDIFF215
	FDIFF216
	FDIFF217
	FDIFF218
	FDIFF219

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170 CONTINUE
W(MN -2,1) = WN(1)*ESY(JS+N)
W(MN -2,2) = WN(2)/WN(1)
W(MN -2,3) = WN(3)/WN(1)
VEL = W(MN-2,2)**2+W(MN-2,3)**2
W(MN -2,4) = AMAX1(WN(4)/WN(1)-0.5*VEL,0.0)
W(MN -2,5) = WN(5)*ESYN
W(MN -2,6) = WN(6)*ESYN
W(MN -2,7) = WN(7)*ESYN
YIELD = W(MN-2,5)**2+W(MN-2,6)**2+W(MN-2,7)**2+W(MN-2,5)*W(MN-2,7)
IF (YIELD.LT.YC) GO TO 200
IF (AXIS) GO TO 190
WDOT = ((W(MN,5)-ASY(JS+N)*W(MN,6))*(W(MN+1,2)-W(MN-1,2))+(W(MN,6)
1-ASY(JS+N)*W(MN,7))*(W(MN+1,3)-W(MN-1,3)))*QAL*ESY(JS+N)*W(MN,6)*
2(W(MN+NIP2,2)-W(MN-NIP2,2))+W(MN,7)*(W(MN+NIP2,3)-W(MN-NIP2,3))*QAF
3S=MAK*(W(MN,5)+W(MN,7))*W(MN,3)*DY(JS+N)
GC TO 190
180 WDOT = W(MN,5)*((W(MN+1,2)-W(MN-1,2))*QAL-ESY(JS+N)*(W(MN+NIP2,3)-
1W(MN-NIP2,3))*QAS)
190 WDOT=AMAX1(WDOT,0.0)
ACUN = WDOT*MU/YC
SSU = (W(MN-2,5)-ACON*W(MN,5))**2*(W(MN-2,7)-ACON*W(MN,7))**2*(W(MN-2,6)-ACON*W(MN,6))**2*(W(MN-2,5)-ACON*W(MN,5))*(W(MN-2,7)-ACON*W(MN,7))
ALPHA = SQRT(YC/SSQ)
W(MN-2,5) = ALPHA*(W(MN-2,5)-ACON*W(MN,5))
W(MN-2,6) = ALPHA*(W(MN-2,6)-ACON*W(MN,6))
W(MN-2,7) = ALPHA*(W(MN-2,7)-ACON*W(MN,7))
200 PCER = .TRUE.
RHO = W(MN-2,1)
E = W(MN-2,4)
P = PRS(RHO,E)
C2 = PR+P*PE/RHO**2
IF (C2.GE.0.0) GO TO 240
WRITE (6,300) MM2,N,MAT,ESY(JS+N),AKT,(W(MN-2,K),K = 1,KMAX)
GC TO 230
210 IF (NEIBR.LT.240) GO TO 230
L(MN) = 2
DO 220 K = 1,KMAX
220 W(MN-2,K) = W(MN,K)
GC TO 260
230 BSAVE = B
CALL ONESTP (M,N)
B = BSAVE
GC TO 260
240 C = SQRT(C2)
UC = (ABS(W(MN-2,2)-ASY(JS+N)*W(MN-2,3))*EIGF(JS+N)*C)*DAY
VC = (ABS(W(MN-2,3))*C)*ESY(JS+N)*DAY
SB = AMAX1(UC,VC)
IF (SB.LE.SBM) GO TO 250
SBM = SB
ISB = MM2
JSB = N
250 CONTINUE
BS = AK*SB
IF (BS.GE.0.9) WRITE (6,290) MM2,N,AKT,BS,MAT,(W(MN-2,K),K=1,KMAX)

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IF (WS,GE,1.0) GO TO 230	FDIFF276
260 CONTINUE	FDIFF277
DO 270 N = 1,NJ	FDIFF278
JJ=IJS+(N-1)*NIP2	FDIFF279
DO 270 M = 1,NI	FDIFF280
MM=JJ+M	FDIFF281
L(MN) = L(MN+2)	FDIFF282
270 CONTINUE	FDIFF283
DO 280 M = 2,NIM1	FDIFF284
280 L(IJS+M) = L(IJS+2*NIP2+M)	FDIFF285
FMAT(22,MAT) = CFL/SRM	FDIFF286
IMAT(8,MAT) = ISB	FDIFF287
IMAT(9,MAT) = JSB	FDIFF288
RETURN	FDIFF289
C	FDIFF290
290 FORMAT (11H AT POINT (I3,1H,I2,16H) IN DIFFP AT T=F0,5,5X5HSTAB=F9	FDIFF291
1,5,5X4HMAT=I2/3H W=7E15,5)	FDIFF292
300 FORMAT (11H AT POINT (I3,1H,I2,1H)31H IMAGINARY SOUND SPEED IN FDI	FDIFF293
1FF3X4HMAT=I2,3X4HESV=F9,5,3X2HT=F9,5/3H W=7E15,5)	FDIFF294
END	FDIFF295

SUBROUTINE ONESTP (I,JJ)	ONESTP 2
COMMON// W(2200,7),L(2200)	INTVAL 2
COMMON/BNDCHS/ WB!(109,8,7),PRI(109,8),IND(109,9)	BNDCHS 2
1WBJ(78,8,7),PBJ(78,8),JND(78,9)	BNDCHS 3
COMMON/MSHFCN/ Y(78),DY(78),DYA(78),ESY(78),YSE(78),ESYA(78),	MSHFCN 2
1YSEA(78),ESYE(78),EIGF(78),ASY(78),AYY(78),ASYA(78)	MSHFCN 3
COMMON /MATARR/ NMAT,IMAT(12,9),FMAT(23,5),MAT	MATARR 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIRR,IPOINT,ERR,EPS,EPS1,RD	COMVAL 2
1S,IOP,DAL,KMAX,PORG,PSCL,LR,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,XO,PO,TO,XZ,A,R,ABL,DMATVAL	MATVAL 2
1ABL,CHAN,RMAX,FACT,ANG,AF,SRH,AL,AS,AK,HAL,HAS,HAK,DAL,QAS,QAK,DAXMATVAL	MATVAL 3
2,DAX,HMAX,HDAY,DAX2,DAXY,HDAXY,QDAXY,DTR,HALFMU,TWTCMU,FRTDMU,ODVM	MATVAL 4
3U,IROOT,N1,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSR,N1N1,NJM1,ND1,NE,NE1	MATVAL 5
4,N1,NIP2,NTR	MATVAL 6
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS 2
COMMON /DER1/ RT,UT,VT,ET,S11T,S12T,S22T	ONESTP10
COMMON /DER2/ RTT,UTT,VTT,ETT,S11TT,S12TT,S22TT	ONESTP11
DIMENSION WW(7), WT(7), WTT(7)	ONESTP12
DIMENSION WSA(7), WSB(7), WSA(7), WSB(7), WSAB(7)	ONESTP13
EQUIVALENCE (RT,WT(1)), (RTT,WTT(1))	ONESTP14
REAL K1,K2	ONESTP15
LOGICAL AXIS	ONESTP16
REAL MU,MUMHS,MUPHS	ONESTP17
LOGICAL PDER	ONESTP18
HAX = 0.5*AX	ONESTP19
HAY = 0.5*AY	ONESTP20
I = II	ONESTP21
J = JJ	ONESTP22
IJ=IJS+(J-1)*NIP2+I	ONESTP23
IP2 = I-2	ONESTP24
AXIS = .FALSE.	ONESTP25
IF (J,EQ,2) AXIS = .TRUE.	ONESTP26
AI = FLOAT(I-3)*AX	ONESTP27
AJ = FLOAT(J-2)*AY	ONESTP28
DJ = ESY(JS+J)*DY(JS+J)	ONESTP29
DO 10 KK = 1,KMAX	ONESTP30
WW(KK) = W(IJ,KK)	ONESTP31
10 CONTINUE	ONESTP32
PDER = .TRUE.	ONESTP33
PP = PRS(WW(1),WW(4))	ONESTP34
PPH = PR	ONESTP35
PPE = PE	ONESTP36
JPOINT = NEIRR/16	ONESTP37
IPOINT = NEIRR-16*JPOINT+1	ONESTP38
JPOINT = JPOINT+1	ONESTP39
GO TO (20,40,20,40,120,80,120,80,20,40,20,40,120,80,120,80), IPOINT	ONESTP40
1T	ONESTP41
C USX IS U SUB X UXX IS U SUB XX UXY IS U SUB XY	ONESTP42
C USY IS U SUB Y UYY IS U SUB YY	ONESTP43
C UT IS U SUB T UXT IS U SUB XT UYT IS U SUB YT UTT IS U SUB TT	ONESTP44
C SECTION 100 IS FOR WHEN NEITHER (IP,J) NOR (IM,J) IS MISSING	ONESTP45
	ONESTP46
20 DO 30 KK = 1,KMAX	ONESTP47
WSA(KK) = (W(IJ+1,KK)-W(IJ-1,KK))*HDAX	ONESTP48
WSAA(KK) = (W(IJ+1,KK)-2.0*W(IJ,KK)+W(IJ-1,KK))*DAX2	ONESTP49
30 CONTINUE	ONESTP50

P1 = PRS(W(IJ+1,1),W(IJ+1,4))	ONESTP51
PR1 = PR	ONESTP52
PE1 = PE	ONESTP53
P2 = PRS(W(IJ-1,1),W(IJ-1,4))	ONESTP54
PR2 = PR	ONESTP55
PE2 = PE	ONESTP56
PSA = (P1-P2)*WDAX	ONESTP57
PRSA = (PR1-PR2)*WDAX	ONESTP58
PESA = (PE1-PE2)*WDAX	ONESTP59
PAA = (P1-2.0*PP+P2)*DAY2	ONESTP60
DELX = AX	ONESTP61
GO TO 160	ONESTP62
40 N = JND(JS+J,1)	ONESTP63
DO 50 K = 2,N	ONESTP64
IF (A1,LE,PBJ(JS+J,K)) GO TO 60	ONESTP65
50 CONTINUE	ONESTP66
60 K1 = PBJ(JS+J,K)-A1	ONESTP67
K2 = AX	ONESTP68
IF (K1,LT,RDIS*AX) GO TO 680	ONESTP69
DELX = K1	ONESTP70
DK = 1./(K1+K2*(K1+K2))	ONESTP71
SK1 = DK*K1**2	ONESTP72
SK2 = DK*K2**2	ONESTP73
K1 = 2.*K1*DK	ONESTP74
K2 = 2.*K2*DK	ONESTP75
DO 70 KK = 1,KMAX	ONESTP76
WSA(KK) = SK2*(WBJ(JS+J,K,KK)-WW(KK))+SK1*(WW(KK)*W(IJ-1,KK))	ONESTP77
WSAA(KK) = K2*(WBJ(JS+J,K,KK)-WW(KK))-K1*(WW(KK)*W(IJ-1,KK))	ONESTP78
70 CONTINUE	ONESTP79
P1 = PRS(WBJ(JS+J,K,1),WBJ(JS+J,K,4))-PP	ONESTP80
PR1 = PR-PPR	ONESTP81
PE1 = PE-PPE	ONESTP82
P2 = PP-PRS(W(IJ+1,1),W(IJ-1,4))	ONESTP83
PR2 = PPR-PR	ONESTP84
PE2 = PPE-PE	ONESTP85
PSA = SK2*P1+SK1*P2	ONESTP86
PRSA = SK2*PR1+SK1*PR2	ONESTP87
PESA = SK2*PE1+SK1*PE2	ONESTP88
PAA = K2*P1-K1*P2	ONESTP89
GO TO 160	ONESTP90
80 N = JND(JS+J,1)	ONESTP91
DO 90 K = 2,N	ONESTP92
IF (A1,LE,PBJ(JS+J,K)) GO TO 100	ONESTP93
90 CONTINUE	ONESTP94
100 K1 = PBJ(JS+J,K)-A1	ONESTP95
K2 = A1-PBJ(JS+J,K-1)	ONESTP96
IF (K1,LT,RDIS*AX,OR,K2,LT,RDIS*AX) GO TO 680	ONESTP97
DELX = AMIN1(K1,K2)	ONESTP98
DK = K1+K2	ONESTP99
SK1 = K1/(K2+DK)	ONEST100
SK2 = K2/(K1+DK)	ONEST101
K1 = 2.0/(K1+DK)	ONEST102
K2 = 2.0/(K2+DK)	ONEST103
DO 110 KK = 1,KMAX	ONEST104
WSA(KK) = SK2*(WBJ(JS+J,K,KK)-WW(KK))+SK1*(WW(KK)*WBJ(JS+J,K-1,KK))	ONEST105
1)	ONEST106

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110 WSA(KK) = K1*(WBJ(JS+J,K,KK)-WW(KK))-K2*(WW(KK)-WBJ(JS+J,K-1,KK)) ONEST107
    P1 = PRS(WBJ(JS+J,K,1),WBJ(JS+J,K,4))-PP ONEST108
    PR1 = PR-PPR ONEST109
    PE1 = PE-PPE ONEST110
    P2 = PP-PRS(WBJ(JS+J,K-1,1),WBJ(JS+J,K-1,4)) ONEST111
    PR2 = PPR-PR ONEST112
    PE2 = PPE-PE ONEST113
    PSA = SK2*P1+SK1*P2 ONEST114
    PRSA = SK2*PR1+SK1*PR2 ONEST115
    PES1 = SK2*PE1+SK1*PE2 ONEST116
    PAA = K2*P1-K1*P2 ONEST117
    GO TO 160 ONEST118
120 N = JND(JS+J,1) ONEST119
    DO 130 K = 2,N ONEST120
    IF (AI,LT,PBJ(JS+J,K)) GO TO 140 ONEST121
130 CONTINUE ONEST122
140 K = K-1 ONEST123
    K2 = AI-PBJ(JS+J,K) ONEST124
    K1 = AX ONEST125
    IF (K2,LT,RDIS*AX) GO TO 680 ONEST126
    DELX = K2 ONEST127
    DK = 1/(K1*K2*(K1+K2)) ONEST128
    SK1 = DK*K1**2 ONEST129
    SK2 = DK*K2**2 ONEST130
    K1 = 2,*K1*DK ONEST131
    K2 = 2,*K2*DK ONEST132
    DC 150 KK = 1,KMAX ONEST133
    WSA(KK) = SK2*(W(IJ+1,KK)-WW(KK))+SK1*(WW(KK)-WBJ(JS+J,K,KK)) ONEST134
    WSA(KK) = K2*(W(IJ+1,KK)-WW(KK))-K1*(WW(KK)-WBJ(JS+J,K,KK)) ONEST135
150 CONTINUE ONEST136
    P1 = PRS(W(IJ+1,1),W(IJ+1,4))-PP ONEST137
    PR1 = PR-PPR ONEST138
    PE1 = PE-PPE ONEST139
    P2 = PP-PRS(WBJ(JS+J,K,1),WBJ(JS+J,K,4)) ONEST140
    PR2 = PPR-PR ONEST141
    PE2 = PPE-PE ONEST142
    PSA = SK2*P1+SK1*P2 ONEST143
    PRSA = SK2*PR1+SK1*PR2 ONEST144
    PES1 = SK2*PE1+SK1*PE2 ONEST145
    PAA = K2*P1-K1*P2 ONEST146
160 GO TO (170,170,190,190,170,170,190,190,230,230,270,270,230,230,270) ONEST147
    1,2/0), IPOINT ONEST148
170 DC 180 KK = 1,KMAX ONEST149
    WSB(KK) = (W(IJ+NIP2,KK)-W(IJ-NIP2,KK))*HDAY ONEST150
    WSB(KK) = (W(IJ+NIP2,KK)-2.0*WW(KK)+W(IJ-NIP2,KK))*DAY2 ONEST151
180 CONTINUE ONEST152
    P1 = PRS(W(IJ+NIP2,1),W(IJ+NIP2,4)) ONEST153
    PR1 = PR ONEST154
    PE1 = PE ONEST155
    P2 = PRS(W(IJ-NIP2,1),W(IJ-NIP2,4)) ONEST156
    PR2 = PR ONEST157
    PE2 = PE ONEST158
    PSB = (P1-P2)*HDAY ONEST159
    PRSB = (PR1-PR2)*HDAY ONEST160
    PESB = (PE1-PE2)*HDAY ONEST161
    PSB = (P1-2.0*PP+P2)*DAY2 ONEST162

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DELY = AY	ONEST163
GC TO J30	ONEST164
190 N = IND(IS+IM2,1)	ONEST165
DC 200 K = 1,N	ONEST166
IF (AJ,LE,PBI(IS+IM2,K)) GO TO 210	ONEST167
200 CONTINUE	ONEST168
210 K1 = PBI(IS+IM2,K)-AJ	ONEST169
K2 = AY	ONEST170
IF (K1,LT,RDIS*AY) GO TO 680	ONEST171
DK = 1,/(K1+K2*(K1+K2))	ONEST172
DELY = K1	ONEST173
SK1 = DK*K1**2	ONEST174
SK2 = DK*K2**2	ONEST175
K1 = 2,*K1*DK	ONEST176
K2 = 2,*K2*DK	ONEST177
DC 220 KK = 1,KMAX	ONEST178
WSB(KK) = SK2*(WBI(IS+IM2,K,KK)-WW(KK))+SK1*(WW(KK)-W(IJ-NIP2,KK))	ONEST179
WSBB(KK) = K2*(WBI(IS+IM2,K,KK)-WW(KK))-K1*(WW(KK)-W(IJ-NIP2,KK))	ONEST180
220 CONTINUE	ONEST181
P1 = PRS(WBI(IS+IM2,K,1),WBI(IS+IM2,K,4))-PP	ONEST182
PR1 = PR-PPR	ONEST183
PE1 = PE-PPE	ONEST184
P2 = PP-PRS(W(IJ-NIP2,1),W(IJ-NIP2,4))	ONEST185
PR2 = PPR-PR	ONEST186
PE2 = PPE-PE	ONEST187
PSB = SK2*P1+SK1*P2	ONEST188
PRSB = SK2*PR1+SK1*PR2	ONEST189
PESB = SK2*PE1+SK1*PE2	ONEST190
PBB = K2*P1-K1*P2	ONEST191
GC TO J30	ONEST192
230 N = IND(IS+IM2,1)	ONEST193
DC 240 K = 1,N	ONEST194
IF (AJ,LT,PBI(IS+IM2,K)) GO TO 250	ONEST195
240 CONTINUE	ONEST196
250 K = K-1	ONEST197
K2 = AJ-PBI(IS+IM2,K)	ONEST198
K1 = AY	ONEST199
IF (K2,LT,RDIS*AY) GO TO 680	ONEST200
DK = 1,/(K1+K2*(K1+K2))	ONEST201
DELY = K2	ONEST202
SK1 = DK*K1**2	ONEST203
SK2 = DK*K2**2	ONEST204
K1 = 2,*K1*DK	ONEST205
K2 = 2,*K2*DK	ONEST206
DC 260 KK = 1,KMAX	ONEST207
WSB(KK) = SK2*(W(IJ+NIP2,KK)-WW(KK))+SK1*(WW(KK)-WBI(IS+IM2,K,KK))	ONEST208
WSBB(KK) = K2*(W(IJ+NIP2,KK)-WW(KK))-K1*(WW(KK)-WBI(IS+IM2,K,KK))	ONEST209
260 CONTINUE	ONEST210
P1 = PRS(W(IJ+NIP2,1),W(IJ+NIP2,4))-PP	ONEST211
PR1 = PR-PPR	ONEST212
PE1 = PE-PPE	ONEST213
P2 = PP-PRS(WBI(IS+IM2,K,1),WBI(IS+IM2,K,4))	ONEST214
PR2 = PPR-PR	ONEST215
PE2 = PPE-PE	ONEST216
PSB = SK2*P1+SK1*P2	ONEST217
PRSB = SK2*PR1+SK1*PR2	ONEST218

PESB = SK2*PE1+SK1*PE2	ONEST219
PBB = K2*P1-K1*P2	ONEST220
GO TO J30	ONEST221
270 N = IND(IS+IM2,1)	ONEST222
DO 280 K = 1,N	ONEST223
IF (AJ,LE,PRI(IS+IM2,K)) GO TO 290	ONEST224
280 CONTINUE	ONEST225
290 K1 = PWI(IS+IM2,K)-AJ	ONEST226
IF (K1,LT,RDIS*AY) GO TO 680	ONEST227
IF (J,EQ,2) GO TO 310	ONEST228
K2 = AJ-PBI(IS+IM2,K-1)	ONEST229
IF (K2,LT,RDIS*AY) GO TO 680	ONEST230
DELY = AMIN1(K1,K2)	ONEST231
DK = 1/(K1+K2*(K1+K2))	ONEST232
SK1 = DK*K1**2	ONEST233
SK2 = DK*K2**2	ONEST234
K1 = 2.*K1*DK	ONEST235
K2 = 2.*K2*DK	ONEST236
DO 300 KK = 1,KMAX	ONEST237
WSB(KK) = SK2*(WBI(IS+IM2,K,KK)-WW(KK))+SK1*(WW(KK)-WBI(IS+IM2,K-1	ONEST238
1,KK))	ONEST239
WSBB(KK) = K2*(WBI(IS+IM2,K,KK)-WW(KK))-K1*(WW(KK)-WBI(IS+IM2,K-1,	ONEST240
1,KK))	ONEST241
300 CONTINUE	ONEST242
P1 = PRS(WBI(IS+IM2,K,1),WBI(IS+IM2,K,4))-PP	ONEST243
PR1 = PR-PPR	ONEST244
PE1 = PE-PPE	ONEST245
P2 = PP-PRS(WBI(IS+IM2,K-1,1),WBI(IS+IM2,K-1,4))	ONEST246
PR2 = PPR-PR	ONEST247
PE2 = PPE-PE	ONEST248
PSB = SK2*P1+SK1*P2	ONEST249
PRSB = SK2*PR1+SK1*PR2	ONEST250
PESB = SK2*PE1+SK1*PE2	ONEST251
PBB = K2*P1-K1*P2	ONEST252
GO TO J30	ONEST253
310 WSB(1) = 0.	ONEST254
WSB(2) = 0.	ONEST255
WSB(3) = WBI(IS+IM2,K,3)*DAY/K1	ONEST256
DELY = K1	ONEST257
SK1 = 2.0/(K1+K1)	ONEST258
DO 320 KK = 1,KMAX	ONEST259
WSBB(KK) = (WBI(IS+IM2,K,KK)-WW(KK))*SK1	ONEST260
320 CONTINUE	ONEST261
PSB = 0.0	ONEST262
PRSB = 0.	ONEST263
PESB = 0.	ONEST264
PBB = (PRS(WBI(IS+IM2,K,1),WBI(IS+IM2,K,4))-PP)*SK1	ONEST265
330 PDER = .FALSE,	ONEST266
GO TO (540,360,400,360,340,420,400,480,380,380,440,520,340,500,460	ONEST267
1,680), JPOINT	ONEST268
340 DO 350 KK = 1,KMAX	ONEST269
WSAB(KK) = ((W(IJ+NIP2+1,KK)-W(IJ+NIP2+1,KK))*HDAX-WSA(KK))*DAY	ONEST270
350 CONTINUE	ONEST271
P1 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST272
P2 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST273
PAD = ((P1-P2)*HDAX-PSA)*DAY	ONEST274

GO TO 560	ONEST275
360 DO 370 KK = 1,KMAX	ONEST276
WSAB(KK) = (WSA(KK)-(W(IJ+NIP2+1,KK)-W(IJ+NIP2-1,KK))*HMAX)*DAY	ONEST277
370 CCNTINUE	ONEST278
P1 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST279
P2 = PRS(W(IJ+NIP2-1,1),W(IJ+NIP2-1,4))	ONEST280
PAB = (PSA-(P1-P2)*HMAX)*DAY	ONEST281
GO TO 560	ONEST282
380 DO 390 KK = 1,KMAX	ONEST283
WSAB(KK) = (WSH(KK)-(W(IJ+NIP2-1,KK)-W(IJ+NIP2-1,KK))*HMAX)*DAY	ONEST284
390 CCNTINUE	ONEST285
P1 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST286
P2 = PRS(W(IJ+NIP2-1,1),W(IJ+NIP2-1,4))	ONEST287
PAB = (PSB-(P1-P2)*HMAX)*DAY	ONEST288
GO TO 560	ONEST289
400 DO 410 KK = 1,KMAX	ONEST290
WSAB(KK) = ((W(IJ+NIP2+1,KK)-W(IJ+NIP2+1,KK))*HMAX-WSR(KK))*DAY	ONEST291
410 CCNTINUE	ONEST292
P1 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST293
P2 = PRS(W(IJ+NIP2-1,1),W(IJ+NIP2-1,4))	ONEST294
PAB = ((P1-P2)*HMAX-PSB)*DAY	ONEST295
GO TO 560	ONEST296
420 DK = -HMAX*DAY	ONEST297
DO 430 KK = 1,KMAX	ONEST298
430 WSAB(KK) = (W(IJ+NIP2+1,KK)-W(IJ+NIP2-1,KK)-2.0*HW(K	ONEST299
1K)-AX*AX*WSAA(KK)-AY*AY*WSBB(KK))*DK	ONEST300
P1 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST301
P2 = PRS(W(IJ+NIP2-1,1),W(IJ+NIP2-1,4))	ONEST302
PAB = (P1-P2-2.0*PP*AX*AX*PAA-AY*AY*PBB)*DK	ONEST303
GO TO 560	ONEST304
440 DK = HMAX*DAY	ONEST305
DO 450 KK = 1,KMAX	ONEST306
450 WSAB(KK) = (W(IJ+NIP2+1,KK)-W(IJ+NIP2-1,KK)-2.0*HW(K	ONEST307
1K)-AX*AX*WSAA(KK)-AY*AY*WSBB(KK))*DK	ONEST308
P1 = PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST309
P2 = PRS(W(IJ+NIP2-1,1),W(IJ+NIP2-1,4))	ONEST310
PAB = (P1-P2-2.0*PP*AX*AX*PAA-AY*AY*PBB)*DK	ONEST311
GO TO 560	ONEST312
460 DK = HMAX*DAY	ONEST313
DO 470 KK = 1,KMAX	ONEST314
470 WSAB(KK) = (W(IJ+NIP2+1,KK)-W(KK)-AX*(WSA(KK)+HAX*WSAA(KK))-	ONEST315
1AY*(WSB(KK)+HAY*WSBB(KK))*DK	ONEST316
PAB = (PRS(W(IJ+NIP2+1,1),W(IJ+NIP2+1,4))	ONEST317
1*PAA)-AY*(PSB+HAY*PBB))*DK	ONEST318
GO TO 560	ONEST319
480 DK = -HMAX*DAY	ONEST320
DO 490 KK = 1,KMAX	ONEST321
490 WSAB(KK) = (W(IJ+NIP2	ONEST322
1K))*AY*(WSB(KK)-HAY*WSBB(KK))*DK	ONEST323
PAB = (PRS(W(IJ+NIP2	ONEST324
1(PSA+HAX*PAA)+AY*(PSB-HAY*PBB))*DK	ONEST325
GO TO 560	ONEST326
500 DK = -HMAX*DAY	ONEST327
DO 510 KK = 1,KMAX	ONEST328
510 WSAB(KK) = (W(IJ+NIP2	ONEST329
1AY*(WSB(KK)+HAY*WSBB(KK))*DK	ONEST330

PAB = (PRS(W(IJ+NIP2	-1,1),W(IJ+NIP2	-1,4))-PP+AX*(PSA-HAX	ONEST331
1*PAA)-AY*(PSB-HAY*PRB))*DK			ONEST332
GC TO 560			ONEST333
520 DK = HDAY*DAX			ONEST334
DC 530 KK = 1,KMAX			ONEST335
530 WSAB(KK) = (W(IJ+NIP2	-1,KK)-WW(KK)+AX*(WSA(KK)+HAX+WSAA(KK	ONEST336	
1K))*AY*(WSB(KK)-HAY*WSBH(KK))*DK			ONEST337
PAB = (PRS(W(IJ+NIP2	-1,1),W(IJ+NIP2	-1,4))-PP+AX*	ONEST338
1(PSA-HAX*PAA)+AY*(PSB-HAY*PRB))*DK			ONEST339
GC TO 560			ONEST340
540 DC 550 KK = 1,KMAX			ONEST341
WSAB(KK) = (W(IJ+NIP2+1,KK)-W(IJ+NIP2-1,KK)-W(IJ+NIP2+1,KK)+W(IJ+NIP2-1,KK))*QDAXY			ONEST342
1IP2-1,KK))*QDAXY			ONEST343
550 CONTINUE			ONEST344
PAB = (PRS(W(IJ+NIP2	+1,1),W(IJ+NIP2	+1,4))-PRS(W(IJ+NIP2	ONEST345
1	-1,1),W(IJ+NIP2	-1,4))-PRS(W(IJ+NIP2	+1,1),W(IJ
2-NIP2	+1,4))*PRS(W(IJ+NIP2	-1,1),W(IJ+NIP2	-1,1),W(IJ+NIP2
3,4))*QDAXY			ONEST348
560 RR = WW(1)			ONEST349
UU = WW(2)			ONEST350
VV = WW(3)			ONEST351
EE = WW(4)			ONEST352
S11 = WW(5)			ONEST353
S12 = WW(6)			ONEST354
S22 = WW(7)			ONEST355
DR = 1, /RR			ONEST356
T11 = S11*PP			ONEST357
T22 = S22*PP			ONEST358
RSA = WSA(1)			ONEST359
USA = WSA(2)			ONEST360
VSA = WSA(3)			ONEST361
ESA = WSA(4)			ONEST362
S11A = WSA(5)			ONEST363
S12A = WSA(6)			ONEST364
S22A = WSA(7)			ONEST365
RSB = WSB(1)			ONEST366
USB = WSB(2)			ONEST367
VSB = WSB(3)			ONEST368
ESB = WSB(4)			ONEST369
S11B = WSB(5)			ONEST370
S12B = WSB(6)			ONEST371
S22B = WSB(7)			ONEST372
RAA = WSAA(1)			ONEST373
UAA = WSAA(2)			ONEST374
VAA = WSAA(3)			ONEST375
EAA = WSAA(4)			ONEST376
S11AA = WSAA(5)			ONEST377
S12AA = WSAA(6)			ONEST378
S22AA = WSAA(7)			ONEST379
RAB = WSAB(1)			ONEST380
UAB = WSAB(2)			ONEST381
VAB = WSAB(3)			ONEST382
EAB = WSAB(4)			ONEST383
S11AB = WSAB(5)			ONEST384
S12AB = WSAB(6)			ONEST385
S22AB = WSAB(7)			ONEST386

RRB = WSWR(1)
 URB = WSWB(2)
 VRB = WSWB(3)
 LRB = WSWB(4)
 S11RB = WSWB(5)
 S12RB = WSWB(6)
 S22RB = WSWB(7)
 T11A = S11A-PSA
 T22A = S22A-PSA
 T11B = S11B-PSB
 T22B = S22B-PSB
 T11AA = S11AA-PAA
 T22AA = S22AA-PAA
 T11AB = S11AB-PAB
 T22BB = S22BB-PBB
 B = ESY(JS+J)
 BB = YSE(JS+J)*DJ
 BSE = ESYE(JS+J)
 AP = ASY(JS+J)
 AYE = AYY(JS+J)
 MUPHS = MU+.5*(S11-S22)
 MUMHS = MU-.5*(S11-S22)
 UV = UU-AP*VV
 UVA = USA-AP*VSA
 IF (AXIS) GO TO 580
 ERMS = PP*S11*S22
 HSA = .5*(S11A-S22A)
 HSB = .5*(S11B-S22B)
 FAP12 = FRTDMU-AP*S12
 S12TWT = S12-TWTD MU*AP
 TW112 = TWTD MU-AP*S12
 S12FRT = S12-AP*FRTDMU
 UVB = USB-AP*VSB-AYE*VV
 UVAA = UAA-AP*VAA
 UVAB = UAB-AP*VAB-AYE*VSA
 VUA = VSA*AP*USA
 STUV = S12*USB+T22*VSR
 STU = T11-AP*S12
 STV = S12-AP*T22
 STUA = T11A-AP*S12A
 STVA = S12A-AP*T22A
 TS2PS1 = DJ*(2,.S22+S11)
 SIP = TWTD MU*DJ*VV
 SIPA = TWTD MU*DJ*VSA
 SIPB = TWTD MU*DJ*(VSB-BR*VV)
 RBD = HR*VSB+VV*RSB
 UBD = VV*USB-DR*S12R
 VBD = VV*VSB-DR*T22R
 EAD = STU*USA+STV*VSA
 EBD = VV*ESB-DR*STUV
 S11BD = VV*S11B-S12*USB+TWTD MU*VSB
 S22BD = VV*S22B-S12*USB-FRTDMU*VSB
 RT = -HR*UVA-UV*RSA-B*RBD-RR*VV*DJ
 UT = -UV*USA+DR*(STUA+DJ*S12)-B*UBD
 VT = -UV*VSA+DR*(STVA+TS2PS1)-B*VBD
 ET = -UV*ESA+DR*EAD-B*EBD-VV*DR*DJ*ERMS

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PT = RT*PR*ET*PE ONEST443
 S11T = -UV*S11A*FAP12*USA-S12TWT*VSA-B*S11RD-SIP ONEST444
 S12T = -UV*S12A*MUPHS*VSA-AP*MUMHS*USA-B*(VV*S12B*MUMHS*USB) ONEST445
 S22T = -UV*S22A-TWT12*USA-S12FRT*VSA-B*S22BD-SIP ONEST446
 UVI = UT-AP*VT ONEST447
 T11T = S11T-PT ONEST448
 T22T = S22T-PT ONEST449
 HSI = ,5*(S11T-S22T) ONEST450
 SIPT = TWTDMU*DJ*VT ONEST451
 RAI = -RR*UVA-2,*RSA*UVA-UV*RAA-B*(RR*VAB-RSA*VSR*VSA*RSR*VV*VAB) ONEST452
 1-DJ*(RH*VSA*VV*RSA) ONEST453
 UAI = -UVA*USA-UV*UAA*DR*(T11AA-AP*S12AA-RSA*DR*(STUA*S12*DJ)*DJ*SONEST454
 112A)=-B*(VSA*USB*VV*UAB-DR*(S12AB-DR*RSA*S12B)) ONEST455
 VAI = -UVA*VSA-UV*VAA*DR*(S12AA-AP*T22AA-DR*PSA*(STVA*TS2PS1)*DJ*(ONEST456
 12,*S22A*S11A))-B*(VSA*VSB*VV*VAB-DR*(S22AB-PAB-DR*RSA*T22P)) ONEST457
 EAI = -UVA*ESA-UV*EAA*DR*((T11A-AP*S12A)*USA*STU*UAA*(S12A-AP*T22AONEST458
 1)*VSA*STV*VAA-DR*RSA*EAD)-B*(VSA*ESR*VV*EAB-DR*(T22A*VSR*T22*VAP*SONEST459
 212A*USB*S12*UAB-DR*RSA*STUV))-DJ*DR*(ERHS*(VSA-DR*RSA*VV)*VV*(PSA*ONEST460
 3S11A*S22A)) ONEST461
 PAI = HAT*PR*RT*PRSA*EAT*PE*ET*PESA ONEST462
 S11AT = -UVA*S11A-UV*S11AA*FAP12*UAA-S12TWT*VAA-S12A*VUA-P*(VSA*S1ONEST463
 11B*VV*S11AB-S12A*USR-S12*UAR-TWTDMU*VAB)-SIPA ONEST464
 S12AT = -UVA*S12A-UV*S12AA*HSA*VSA*MUPHS*VAA-AP*(MUMHS*UAA-HSA*USAONEST465
 1)-B*(VSA*S12B*VV*S12AB*HSA*USB-MUMHS*UAB) ONEST466
 S22AT = -UVA*S22A-UV*S22AA-TWT12*UAA-S12FRT*VAA-S12A*VUA-P*(VSA*S2ONEST467
 12B*VV*S22AB-S12A*USR-S12*UAB-FRTDMU*VAB)-SIPA ONEST468
 UAT = UAT-AP*VAT ONEST469
 RBI = -RR*UVAB-RSR*UVA-UV*PSA-UV*RAE-B*(RR*VBB*2,*RSR*VSR*VV*RBB) ONEST470
 1-BSE*RBD-DJ*(RR*VSB*VV*RSB-RR*RR*VV) ONEST471
 UBI = -UVB*USA-UV*UAB*DR*(T11AB-AP*S12AB-AYE*S12A*DR*RSR*(STUA*DJ*ONEST472
 1S12)*DJ*(S12B*BB*S12))-R*(VSR*USB*VV*UBB-DR*(S12RR-DR*RSB*S12R))-RONEST473
 2SE*UBD ONEST474
 VEI = -UVB*VSA-UV*VAB*DR*(S12AB-AP*(S22AB-PAB)-AYE*T22A*DR*RSB*STVONEST475
 1A*UJ*(2,*S22B*S11B-(2,*S22*S11)*BB)-DR*RSR*TS2PS1)-R*(VSR*VSB*VV*VONEST476
 2BB-DR*(T22BB-DR*RSB*T22B))-RSE*VBD ONEST477
 EBI = -UVB*ESA-UV*EAB*DR*((T11B-AP*S12B*AYE*S12)*USA*STU*UAR*(S12BONEST478
 1-AP*T22B-AYE*T22)*VSA*STV*VAP-DR*RSB*EAD)-B*(VSB*ESB*VV*ERP-DR*(T2ONEST479
 22B*VSB*T22*VBB-S12B*USB*S12*UAB-DR*RSB*STUV))-BSE*EBD-DJ*DR*(VSB*EONEST480
 3RHS*VV*(PSB*S11B*S22B)-VV*ERHS*(DR*RSB*RP)) ONEST481
 PBT = HRT*PR*RT*PRSR*EBT*PE*ET*PESB ONEST482
 S11BT = -UVB*S11A-UV*S11AP*FAP12*UAR-S12TWT*VAB-S12B*VUA-AYE*(S12*ONEST483
 1USA-TWTDMU*VSA)-B*(VSR*S11B*VV*S11BB-S12P*USB-S12*UBR-TWTDMU*VBB)-ONEST484
 2BSE*S11BD-SIPB ONEST485
 S12BT = -UVB*S12A-UV*S12AB*HSA*VSA*MUPHS*VAB-AP*(MUMHS*UAB-HSA*USAONEST486
 1)-AYE*MUMHS*USA-B*(VSB*S12B*VV*12BB*HSA*USB-MUMHS*UBR)-BSE*(VV*S1ONEST487
 22B-MUMHS*USB) ONEST488
 S22BT = -UVB*S22A-UV*S22AB-TWT12*UAB-S12FRT*VAB-S12B*VUA-AYE*(S12*ONEST489
 1USA-FRTDMU*VSA)-B*(VSR*S22B*VV*S22BB-S12P*USB*S12*UBR-FRTDMU*VBB)-ONEST490
 2BSE*S22BD-SIPB ONEST491
 RTI = -UVA*RT-RR*UVAT-RSA*UVT-UV*RAT-B*(RR*VFT*RT*VSB*VV*RET*VT*RSONEST492
 1B)-DJ*(RR*VT*VV*RT) ONEST493
 UTI = -UVT*USA-UV*UAT*DR*(S11AT-PAT-AP*S12AT-RT*DR*(STUA*S12*DJ)*DONEST494
 1J*S12T)-B*(VT*USB*VV*UBT-DR*(S12BT-DR*RT*S12B)) ONEST495
 VTI = -VSA*UVT-UV*VAT*DR*(S12AT-AP*(S22AT-PAT)-DR*RT*(STVA*TS2PS1)ONEST496
 1*DJ*(2,*S22T*S11T))-B*(VT*VSB*VV*VBT-DR*(S22BT-PBT-DR*RT*T22B)) ONEST497
 ETI = -UVT*ESA-UV*EAT*DR*((T11T-AP*S12T)*USA*STU*UAT*(S12T-AP*T22TONEST498

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1)*VSA+STV+VAT-DR*RT+EAD)-R*(VT*ESB+VV*EBT-DR*(T22T+VSR+T22*VBT+S12ONEST499
2T*USB+S12*UBT-DR*RT*STUV))-DJ*DR*(VT*ERHS+VV*(PT+S11T+S22T))-DR*RT*ONEST500
3VV*ERHS) ONEST501
S11TT = -UVT+S11A+UV+S11T+T+FAP12*UAT-S12TWT+VAT-S12T+VUA-B*(VT+S11ONEST502
1B+VV+S11BT-S12T+USB-S12*UBT+TWTDMU+VBT)-S1PT ONEST503
S12TT = -UVT+S12A+UV+S12AT+HST+VSA+MUPHS+VAT-AP*(MUPHS+UAT+HST+USAONEST504
1)*B*(VT+S12B+VV+S12BT+HST+USB+MUMHS+UBT) ONEST505
S22TT = -UVT+S22A+UV+S22AT-TWT12*UAT-S12FRT+VAT-S12T+VUA-R*(VT+S22ONEST506
1B+VV+S22BT+S12T+USB-S12*UBT+FRTDMU+VBT)-S1PT ONEST507
DC 570 KK = 1,KMAX ONEST508
W(IJ-2,KK) = W(IJ,KK)+AK*(WT(KK)+HAK+WTT(KK)) ONEST509
570 CONTINUE ONEST510
GO TO 600 ONEST511
580 RT = -RR*USA-UU*RSA-2,*B*RR+VSB ONEST512
UT = -UU*USA+DR*(T11A+2,*B*S12B) ONEST513
VT = 0, ONEST514
EAD = UR*(T11*USA+2,*B*T22*VSR) ONEST515
ET = -UU*ESA+EAD ONEST516
PT = RT+PR+ET+PE ONEST517
S11T = -UU*S11A+FRTDMU*(USA-B+VSB) ONEST518
S12T = 0, ONEST519
S22T = -UU*S22A-TWTDMU*(USA-R+VSB) ONEST520
RAT = -RR*UAA-2,*RSA+USA-UU*PAA-2,*B*(RSA+VSB+RR+VAB) ONEST521
UAT = -USA+USA-UU*UAA+DR*(T11AA+DR+RSA+T11A+2,*B*(S12AB+DR+RSA+S12ONEST522
1B)) ONEST523
EAT = -USA+ESA-UU*EAA+DR*(T11A+USA+T11*UAA-RSA+EAD+2,*B*T22A+VSR+TONEST524
122*VAB) ONEST525
PAT = RAT+PR+RT+PRSA+EAT+PE+ET+PESA ONEST526
S11AT = -USA+S11A-UU+S11AA+FRTDMU*(UAA-B+VAB) ONEST527
S22AT = -USA+S22A-UU+S22AA-TWTDMU*(UAA-R+VAB) ONEST528
VBT = -UU+VAB+DR*(S12AB+AYE+T22A)+B*(VSB+VSB-DR*(T22BB+2,*S22BB+S1ONEST529
11BB)) ONEST530
S12BT = -UU+S12AB+MUPHS+VAB+AYE+MUMHS+USA-B*(VSB+S12B+MUMHS+URB) ONEST531
RTI = -RR*UAT-RT+USA-UT+RSA-UU*RAT-2,*B*(RT+VSB+RR+VBT) ONEST532
UTI = -UT+USA-UU*UAT+DR*(S11AT+PAT+2,*B*S12BT-DR*RT*(T11A+2,*B*S12ONEST533
1B)) ONEST534
VTI = 0, ONEST535
ETI = -UT+ESA-UU+EAT+DR*((S11T-PT)*USA+T11*UAT-RT+EAD+2,*B*(S22T-PONEST536
1T)*VSB+T22*VBT) ONEST537
S11TT = -UT+S11A+UU+S11AT+FRTDMU*(UAT-B+VPT) ONEST538
S12TT = 0, ONEST539
S22TT = -UT+S22A+UU+S22AT-TWTDMU*(UAT-B+VBT) ONEST540
DO 590 KK = 1,KMAX ONEST541
W(IJ-2,KK) = W(IJ,KK)+AK*(WT(KK)+HAK+WTT(KK)) ONEST542
590 CONTINUE ONEST543
600 Q = VIS*AK*SQRT((UVA+AX)**2+(B+VSB+AY)**2) ONEST544
DO 610 KK = 1,KMAX ONEST545
W(IJ-2,KK) = W(IJ-2,KK)+Q*(WSAA(KK)+AX**2+WSBB(KK)+AY**2) ONEST546
610 CONTINUE ONEST547
W(IJ-2,4) = AMAX1(W(IJ-2,4),C,0) ONEST548
YIELD = W(IJ-2,5)**2+W(IJ-2,7)**2+W(IJ-2,6)**2+W(IJ-2,5)+W(IJ-2,7) ONEST549
IF (YIELD.LT.YC) GO TO 650 ONEST550
IF (AXIS) GO TO 620 ONEST551
WDUT = (WW(5)+AP+WW(6))*USA+(WW(6)+AP+WW(7))*VSA+R*(WW(6)+USB+WW(7ONEST552
1)*VSB)-(WW(5)+WW(7))+WW(3)*DJ ONEST553
GO TO 630 ONEST554

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620 WDOT = WW(5)*(USA-B+VSB)                                ONEST555
630 WDOT=AMAX1(WDOT,0,0)                                     ONEST556
    ACUN = .5*WDOT*WU*AK/YC                                   ONEST557
    SSQ = (W(IJ-2,5)-ACON*W(IJ,5))*2+(W(IJ-2,7)-ACON*W(IJ,7))*2+(W(IJ-2,6)-ACON*W(IJ,6))*2+(W(IJ-2,5)-ACON*W(IJ,5))*2+(W(IJ-2,7)-ACON*W(IJ,7))
    ALPHA = SQRT(YC/SSQ)                                       ONEST561
    DO 640 KK = 5,7                                           ONEST562
        W(IJ-2,KK) = ALPHA*(W(IJ-2,KK)-ACON*W(IJ,KK))        ONEST563
640 CONTINUE                                                  ONEST564
650 RR = W(IJ-2,1)                                           ONEST565
    UU = W(IJ-2,2)                                           ONEST566
    VV = W(IJ-2,3)                                           ONEST567
    EE = W(IJ-2,4)                                           ONEST568
    PDER = .TRUE.                                           ONEST569
    PP = PRS(RR,EE)                                           ONEST570
    C2 = PR+PP*PE/RR**2                                       ONEST571
    IF (C2,LT,0.) GO TO 670                                   ONEST572
    C = SQRT(C2)                                              ONEST573
    UC = ABS(UU-ASY(JS+J)*VV)*EIGF(JS+J)*C                  ONEST574
    VC = (ABS(VV)+C)*ESY(JS+J)                               ONEST575
    SB = AMAX1(UC,VC)                                         ONEST576
    IF (SB,LE,SBM) GO TO 660                                  ONEST577
    SBM = SB                                                  ONEST578
    ISB = IM2                                                 ONEST579
    JSB = J                                                    ONEST580
660 CONTINUE                                                  ONEST581
    BS = AK*SB                                                ONEST582
    IF (BS,LT,.9) RETURN                                     ONEST583
    WRITE (6,700) IM2,J,AKT,IPOINT,BS,RR,UU,VV,DELX,DELY,ESY(JS+J),MATONEST584
    GO TO 680                                                  ONEST585
670 WRITE (6,710) IM2,J,RR,UU,VV,AKT,MAT                   ONEST586
680 L(IJ) = 2                                                 ONEST587
    DO 690 KK = 1,KMAX                                       ONEST588
        W(IJ-2,KK) = W(IJ,KK)                               ONEST589
690 CONTINUE                                                  ONEST590
    RETURN                                                    ONEST591
C                                                            ONEST592
700 FORMAT (11H AT POINT (I3,1H,I2,17H) IN ONESTP AT F9.5/8H IPOINT=ONEST593
1I2,3X5HSTAB=F7.4,3X4HHRMO=F7.4,3X2HU=F7.4,3X2HV=F7.4,3X5HDELA=F5.3,ONEST594
23X5HDELB=F5.3,3X8HB SUB R=F7.4,3X4HMAT=I2)                ONEST595
710 FORMAT (11H AT POINT (I2,1H,I2,33H) IMAGINARY SOUND SPEED IN ONESTONEST596
1P3X4HHRMO=F9.5,3X2HU=F9.5,3X2HV=F9.5,3X2HT=F9.5,3X4HMAT=I2) ONEST597
    END                                                       ONEST598

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SUBROUTINE BONDY	BONDY 2
COMMON// W(2200,7),L(2200)	INTVAL 2
COMMON/BNDGRS/ WBI(109,8,7),PBI(109,8),IND(109,9),	BNDGRS 2
1WRJ(78,8,7),PB(78,8),JND(78,9)	BNDGRS 3
COMMON /BNDVAL/ WB(600,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON/SCRTCH/ TWB(300,7),TFRX(300),TFRY(300)	SCRTCH 2
COMMON /ZONES/ NBEG(5,3),NEND(5,3),ARCSIZ(5,3),DISMAX(5,3),DISMIN(5,3)	ZONES 2
15,3)	ZONES 3
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,NDI	COMVAL 2
1S,TOP,DAL,KMAX,PORG,PSCL,LB,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,XO,PO,TO,XZ,A,B,ABL,DHATVAL	MATVAL 2
1ARL,CHAN,BMAX,FACT,ANG,AF,SBM,AL,AB,AK,HAL,HAS,HAK,GAL,G'J,GAQ,DAXMATVAL	MATVAL 3
2,DAY,HMAX,HDAY,DAX2,DAY2,HMAXY,ODAXY,DTR,HALFHJ,TWTDHU,FRTDMU,DOVMATVAL	MATVAL 4
3U,TREOTH,NJ,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSB,NIM1,NJM1,ND,ND1,NE,NE1MATVAL	MATVAL 5
4,NF,NIP2,NTR	MATVAL 6
COMMON /TRCPRT/ NTRS(5),ITR(5,25),TRS(5,25)	TRCPRT 2
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS 2
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC 2
EQUIVALENCE(YZ,TO)	OFAX 24
LOGICAL ERR	BONDY14
ETA(Y) = BMAX-ALOG((B+A*Y)/(B-A*Y))*ABL	BONDY15
ALP(X,Y) = FACT*(X*ANG*Y*TOP*ATAN(AF*Y))	BONDY16
DO 90 MAT = 1,NMAT	BONDY17
CALL GENVAL	BONDY19
N1 = IBS+2	BONDY20
N2 = IBS+NF	BONDY21
FRX(1BS+1) = ALP(FRX(1BS+1),FRY(1BS+1))*XZ	BONDY22
FRY(1BS+1)=ETA(FRY(1BS+1))*YZ	OFAX 25
DO 10 I = N1,N2	BONDY24
FRX(I) = ALP(FRX(I),FRY(I))*XZ	BONDY25
FRY(I)=ETA(FRY(I))*YZ	OFAX 26
10 FRS(I) = FRS(I-1)*SQRT((FRX(I)-FRX(I-1))*2+(FRY(I)-FRY(I-1))*2)	BONDY27
DO 60 I = 1,NF	BONDY28
II = FRX(1BS+1)*DAX+1.0	BONDY29
JJ = FRY(1BS+1)*DAY+2.0	BONDY30
DS = 1.0E10	BONDY31
KJ = 0	BONDY32
DO 20 J = 1,4	BONDY33
K = II*MOD(J,2)	BONDY34
M = JJ*J/3	BONDY35
IF(K,LT,1,OR,K,GT,N),OR,M,LT,2,OR,P,GT,NJ) GO TO 20	BONDRC11
MN = IJS*(M-1)*NIP2+K	BONDY36
IF (L(MN),EQ,0) GO TO 20	BONDY37
DD = (FRX(1BS+I)-FLOAT(K-1)*AX)**2+(FRY(1BS+I)-FLOAT(M-1)*AY)**2	BONDY38
IF (DD,GE,DS) GO TO 20	BONDY39
KJ = J	BONDY40
DS = DD	BONDY41
20 CONTINUE	BONDY42
IF(KJ,EQ,0) GO TO 60	NSMTHB 1
40 K = II*MOD(KJ,2)	BONDY47
M = JJ*KJ/3	BONDY48
MN = IJS*(M-1)*NIP2+K	BONDY49
DO 50 KK = 1,KMAX	BONDY50
50 WB(1BS+I,KK) = W(MN,KK)	NSMTHB 2
60 CONTINUE	BONDY52

90 CONTINUE
RETURN
END

BONDRY65
BONDRY66
BONDRY67

SUBROUTINE DENS8	DENS8 2
COMMON /ENDVAL/ NR(400,7),FRX(600),FRY(600),FRS(600)	ENDVAL 2
COMMON/SCRTCH/ TWR(300,7),TFRX(300),TFRY(300)	SCRTCH 2
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,X0,PO,TO,XZ,A,B,ABL,DMATVAL	MATVAL 2
1ABL,CHAN,BMAX,FACT,ANG,AF,SRH,AL,AB,AK,HAL,HAS,HAK,CAL,BAS,OAK,DAXMATVAL	3
2,CAY,HMAX,HDAY,DAX2,DAY2,HMAXY,QDAXY,DTR,HALFHU,TWTDHU,PRYDHU,DOVHMATVAL	4
3U,IREOTH,N1,NJ,NFMAX,IS,JS,IJR,IRS,ISB,JSB,NIM1,NJM1,ND,ND1,NE,NEIMATVAL	5
4,NF,NIP2,NTR	MATVAL 6
COMMON /ZONES/ NBEG(5,3),NEND(5,3),ARC312(5,3),DISMAX(5,3),DISMIN(ZONES	2
15,3)	ZONES 3
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RD	COMVAL 2
1S,IOP,DAL,KMAX,PORG,PSCL,LB,LF	COMVAL 3
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS 2
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC 2
EQUIVALENCE(YZ,TO)	OFAX 32
LOGICAL PDER	DENS8 11
LOGICAL ERR	DENS8 12
DATA MAXIT/10/	DENS8 11
RY)=A-B*(CHAN**((BMAX-Y*YZ)-1.0)/(CHAN**((BMAX-Y*YZ)+1.0)	OFAX 33
Z(X,Y) = X0*(X-XZ)+ANG*Y+TCP*ATAN(AF*Y)	DENS8 15
CALL INFACE	DENS8 16
NIN2=2*NINFC+1	DENS8 17
DC 10 MAT = 1,NMAT	DENS8 18
DC 10 I = 1,NIN2	DENS8 19
10 NONIN(I,MAT) = 0	DENS8 20
DC 70 K = 1,NINFC	DENS8 21
MAT1 = INFC(6*K-5)	DENS8 22
MAT2 = INFC(6*K-2)	DENS8 23
MAT = MAT1	DENS8 24
N1 = INFC(6*K-4)	DENS8 25
N2 = INFC(6*K-3)	DENS8 26
20 IJ = -1	DENS8 27
30 IJ = IJ+2	DENS8 28
IF (NONIN(IJ,MAT),NE,0) GO TO 30	DENS8 29
40 IF (IJ,EQ,1) GO TO 50	DENS8 30
IF (NONIN(IJ-1,MAT),LT,N1) GO TO 50	DENS8 31
NONIN(IJ,MAT) = NONIN(IJ-2,MAT)	DENS8 32
NONIN(IJ+1,MAT) = NONIN(IJ-1,MAT)	DENS8 33
IJ = IJ-2	DENS8 34
GO TO 40	DENS8 35
50 NONIN(IJ,MAT) = N1	DENS8 36
NONIN(IJ+1,MAT) = N2	DENS8 37
IF (MAT.EQ,MAT2) GO TO 60	DENS8 38
MAT = MAT2	DENS8 39
N1 = INFC(6*K)	DENS8 40
N2 = INFC(6*K-1)	DENS8 41
GO TO 20	DENS8 42
60 IRS = IMAT(7,MAT2)	DENS8 43
N1 = IRS*INFC(6*K)	DENS8 44
N2 = IRS*INFC(6*K-1)	DENS8 45
DC 70 J = N1,N2	DENS8 46
70 WB(J,1) = -WB(J,1)	DENS8 47
DO 220 MAT = 1,NMAT	DENS8 48
CALL GENVAL	DENS8 49
DO 80 J = 1,NF	DENS8 50

I = IBS+J	DENSR 51
TFHY(J) = R(FRY(I))	DENSB 52
80 TFRX(J) = Z(FRX(I),TFRY(J))	DENSB 53
IJ = 1	DENSB 54
N1 = 1	DENSB 55
N2 = NONIN(1,MAT)	DENSB 56
IF (N2,NE,0) GO TO 100	DENSB 57
N1 = IBS+1	DENSB 58
N2 = IBS+NF	DENSB 59
GO TO 110	DENSB 60
90 IJ = IJ+2	DENSB 61
N1 = NONIN(IJ-1,MAT)+1	DENSB 62
N2 = NONIN(IJ,MAT)	DENSB 63
IF (N2,NE,0) GO TO 100	DENSB 64
IF (N1,GT,NF) GO TO 190	DENSB 65
N1 = IBS+N1	DENSB 66
N2 = IBS+NF	DENSB 67
GO TO 110	DENSB 68
100 IF (N1,EQ,N2) GO TO 90	DENSB 69
N1 = IBS+N1	DENSB 70
N2 = IBS+N2-1	DENSB 71
110 DO 180 I = N1,N2	DENSR 72
J = I-IBS	DENSB 73
IF (J,NE,1.AND,J,NE,NF) GO TO 140	DENSB 74
IF (TFHY(J),GT,1.0E-4) GO TO 120	DENSB 75
CCSPSI = 0.0	DENSB 76
SINPSI = 1.0	DENSB 77
GO TO 160	DENSB 78
120 IF (J,EQ,NF) GO TO 130	DENSB 79
JP = 2	DENSB 80
JM = NF-1	DENSB C21
GO TO 150	DENSB 82
130 JP = 2	DENSB C22
JM = NF-1	DENSB 84
GO TO 150	DENSB 85
140 JP = J+1	DENSB 86
JM = J-1	DENSB 87
150 DZ = TFRX(JP)-TFRX(JM)	DENSB 88
DR = TFRY(JP)-TFRY(JM)	DENSB 89
CCSPSI = DZ/SQRT(DZ**2+DR**2)	DENSB 90
SINPSI = DR/SQRT(DZ**2+DR**2)	DENSB 91
160 CONTINUE	DENSB C12
PP = WB(I,5)*SINPSI**2+2.0*WB(I,6)*SINPSI*COSPSI+WB(I,7)*CCSPSI**2	DENSB 107
E = WB(I,4)	DENSB 108
PDER = .TRUE.	DENSB 109
DO 170 N = 1,MAXIT	DENSB 110
RHO = -WB(I,1)	DENSB 111
P = PRS(RHO,E)	DENSB 112
CORR = (P-PP)/PR	DENSB 113
WB(I,1) = WB(I,1)-CORR	DENSB 114
IF (ABS(CORR),LE,ABS(WB(I,1))*EPS1) GO TO 180	DENSB C13
170 CONTINUE	DENSB 116
ERR = .TRUE.	DENSB 117
WRITE (6,230) AKT,MAT,J,E,PP,WB(I,1),P,PR,CORR	DENSB 118
180 CONTINUE	DENSB 119
IF (NONIN(IJ,MAT),NE,0) GO TO 90	DENSB 120

```

190 DC 220 M = 1,3
    DMAX = 0,0
    DMIN = 1,0E6
    N1 = IWS*NBEG(MAT,M)+1
    N2 = IWS*NEED(MAT,M)
    WB(N1-1,1)=ABS(WB(N1-1,1))
    DC 210 I = N1,N2
    IF (WB(I,1),GE,0,0) GO TO 200
    WB(I,1) = -WB(I,1)
    GO TO 210
200 DIFDIS = FRS(I)-FRS(I-1)
    DMAX = AMAX1(DMAX,DIFDIS)
    DMIN = AMIN1(DMIN,DIFDIS)
210 CCNTINUE
    DISMAX(MAT,M) = DMAX
    DISMIN(MAT,M) = DMIN
    RETURN

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C 230 FOMAT (6H0AT T=F9,5,38H DENSITY DOES NOT CONVERGE ON MATERIAL12,
118H BOUNDARY AT POINT14/19H0E,PP,RHO,P,PR,CORR/6E20.7)
END

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DENS8121
DENS8122
DENS8123
DENS8124
DENS8125
DENS8126
DENS8127
DENS8128
DENS8129
DENS8130
DENS8131
DENS8132
DENS8133
DENS8134
DENS8135
DENS8136
DENS8137
DENS8138
DENS8139
DENS8140
DENS8141

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SUBROUTINE INFACE	INFACE 2
COMMON /BNDVAL/ WB(600,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON/SCHTCH/ TWR(300,7),TFRX(300),TFRY(300)	SCHTCH 2
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /ZONES/ NNEG(5,3),NEND(5,3),ARCSIZ(5,3),DISMAX(5,3),DISMIN(5,3)	ZONES 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDI	ZONES 3
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDI	COMVAL 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDI	COMVAL 3
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS 2
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC 2
LOGICAL PDER,ERR	INFAC1 1
DATA MAXIT/10/	INFAC1 2
Z(X,Y) = FMAT(9,MAT)*(X-FMAT(12,MAT))+FMAT(20,MAT)*Y*TOP*ATAN(FMAT	INFACE11
Z(21,MAT)*Y)	INFACE12
CH(Y)=FMAT(17,MAT)*+(FMAT(18,MAT)-Y*FMAT(11,MAT))	OFAX 34
R(Y) = FMAT(13,MAT)-FMAT(14,MAT)*(CH(Y)-1.0)/(CH(Y)+1.0)	INFACE14
PDER=,TRUE.	INFAC1 3
DO 60 K = 1,NINFC	INFACE16
MAT1 = INFC(6*K-5)	INFACE17
MAT2 = INFC(6*K-2)	INFACE18
RH01 = FMAT(8,MAT1)	INFACE19
RH02 = FMAT(8,MAT2)	INFACE20
RH12 = RH01+RH02	INFACE21
IBS = IMAT(7,MAT1)	INFACE22
N1 = IBS*INFC(6*K-4)	INFACE23
N2 = IBS*INFC(6*K-3)	INFACE24
NF = NEND(MAT1,3)	INFACE25
MAT = MAT1	INFACE26
J = IMAT(7,MAT2)+INFC(6*K-1)+1	INFACE27
DO 60 I = N1,N2	INFACE28
J = J-1	INFACE29
IJ = I-IBS	INFACE30
IF (IJ,NE,1,AND,IJ,NE,NF) GO TO 30	INFACE31
IF (FRY(I),GT,1.0E-4) GO TO 10	INFACE32
COSPSI = 0.0	INFACE33
SINPSI = 1.0	INFACE34
GO TO 50	INFACE35
10 IF (IJ,EQ,NF) GO TO 20	INFACE36
IP = IBS+2	INFACE37
IP=IBS+NF-1	INFAC2 1
GO TO 40	INFACE39
20 IP=IBS+2	INFAC2 2
IP = IBS+NF-1	INFACE41
GO TO 40	INFACE42
30 IP = I+1	INFACE43
IP = I-1	INFACE44
40 RP = R(FRY(IP))	INFACE45
RP = R(FRY(IM))	INFACE46
DR = RP-RM	INFACE47
DZ = Z(FRX(IP),RP)-Z(FRX(IM),RM)	INFACE48
COSPSI = DZ/SQRT(DZ**2+DR**2)	INFACE49
SINPSI = DR/SQRT(DZ**2+DR**2)	INFACE50
50 MATNO = IMAT(10,MAT1)	INFACE51
RH0 = WB(I,1)	INFACE52
E = WB(I,4)	INFACE53
P1 = PRS(RH0,E)	INFACE54

MAINQ = [MAT(10,MAT2)	INFAC55
RHO = WB(J,1)	INFAC56
E = WB(J,4)	INFAC57
P2 = PRS(RHO,E)	INFAC58
SINSQ = SINPSI**2	INFAC59
COSSQ = COSPSI**2	INFAC60
SINCOS = SINPSI*COSPSI	INFAC61
TNN1 = (WB(I,5)-P1)*SINSQ+2.0*WB(I,6)*SINCOS+(WB(I,7)-P1)*COSSQ	INFAC62
TNN2 = (WB(J,5)-P2)*SINSQ+2.0*WB(J,6)*SINCOS+(WB(J,7)-P2)*COSSQ	INFAC63
UN1 = WB(I,2)*SINPSI+WB(I,3)*COSPSI	INFAC66
UN2 = WB(J,2)*SINPSI+WB(J,3)*COSPSI	INFAC67
UT1 = WB(I,3)*SINPSI-WB(I,2)*COSPSI	INFAC68
UT2 = WB(J,3)*SINPSI-WB(J,2)*COSPSI	INFAC69
TNN = RH12*(WB(J,1)*TNN1+WB(I,1)*TNN2)/(RH01*WB(I,1)+RH02*WB(J,1))	INFAC70
TNN1 = TNN/RH01	INFAC71
TNN2 = TNN/RH02	INFAC72
CON1 = RH01*WB(I,1)	INFAC75
CON2 = RH02*WB(J,1)	INFAC76
UN = (CON1*UN1+CON2*UN2)/(CON1+CON2)	INFAC77
WB(I,2) = UN*SINPSI-UT1*COSPSI	INFAC84
WB(J,2) = UN*SINPSI-UT2*COSPSI	INFAC85
WB(I,3) = UN*COSPSI+UT1*SINPSI	INFAC86
WB(J,3) = UN*COSPSI+UT2*SINPSI	INFAC87
TNN=TNN1	INFAC1 4
MAI=MAT1	INFAC1 5
M=1	INFAC1 6
52 MAINQ=[MAT(10,MAT)	INFAC1 7
IF(MATNO,GT,100) GO TO 56	INFAC1 8
E=WB(M,4)	INFAC1 9
PP=WB(M,5)*SINSQ+2.0*WB(M,6)*SINCOS+WB(M,7)*COSSQ*TNN	INFAC110
DC 54 N=1,MAXIT	INFAC111
RHO=WB(M,1)	INFAC112
P=PRS(RHO,E)	INFAC113
CORR=(P-PP)/P	INFAC114
WB(M,1)=WB(M,1)-CORR	INFAC115
IF(ABS(CORR).LE,ABS(WB(M,1))*EPS1) GO TO 56	INFAC116
54 CONTINUE	INFAC117
ERR=.TRUE.	INFAC118
MM=M-1MAT(7,MAT)	INFAC3 1
WRITE(6,100) AKT,MAT,MM,E,PP,WB(M,1),P,PR,CORR	INFAC3 2
56 IF(MAT,EQ,MAT2) GO TO 60	INFAC121
TNN=TNN2	INFAC122
MAI=MAT2	INFAC123
M=J	INFAC124
GO TO 52	INFAC125
60 CONTINUE	INFAC88
RETURN	INFAC89
100 FORMAT (6H0AT T=F9.5,38H DENSITY DOES NOT CONVERGE ON MATERIAL12,	INFAC126
118H BOUNDARY AT POINT14/19H0E,PP,RHO,P,PR,CORR/6E20.7)	INFAC127
END	INFAC90

SLHRoutine FINISH	FINISH 2
COMMON/ W(2200,7),L(2270)	INTVAL 2
COMMON/BNDGRS/ WBI(109,8,7),PRI(109,8),IND(109,9),	BNDGRS 2
1WBJ(78,8,7),PRJ(78,8),JND(78,9)	BNDGRS 3
COMMON /BNDVAL/ WR(600,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON /ZONES/ NBEG(5,3),NEND(5,3),ARCSIZ(5,3),DISMAX(5,3),DISMIN(ZONES)	ZONES 2
15,J)	ZONES 3
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /TRCPRT/ NTRS(5),ITR(5,25),TRS(5,25)	TRCPRT 2
COMMON /COMVAL/ KT,AKT,DT,DTIN,ITER,NEIPR,IPOINT,ERR,EPS,EPS1,RDICO	COMVAL 2
15,10P,DAL,KMAX,PORG,PSCL,LR,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,HU,YC,RHO,XO,PO,TO,XZ,A,R,ABL,DMATVAL	MATVAL 2
1ARL,CHAN,DMAX,FACT,ANG,AF,SBH,AL,AS,AK,HAL,HAS,HAK,CAL,QAS,QAK,DAXMATVAL	MATVAL 3
2,DAY,HUAX,HDAY,DAX2,DAY2,HDAXY,ODAXY,DTR,HALFHU,TWTFHU,FRTHU,DOVMMATVAL	MATVAL 4
3U,IROT,M,NJ,NJ,NFMAX,IS,JS,IJS,IBS,ISR,JSR,NIM1,NJM1,ND,ND1,NE,NE1MATVAL	MATVAL 5
4,N,NIP2,NTR	MATVAL 6
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC 2
LOGICAL ERR	FINISH12
ZBMAX = AX*FLOAT(NIM1)	FINISH13
REMAX = AY*FLOAT(NJ-2)	FINISH14
ZMN = 1.0E6	FINISH15
ZMX = -ZMN	FINISH16
RMX = ZMX	FINISH17
RMN=ZMN	OFAX 35
DO 10 I = 1,NF	FINISH18
ZMY = AMIN1(ZMN,FRX(IRS+1))	FINISH19
ZMX = AMAX1(ZMX,FRX(IRS+1))	FINISH20
RMN=AMIN1(RMN,FRY(IRS+1))	OFAX 36
10 RMX = AMAX1(RMX,FRY(IRS+1))	FINISH21
IF(RMX,GE,RRMAX,OR,RMN,LT,-1.0E-4) GO TO 60	OFAX 37
IF(ZMN,LE,0.0) GO TO 15	FINISH23
IF(ZMX,LT,ZBMAX) GO TO 70	FINISH24
ISH=INT(ZMN*DAX)	FINISH25
K=U	FINISH26
INC=1	FINISH27
GO TO 18	FINISH28
15 ISH=INT((ZMX-ZBMAX)*DAX)	FINISH29
K=N1+1	FINISH30
INC=1	FINISH31
18 ISH=ISH/2	FINISC21
JSH=ABS(ISH)	FINISC22
IF(JSH,LE,2) GO TO 60	FINISH33
ZDF = FLOAT(ISH)*AX	FINISH34
XZ=XZ-ZDF	FINISC23
FMAT(12,MAT) = XZ	FINISH36
DO 20 I = 1,NF	FINISH37
20 FRX(IRS+1)=FRX(IRS+1)-ZDF	FINISC24
ISP=JSH+1	FINISH39
DO 40 M = ISP,N1	FINISH40
K=K+INC	FINISH41
I=K+ISH	FINISH42
DO 30 J = 1,NJ	FINISH43
JJ = IJS-(J-1)*NIP2	FINISH44
L(JJ+K) = L(JJ+1)	FINISH45
DO 30 KK = 1,KMAX	FINISH46
30 W(JJ+K,KK) = W(JJ+1,KK)	FINISH46

DC 40 J = 1,9	FINISH48
40 IND(1S+K,J) = IND(1S+I,J)	FINISH49
DC 50 I=1,JSH	FINISH50
K=K+INC	FINISH51
DC 50 J = 1,NJ	FINISH52
JJ = IJS+(J-1)*NIP2	FINISH53
50 L(JJ+K)=0	FINISH54
WRITE (6,170) MAT,ISH	FINISH55
GO TO 70	FINISH56
60 ERK = ,TRUE,	FINISH57
WRITE (6,180) MAT	FINISH58
WRITE (6,200) ZBMAX,RRMAX,(FRX(1BS+I),FRY(1BS+I)),I = 1,NF)	FINISH59
70 DC 150 M = 1,3	FINISH60
LF = NEND(MAT,M)	FINISH61
LB = NBEG(MAT,M)	FINISH62
DELS = FRX(1BS+LF)-FRX(1BS+LB)	FINISH63
IF (2,0*ARCSIZ(MAT,M).GT,DELS) GO TO 130	FINISH64
LADD = (LF-LB)/2	FINISH65
IF (NF+LADD,GT,NFMAX) GO TO 130	FINISH66
LM = NF-LF	FINISH67
IF (LM,EQ,0) GO TO 110	FINISH68
DO 80 I = 1,NTR	FINISH69
IF (1TR(MAT,I),LT,LF) GO TO 80	FINISH70
1TR(MAT,I) = 1TR(MAT,I)+LADD	FINISH71
80 CONTINUE	FINISH72
NIN2 = 2*NINFC	FINISH73
DC 90 I = 1,NIN2	FINISH74
IF (INFC(3*I-2),NE,MAT) GO TO 90	FINISH75
IF (INFC(3*I-1),GE,IF) INFC(3*I-1) = INFC(3*I-1)+LADD	FINISH76
IF (INFC(3*I),GE,LF) INFC(3*I) = INFC(3*I)+LADD	FINISH77
90 CONTINUE	FINISH78
NF1 = NF+1	FINISH79
DC 100 LL = 1,LM	FINISH80
L1 = NF1-LL	FINISH81
L2 = L1+LADD	FINISH82
FRX(1BS+L2) = FRX(1BS+L1)	FINISH83
FRY(1BS+L2) = FRY(1BS+L1)	FINISH84
DC 100 KK = 1,KMAX	FINISH85
WR(1BS+L2,KK) = WR(1BS+L1,KK)	FINISH86
100 CONTINUE	FINISH87
110 DO 120 L1 = M,3	FINISH88
IF (L1,EQ,1) GO TO 120	FINISH89
NBEG(MAT,L1) = NEND(MAT,L1-1)	FINISH90
120 NEND(MAT,L1) = NEND(MAT,L1)+LADD	FINISH91
NF = NF+LADD	FINISH92
NE = NEND(MAT,2)	FINISH93
NE1 = NE+1	FINISH94
ND = NEND(MAT,1)	FINISH95
ND1 = ND+1	FINISH96
WRITE (6,190) MAT,M,DELS,ARCSIZ(MAT,M),AKT	FINISH97
ARCSIZ(MAT,M) = DELS	FINISH98
GO TO 140	FINISH99
130 DELS = DELS/FLOAT(LF-LB)	FINIS100
IF (DISHIN(MAT,M),GE,(1,0-DAL)*DELS,AND,DISHAX(MAT,M),LE,(1,0+DAL)*DELS) GO TO 150	FINIS101
140 WRITE (6,160) MAT,M,DELS,DISHIN(MAT,M),DISHAX(MAT,M),AKT	FINIS102
	FINIS103

140	CALL RELABL (M)	FINIS104
150	CONTINUE	FINIS105
	RETURN	FINIS106
		FINIS107
C		
160	FORMAT (18H REZONING MATERIAL12,8H SLRFACF12,6X5HDELG=F10,7,6X7HDI	FINIS108
	1SPIN=F10,7,6X7HDI\$MAX=F10,7,6X2HT=F9,5)	FINIS109
170	FORMAT (9H0MATERIAL12,30H BOUNDARY EXCEEDS DOMAIN SHIFT15)	FINIS110
180	FORMAT (9H0MATERIAL12,36H BOUNDARY EXCEEDS DOMAIN=RUN ABORTED)	FINIS111
190	FORMAT (26H ADDING POINTS TO MATERIAL12,5H SIDE12,6X8HARCSIZE=F12,	FINIS112
	15,6X12HOLD ARCSIZE=F12,5,6X2HT=F9,5)	FINIS113
200	FORMAT (24H0(ZMAX,RMAX)/(Z(1),R(1))/F11,3,F9,3/(6(F11,3,F9,3)))	FINIS114
	END	FINIS115

SUBROUTINE RELABL (M)	RELABL 2
COMMON /BNDVAL/ MB(400,7),FRX(600),FFY(600),FPS(600)	BNDVAL 2
COMMON /ZONFS/ NBEG(5,3),NEND(5,3),AFCSIZ(5,3),DISMAX(5,3),DISMIN(5,3)	ZONFS 2
COMMON /MATARR/ VMAT,INAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /SCRTCH/ TWR(300,7),TFRX(300),TFRY(300)	SCRTCH 2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIRR,IPOINT,ERR,EPS,EPS1,RDICO	COMVAL 2
1S,1OP,DAL,KMAX,PORG,PSCL,LR,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,XO,PO,TO,XZ,A,P,ABL,DMATVAL	MATVAL 2
1ARL,CHAN,BMAX,FACT,ANG,AF,SRH,AL,AS,AK,HAL,HAS,HAK,CAL,DAS,DAF,DAXMATVAL	MATVAL 3
2,DAY,HMAX,HDAY,DAX2,DAXY,HDAXY,ODAXY,DTP,HALFHU,TWTHU,FPTHU,OOVHMATVAL	MATVAL 4
3U,IREOTM,NI,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSP,NIH1,NJH1,ND,ND1,NF,NEIMATVAL	MATVAL 5
4,NI,NIP2,NTR	MATVAL 6
COMMON /THCPRT/ NTRS(5),ITR(5,25),TRS(5,25)	THCPRT 2
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC 2
DATA EPS/1.E-5/	RELABL11
10 MF = NEND(MAT,M)	RELABL12
NB = NBEG(MAT,M)	RELABL13
LB IS THE BEGINNING OF THE OLD SET	RELABL14
NB IS THE BEGINNING OF THE NEW SET	RELABL15
LF IS THE END OF THE OLD SET	RELABL16
MF IS THE END OF THE NEW SET	RELABL17
	RELABL18
NB1 = NB+1	RELABL19
NFM1 = MF-1	RELABL20
DELS = (FRS(IRS+LF)-FRS(IRS+LR))/FLOAT(MF-NB)	RELABL21
S = FRS(IRS+LR)	RELABL22
K = LB+1	RELABL23
DO 20 J = 1,NTR	RELABL24
IF (ITR(MAT,J),GE,LR) GO TO 40	RELABL25
20 CONTINUE	RELABL26
30 STR = 1.0E10	RELABL27
IJ = LF+1	RELABL28
GO TO 50	RELABL29
40 IJ = ITR(MAT,J)	RELABL30
IF (IJ,GE,LF) GO TO 30	RELABL31
STR = FRS(IRS+IJ)+TRS(MAT,J)*(FRS(IRS+IJ+1)-FRS(IRS+IJ))	RELABL32
50 CONTINUE	RELABL33
DO 110 I = NB1,NFM1	RELABL34
S = S+DELS	RELABL35
60 IF (FRS(IRS+K),GE,S) GO TO 70	RELABL36
K = K+1	RELABL37
GO TO 60	RELABL38
70 A0 = (S-FRS(IRS+K))/(FRS(IRS+K-1)-FRS(IRS+K))	RELABL39
A1 = 1.0-A0	RELABL40
TFRX(I) = A0*FRX(IRS+K-1)+A1*FRX(IRS+K)	RELABL41
TFRY(I) = A0*FRY(IRS+K-1)+A1*FRY(IRS+K)	RELABL42
DO 80 KK = 1,KMAX	RELABL43
TWB(I,KK) = A0*WB(IRS+K-1,KK)+A1*WB(IRS+K,KK)	RELABL44
90 IF (STR,GT,S) GO TO 110	RELABL45
ITR(MAT,J) = I-1	RELABL46
TRS(MAT,J) = (STR-S+DELS)/DELS	RELABL47
J = J+1	RELABL48
IF (J,GT,NTR) GO TO 100	RELABL49
IJ = ITR(MAT,J)	RELABL50
IF (IJ,GE,LF) GO TO 100	RELABL51

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      STR = FRS(IRS+IJ)+TRS(MAT,J)*(FRS(IRS+IJ+1)-FRS(IRS+IJ))
      GC TO 90
100  STR = 1.0E10
      IJ = LF+1
110  CONTINUE
      IF (IJ,GE,LF) GO TO 130
      DC 120 I = J,NTR
      IJ = ITR(MAT,I)
      IF (IJ,GE,LF) GO TO 130
      STR = FRS(IRS+IJ)+TRS(MAT,I)*(FRS(IRS+IJ+1)-FRS(IRS+IJ))
      ITR(MAT,I) = NFM1
120  TRS(MAT,I) = (STR-S)/DELS
130  CONTINUE
      TFRX(NB) = FRX(IRS+LB)
      TFRY(NB) = FRY(IRS+LB)
      TFRX(MF) = FRX(IRS+LF)
      TFRY(MF) = FRY(IRS+LF)
      DC 140 KK = 1,KMAX
      TWB(NB,KK) = WB(IRS+LB,KK)
140  TWB(MF,KK) = WB(IRS+LF,KK)
C
C      WE HAVE JUST FOUND FU AND FV
C
      DC 150 I = NB,MF
      FRX(IRS+I) = TFRX(I)
      FRY(IRS+I) = TFRY(I)
      DC 150 KK = 1,KMAX
150  WB(IRS+I,KK) = TWB(I,KK)
      TFRX(1) = 0.0
      DC 160 I = 2,NF
      TFRX(I) = FRS(IRS+I)
160  FRS(IRS+I) = FRS(IRS+I-1)+SQRT((FRY(IRS+I)-FRY(IRS+I-1))**2+(FRY(
1IRS+I)-FRX(IRS+I-1))**2)
      NIN2 = 2*NINFC
      N1 = IRS+NB1
      N2 = IRS+NF
      DC 220 I = 1,NIN2
      IF (INFC(3*I-2),NF,MAT) GO TO 220
      IJ = MOD(I,2)
      K1 = 3*I-IJ
      I1 = INFC(K1)
      K2 = 3*I-1-IJ
      I2 = INFC(K2)
      IF (I1,LE,LR.OP,I1,GT,LF) GO TO 190
      S = TFRX(I1)
      DC 170 J = N1,N2
      IF (S,LE,FRS(J)) GO TO 180
170  CONTINUE
      J = N2
180  INFC(K1) = J-IRS
190  IF (I2,LE,LR.OP,I2,GT,LF) GO TO 220
      S = TFRX(I2)
      DC 200 J = N1,N2
      IF (S,LT,FRS(J)) GO TO 210
200  CONTINUE
      J = N2+1

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RELABL52
RFLABL53
RELABL54
RFLABL55
RELABL56
RELABL57
RELABL58
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RELABL99
RFLAB100
RELAB101
RFLAB102
RFLAB103
RFLAB104
RFLAB105
RFLAB106
RELAB107

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210 INFC(K2) = J-1-13S
220 CONTINUE
RETURN
END

RELAP108
RELAP109
RELAP110
RELAP111

SUBROUTINE RPOSN	BPOSN 2
COMMON/BNDCKR/ WBI(109,8,7),PRI(109,8),IND(109,9);	BNDCKR 2
1WBJ(78,8,7),PRJ(78,8),JND(78,9)	BNDCKR 3
COMMON /BNDVAL/ WH(400,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON /MATARR/ NHAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /COMVAL/ KT,AKT,DT,DTMIN,ITER,NEIPR,IPOINT,ERP,EPS,EPS1,FDICOMVAL	COMVAL 2
1S,IOP,DAL,KMAX,PORG,PSCL,LB,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,PHO,XO,PO,TO,XZ,A,B,ABL,DMATVAL	MATVAL 2
1ABL,CHAN,BMAX,FACT,ANG,AF,SRI,AL,AS,AK,HAL,HAS,HAK,CAL,GAS,DAK,DAXMATVAL	MATVAL 3
2,DAY,HUAX,HDAY,DAX2,DAY2,HDAXY,QDAXY,DTR,HALFHU,TWTCMU,FRTCMU,QQVMMATVAL	MATVAL 4
3U,IROOTM,NI,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSR,NIM1,NJM1,ND,ND1,NE,NE1MATVAL	MATVAL 5
4,AF,NIP2,NTR	MATVAL 6
LOGICAL ERR	BPOSN 7
DATA IH,JH,MXSI,MXSJ/2HI=,2HJ=,8,8/	BPOSN 8
DC 10 I = 1,NI	BPOSN 10
10 IND(IS+I,1) = 0	BPOSN 11
DC 20 J=1,NJ	BPOSN 12
20 JND(JS+J,1) = 0	BPOSN 13
IA = FRX(IRS+1)*DAX	BPOSN 14
JA = FRY(IRS+1)*DAY	BPOSN 15
IF(ABS(FRY(IRS+1)),LE.1,0F-4) JA=-1	BPOSN 16
DC 170 L = 2,NF	BPOSN 17
IE = FRX(IRS+L)*DAX	BPOSN 18
JE = FRY(IRS+L)*DAY	BPOSN 19
IF(ABS(FRY(IRS+L)),GT.1,0F-4) GO TO 30	BPOSN 20
IA=IB	BPOSN 21
JB=-1	BPOSN 22
30 IC = IB-JA	BPOSN 23
IF (IC) 40,100,50	BPOSN 24
40 IP = IA+1	BPOSN 25
IA = IA-1	BPOSN 26
GO TO 60	BPOSN 27
50 IA = IA+1	BPOSN 28
IP = IA+	BPOSN 29
60 K = IND(IS+IP,1)+1	BPOSN 30
IF (K,GT,MXSJ) GO TO 90	BPOSN 31
IND(IS+IP,1) = K	BPOSN 32
70 IF (K,EG,1) GO TO 80	BPOSN 33
LA = IND(IS+IP,K)	BPOSN 34
IF (FRY(IRS+LA),LE,FRY(IRS+L-1)) GO TO 80	BPOSN 35
IND(IS+IP,K+1) = IND(IS+IP,K)	BPOSN 36
K = K+1	BPOSN 37
GO TO 70	BPOSN 38
80 IND(IS+IP,K+1) = L-1	BPOSN 39
GO TO 30	BPOSN 40
90 WRITE (6,180) IH,IP,MAT,MXSI,AKT	BPOSN 41
ERR = ,TRUE,	BPOSN 42
100 JC = JB-JA	BPOSN 43
IF (JC) 110,170,120	BPOSN 44
110 JP = JA+2	BPOSN 45
JA = JA-1	BPOSN 46
GO TO 130	BPOSN 47
120 JA = JA+1	BPOSN 48
JP = JA+2	BPOSN 49
130 K = JND(JS+JP,1)+1	BPOSN 50
IF (K,GT,MXSJ) GO TO 160	BPOSN 51

JND(JS+JP,1) = K	BPUSN 52
140 IF (K,EQ,1) GO TO 150	BPOST 53
LA = JND(JS+JP,K)	BPUSN 54
IF (FRX(1BS+LA),LE,FRX(1BS+L-1)) GO TO 150	BPUSN 55
JND(JS+JP,K+1) = JND(JS+JP,K)	BPOST 56
K = K+1	BPOST 57
GO TO 140	BPUSN 58
150 JND(JS+JP,K+1) = L-1	BPOST 59
GO TO 100	BPUSN 60
160 WRITE (6,180) JH,JP,MAT,MXSJ,AKT	BPUSN 61
ERR = .TRUE.	BPUSN 62
170 CONTINUE	BPOST 63
RETURN	BPUSN 64
	BPOST 65
C 180 FORMAT (4H0AT A2,12,9H MATERIAL,12,27H BOUNDARY CROSSED MORE THAN	BPUSN 66
12,6H TIMES3X2HT=F0,5)	BPUSN 67
END	BPOST 68

SUBROUTINE BVALU	BVALU 2
COMMON/BNDCRS/ WBI(109,8,7),PRI(109,8),IND(109,9);	BNDCRS 3
1WRJ(78,8,7),PRJ(78,8),JND(78,9)	BNDCRS 5
COMMON /BNDVAL/ WB(400,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON /COMVAL/ KT,AKT,DT,DTMIN,ITER,NEIBR,IPOINT,ERR,EPS,FPS1,PDICOMVAL	COMVAL 2
1S,IOP,DAL,KMAX,PORG,PSCL,LB,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,X0,P0,T0,XZ,A,B,ABL,DHATVAL	MATVAL 2
1ABL,CHAN,BMAX,FACT,ANG,AF,SRH,AL,AS,AK,HAL,HAS,HAK,CAL,QAS,QAK,DAXMATVAL	MATVAL 3
2,DAY,HDX,HDAY,DAX2,DAXY,ODAXY,DTR,HALFNU,TWTCMU,FRTCMU,ONVMATVAL	MATVAL 4
3U,IROOT,N1,NJ,NFMAX,IS,JS,IJS,IRS,ISB,JSB,NJM1,NJM1,ND,ND1,NE,NE1MATVAL	MATVAL 5
4,NF,NIP2,NTR	MATVAL 6
DC 20 I = 1,NI	BVALU 7
N = IND(IS+1,1)	BVALU 8
IF (N,EQ,0) GO TO 20	BVALU 9
X = FLOAT(I-1)*AX	BVALU 10
DC 10 K = 1,N	BVALU 11
L = IND(IS+1,K+1)	BVALU 12
PBI(IS+1,K) = FRY(IRS+L)+(X-FRX(IRS+L))*(FRY(IRS+L+1)-FRY(IRS+L))/	BVALU 13
1(FRX(IRS+L+1)-FRX(IRS+L))	BVALU 14
S = SQRT((X-FRX(IRS+L))*2+(PBI(IS+1,K)-FRY(IRS+L))*2)+FRS(IRS+L)	BVALU 15
A0 = (S-FRS(IRS+L+1))/(FRS(IRS+L)-FRS(IRS+L+1))	BVALU 16
A1 = 1.0-A0	BVALU 17
DC 10 KK = 1,KMAX	BVALU 18
WBI(IS+1,K,KK) = A0*WB(IRS+L,KK)+A1*WB(IRS+L+1,KK)	BVALU 19
10 CONTINUE	BVALU 20
20 CONTINUE	BVALU 21
DC 50 J=2,NJ	BVALU 22
N = JND(JS+J,1)	BVALU 23
IF (N,EQ,0) GO TO 50	BVALU 24
Y = FLOAT(J-2)*AY	BVALU 25
DC 40 K = 1,N	BVALU 26
L = JND(JS+J,K+1)	BVALU 27
PBJ(JS+J,K) = FRX(IRS+L)+(Y-FRY(IRS+L))*(FRX(IRS+L+1)-FRX(IRS+L))/	BVALU 28
1(FRY(IRS+L+1)-FRY(IRS+L))	BVALU 29
S = SQRT((PBJ(JS+J,K)-FRX(IRS+L))*2+(Y-FRY(IRS+L))*2)+FRS(IRS+L)	BVALU 30
A0 = (S-FRS(IRS+L+1))/(FRS(IRS+L)-FRS(IRS+L+1))	BVALU 31
A1 = 1.0-A0	BVALU 32
DC 40 KK = 1,KMAX	BVALU 33
WBJ(JS+J,K,KK) = A0*WB(IRS+L,KK)+A1*WB(IRS+L+1,KK)	BVALU 34
40 CONTINUE	BVALU 35
50 CONTINUE	BVALU 36
RETURN	BVALU 37
END	BVALU 38

SUBROUTINE INTRPL	INTRPL 2
COMMON// W(2200,7),L(2200)	INTVAL 2
COMMON/RNDCRS/ WBI(109,8,7),PBI(109,8),IND(109,9),	BNDCHS 2
1WBJ(78,8,7),PBj(78,8),JND(78,9)	BNDCHS 3
COMMON /COMVAL/ KT,AKT,DT,DTMIN,ITER,NEIPR,IPOINT,EFR,EPS,EPS1,RD	COMVAL 2
1S,1OP,DAL,KMAX,PORG,PSCL,LR,LF	COMVAL 3
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,XO,PO,YO,XZ,A,B,ABL,DMATVAL	MATVAL 2
1ABL,CHAN,BMAX,FACT,ANG,AF,SRH,AL,AS,AK,HAL,HAS,HAK,CAL,QAS,QAK,DAXMATVAL	MATVAL 3
2,DAX,HMAX,HDAY,DAX2,DAXY,HMAXY,QDAXY,DTR,HALFMU,TWTMU,PRTEMU,DOVMATVAL	MATVAL 4
3U,IREOTH,N1,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSB,NIM1,NJM1,ND,ND1,NE,NE1	MATVAL 5
4,NF,NIP2,NTR	MATVAL 6
LOGICAL AXIS	INTRPL 7
CALL IPOSN	INTRPL 8
DO 10 I = 2,NIM1	INTRPL 9
W(IJS+I,1) = W(IJS+2*NIP2+I,1)	INTRPL10
W(IJS+I,2) = W(IJS+2*NIP2+I,2)	INTRPL11
W(IJS+I,3) = -W(IJS+2*NIP2+I,3)	INTRPL12
W(IJS+I,4) = W(IJS+2*NIP2+I,4)	INTRPL13
W(IJS+I,5) = W(IJS+2*NIP2+I,5)	INTRPL14
W(IJS+I,6) = -W(IJS+2*NIP2+I,6)	INTRPL15
W(IJS+I,7) = W(IJS+2*NIP2+I,7)	INTRPL16
10 L(IJS+I) = L(IJS+2*NIP2+I)	INTRPL17
DO 580 J = 2,NJM1	INTRPL18
JJ = IJS+(J-1)*NIP2	INTRPL19
AXIS = .FALSE.	INTRPL20
IF (J.EQ.2) AXIS = .TRUE.	INTRPL21
DO 580 I = 2,NIM1	INTRPL22
IJ = JJ+I	INTRPL23
IF (L(IJ),NE.2) GO TO 580	INTRPL24
BNDRY = 0	INTRPL25
AI = FLOAT(I-1)*AX	INTRPL26
AJ = FLOAT(J-2)*AY	INTRPL27
IPOINT = L(IJ-NIP2)+3*L(IJ+NIP2)+9*L(IJ-1)+27*L(IJ+1)	INTRPL28
JPOINT = IPOINT/9	INTRPL29
IPOINT = IPOINT-9*JPOINT+1	INTRPL30
IF (AXIS) IPOINT = 0	INTRPL31
JPOINT = JPOINT+1	INTRPL32
GC TO (20,230,30,100,40,50,60,70,80), IPOINT	INTRPL33
20 GC TO (220,480,220,350,420,400,220,530,220), JPOINT	INTRPL34
30 GC TO (470,480,210,350,420,400,210,530,210), JPOINT	INTRPL35
40 GC TO (300,480,300,350,170,300,300,300,300), JPOINT	INTRPL36
50 GC TO (150,480,150,350,420,150,150,530,150), JPOINT	INTRPL37
60 GC TO (470,480,90,350,420,400,90,530,90), JPOINT	INTRPL38
70 GC TO (280,480,280,350,420,400,280,280,280), JPOINT	INTRPL39
80 GC TO (470,480,460,350,420,400,340,530,530), JPOINT	INTRPL40
90 BNDRY = -1	INTRPL41
100 N = IND(IS+I,1)	INTRPL42
DO 110 K = 2,N	INTRPL43
IF (AJ,LT,PBI(IS+I,K)) GO TO 120	INTRPL44
110 CCNTINUE	INTRPL45
K = N+1	INTRPL46
120 K = K-1	INTRPL47
IF (BNDRY) 190,130,190	INTRPL48
130 D = PBI(IS+I,K)-AJ	INTRPL49
A0 = AY/(AY-D)	INTRPL50
A1 = 1,0-A0	INTRPL51

DC 140 KK = 1,KMAX	INTRPL52
140 W(IJ, KK) = A0*WPI(IS+I, K, KK) + A1*W(IJ+NIP2, KK)	INTRPL53
GC TO 570	INTRPL54
150 DC 160 KK = 1,KMAX	INTRPL55
160 W(IJ, KK) = W(IJ+NIP2, KK)	INTRPL56
GC TO 570	INTRPL57
170 DC 180 KK = 1,KMAX	INTRPL58
180 W(IJ, KK) = .25*(W(IJ+1, KK) + W(IJ-1, KK) + W(IJ+NIP2, KK) + W(IJ-NIP2, KK))	INTRPL59
GC TO 570	INTRPL60
190 DC 200 KK = 1,KMAX	INTRPL61
200 W(IJ, KK) = WBI(IS+I, K, KK)	INTRPL62
GC TO 570	INTRPL63
210 BNDRY = -1	INTRPL64
GC TO 230	INTRPL65
220 BNDRY = 1	INTRPL66
230 N = IND(IS+I, 1)	INTRPL67
DC 240 K = 1, N	INTRPL68
IF (AJ, LE, PRI(IS+I, K)) GO TO 250	INTRPL69
240 CONTINUE	INTRPL70
K = N	INTRPL71
250 D = AJ-PBI(IS+I, K)	INTRPL72
IF (BNDRY) 190, 260, 320	INTRPL73
260 A0 = AY/(AY-D)	INTRPL74
A1 = 1, 0-A0	INTRPL75
DC 270 KK = 1, KMAX	INTRPL76
270 W(IJ, KK) = A0*WBI(IS+I, K, KK) + A1*W(IJ-NIP2, KK)	INTRPL77
GC TO 570	INTRPL78
280 DC 290 KK = 1, KMAX	INTRPL79
290 W(IJ, KK) = W(IJ-NIP2, KK)	INTRPL80
GC TO 570	INTRPL81
300 DC 310 KK = 1, KMAX	INTRPL82
310 W(IJ, KK) = 0.5*(W(IJ+NIP2, KK) + W(IJ-NIP2, KK))	INTRPL83
GC TO 570	INTRPL84
320 D2 = AJ-PBI(IS+I, K-1)	INTRPL85
A0 = D2/(D2-D)	INTRPL86
A1 = 1, 0-A0	INTRPL87
DC 330 KK = 1, KMAX	INTRPL88
330 W(IJ, KK) = A0*WBI(IS+I, K, KK) + A1*WBI(IS+I, K-1, KK)	INTRPL89
GC TO 570	INTRPL90
340 BNDRY = -1	INTRPL91
350 N = JND(JS+J, 1)	INTRPL92
DC 360 K = 2, N	INTRPL93
IF (A1, LT, PRJ(JS+J, K)) GO TO 370	INTRPL94
360 CONTINUE	INTRPL95
K = N+1	INTRPL96
370 K = K-1	INTRPL97
IF (BNDRY) 440, 380, 440	INTRPL98
380 D = PRJ(JS+J, K) - A1	INTRPL99
A0 = AX/(AX-D)	INTRP100
A1 = 1, 0-A0	INTRP101
DC 390 KK = 1, KMAX	INTRP102
390 W(IJ, KK) = A0*WBJ(JS+J, K, KK) + A1*W(IJ+1, KK)	INTRP103
GC TO 570	INTRP104
400 DC 410 KK = 1, KMAX	INTRP105
410 W(IJ, KK) = W(IJ+1, KK)	INTRP106
GC TO 570	INTRP107

420	DC 430 KK = 1,KMAX	INTRP108
430	W(IJ, KK) = 0.5*(W(IJ+1, KK)+W(IJ-1, KK))	INTRP109
	GC TO 570	INTRP110
440	DC 450 KK = 1,KMAX	INTRP111
450	W(IJ, KK) = WBJ(JS+J, K, KK)	INTRP112
	GC TO 570	INTRP113
460	BNDRY = -1	INTRP114
	GC TO 480	INTRP115
470	BNDRY = 1	INTRP116
480	N = JND(JS+J, 1)	INTRP117
	DC 490 K = 1, N	INTRP118
	IF (AI, LE, PRJ(JS+J, K)) GO TO 500	INTRP119
490	CONTINUE	INTRP120
	K = N	INTRP121
500	D = AI-PBJ(JS+J, K)	INTRP122
	IF (BNDRY) 440, 510, 550	INTRP123
510	A0 = AX/(AX-D)	INTRP124
	A1 = 1.0-A0	INTRP125
	DC 520 KK = 1, KMAX	INTRP126
520	W(IJ, KK) = A0*WBJ(JS+J, K, KK)+A1*W(IJ-1, KK)	INTRP127
	GC TO 570	INTRP128
530	DC 540 KK = 1, KMAX	INTRP129
540	W(IJ, KK) = W(IJ-1, KK)	INTRP130
	GC TO 570	INTRP131
550	D2 = AI-PBJ(JS+J, K-1)	INTRP132
	A0 = D2/(D2-D)	INTRP133
	A1 = 1.0-A0	INTRP134
	DC 560 KK = 1, KMAX	INTRP135
560	W(IJ, KK) = A0*WBJ(JS+J, K, KK)+A1*WBJ(JS+J, K-1, KK)	INTRP136
	GC TO 570	INTRP137
570	CONTINUE	INTRP138
580	CONTINUE	INTRP139
	DC 600 I = 1, NI	INTRP140
	DC 590 J = 2, NJ	INTRP141
	IJ = IJS+(J-1)*NIP2+1	INTRP142
590	L(IJ) = MIN0(L(IJ), 1)	INTRP143
	W(IJS+NIP2+1, 3) = 0.0	INTRP144
	W(IJS+NIP2+1, 6) = 0.	INTRP145
	W(IJS+1, 1) = W(IJS+2*NIP2+1, 1)	INTRP146
	W(IJS+1, 2) = W(IJS+2*NIP2+1, 2)	INTRP147
	W(IJS+1, 3) = -W(IJS+2*NIP2+1, 3)	INTRP148
	W(IJS+1, 4) = W(IJS+2*NIP2+1, 4)	INTRP149
	W(IJS+1, 5) = W(IJS+2*NIP2+1, 5)	INTRP150
	W(IJS+1, 6) = -W(IJS+2*NIP2+1, 6)	INTRP151
	W(IJS+1, 7) = W(IJS+2*NIP2+1, 7)	INTRP152
600	L(IJS+1) = L(IJS+2*NIP2+1)	INTRP153
	RETURN	INTRP154
	END	INTRP155

SUBROUTINE IPOSN	IPUSN 2
COMMON// W(2200,7),L(2200)	INTVAL 2
COMMON/BNDCRS/ WBI(109,8,7),PRI(109,8),IND(109,9)	BNDCRS 3
1WBJ(78,8,7),PBJ(78,8),JND(78,9)	BNDCRS 4
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,PHO,XO,PO,TJ,XZ,A,R,ABL,DMATVAL	DMATVAL 5
1ABL,CHAN,BMAX,FACT,ANG,AF,SR,AL,AS,AK,HAL,HAS,HAK,CAL,QAS,QAK,DAXMATVAL	DAXMATVAL 6
2,DAY,HMAX,HDAY,DAX2,DAY2,HMAXY,QDAXY,DTR,HALFHU,TWTFHU,FRTHU,DOVMMATVAL	DOVMMATVAL 7
3U,IREOTH,NI,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSB,NI,1,NJM1,ND,ND1,NE,NE1MATVAL	MATVAL 8
4,N,NIP2,NTR	IPUSN 9
DC 60 J = 2,NJ	IPUSN 10
JJ = IJS+(J-1)*NIP2	IPUSN 11
I2 = 0	IPUSN 12
N = JND(JS+J,1)	IPUSN 13
IF (N,EO,0) GO TO 50	IPUSN 14
DC 40 K = 2,N,2	IPUSN 15
I1 = I2+1	IPUSN 16
I2 = INT(PBJ(JS+J,K-1)*DAX)+1	IPUSN 17
IF (I1.GT.I2) GO TO 20	IPUSN 18
DC 10 I = I1,I2	IPUSN 19
IJ = JJ+I	IPUSN 20
10 L(IJ) = 0	IPUSN 21
20 I1 = I2+1	IPUSN 22
I2 = INT(PBJ(JS+J,K)*DAX)+1	IPUSN 23
IF (I1.GT.I2) GO TO 40	IPUSN 24
DC 30 I = I1,I2	IPUSN 25
IJ = JJ+I	IPUSN 26
IF (L(IJ).GT.1) GO TO 30	IPUSN 27
L(IJ) = 2-L(IJ)	IPUSN 28
30 CONTINUE	IPUSN 29
40 CONTINUE	IPUSN 30
50 I1 = I2+1	IPUSN 31
DC 60 I = I1,NI	IPUSN 32
IJ = JJ+I	IPUSN 33
60 L(IJ) = 0	IPUSN 34
DC 90 I = 1,NI	IPUSN 35
J1 = 2	IPUSN 36
N = IND(IS+I,1)	IPUSN 37
IF (N,NE,0) J1 = INT(PBI(IS+I,N)*DAY)+3	IPUSN 38
DC 70 J = J1,NJ	IPUSN 39
IJ = IJS+(J-1)*NIP2+I	IPUSN 40
70 L(IJ) = 0	IPUSN 41
IF (N,LE,1) GO TO 90	IPUSN 42
K = N	IPUSN 43
DC 80 KK = 2,N,2	IPUSN 44
K = K-2	IPUSN 45
J1 = 2	IPUSN 46
IF (K,NE,0) J1 = INT(PBI(IS+I,K)*DAY)+3	IPUSN 47
J2 = INT(PBI(IS+I,K+1)*DAY)+2	IPUSN 48
IF (J1.GT.J2) GO TO 90	IPUSN 49
DC 80 J = J1,J2	IPUSN 50
IJ = IJS+(J-1)*NIP2+I	IPUSN 51
80 L(IJ) = 0	
90 CONTINUE	
RETURN	
END	

SUBROUTINE PRNPLT	PRNPLT 2
COMMON /BNDVAL/ NR(600,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON /SRTCH/ TWR(300,7),TFRX(300),TFRY(300)	SRTCH 2
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARR 2
COMMON /ZONES/ NBEG(5,3),NEND(5,3),ARCSIZ(5,3),DISMAX(5,3),DISMIN(ZONES 2	ZONES 3
15,3)	
COMMON /COMVAL/ KT,AKT,DT,DTMIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDICO	COMVAL 2
15,10P,DAL,KMAX,PORG,PSCL,LF,LF	COMVAL 3
XS = 1.0/PSCL	PRNPLT 4
YS = XS	PRNPLT 9
CALL PHNT (-XS*PORG,5,0,-3)	PRNPLT10
DO 40 IAT = 1,NMAT	PRNPLT11
NR = NEND(MAT,3)	PRNPLT12
IRS = IMAT(7,MAT)	PRNPLT13
X0 = FMAT(9,MAT)	PRNPLT14
YZ = FMAT(11,MAT)	OFAX 30
XZ = FMAT(12,MAT)	PRNPLT15
A = FMAT(13,MAT)	PRNPLT16
B = FMAT(14,MAT)	PRNPLT17
CHAN = FMAT(17,MAT)	PRNPLT18
BMAX = FMAT(18,MAT)	PRNPLT19
ANG = FMAT(20,MAT)	PRNPLT20
AF = FMAT(21,MAT)	PRNPLT21
DO 10 I = 1,NR	PRNPLT22
CH = CHAN** (BMAX - FRY(IRS+I)) * YZ)	OFAX 39
TFRY(I) = A - B * (CH - 1.0) / (CH + 1.0)	PRNPLT24
TFRX(I) = X0 + (FRX(IRS+I) - XZ) * ANG * TFRY(I) * TOP * ATAN(AF * TFRY(I))	PRNPLT25
TFRX(I) = XS * TFRX(I)	PRNPLT26
10 TFRY(I) = YS * TFRY(I)	PRNPLT27
CALL PHNT (TFRX,TFRY,3)	PRNPLT28
DO 20 I = 2,NR	PRNPLT29
X = TFRX(I)	PRNPLT30
Y = TFRY(I)	PRNPLT31
20 CALL PHNT (X,Y,2)	PRNPLT32
CALL PHNT (TFRX,TFRY,3)	PRNPLT33
DO 30 I = 2,NR	PRNPLT34
X = TFRX(I)	PRNPLT35
Y = -TFRY(I)	PRNPLT36
30 CALL PHNT (X,Y,2)	PRNPLT37
40 CONTINUE	PRNPLT38
CALL FRAME	PRNPLT39
WRITE (6,50) AKT,KT	PRNPLT40
RETURN	PRNPLT41
	PRNPLT42
	PRNPLT43
50 FORMAT (1H045X2HT=E12,5,5X14,7H CYCLES/1H1)	PRNPLT44
END	

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SUBROUTINE PLTOUT
COMMON// W(2200,7),L(2230)
COMMON /HNDVAL/ WH(600,7),FRX(600),FRY(600),FRS(600)
COMMON/SCRTCH/ TWB(300,7),TFRX(300),TFRY(300)
COMMON /MATARR/ NMAT,IMAT(12,5),FMAT(23,5),MAT
COMMON /ZONES/ NBEG(5,3),NEND(5,3),ARCSIZ(5,3),DISMAX(5,3),DISMIN(ZONES
15,3)
COMMON /COMVAL/ KT,AKT,DT,DTIN,ITER,NEIFR,IPOINT,ERC,EPS,EPSI,RDICOMVAL
1S, TOP,DAL,KMAX,PORG,PSCL,LB,LF
COMMON /MATVAL/ AX,AY,CFL,VIC,VIST,MU,YC,RHO,X0,P0,TO,XZ,A,R,ABL,DMATVAL
1ARL,CHAN,BMAX,FACT,ANG,AF,SRH,AL,AS,AK,HAL,HAS,HAK,GAL,GAS,GAH,DAXMATVAL
2,DAY,HUAX,HDAY,DAX2,DAY2,HMAXY,ODAXY,DTR,HALFNU,TWTCMU,FRTCMU,DOVMATVAL
3U,IREOTM,NI,NJ,NFMAX,IS,JS,IJS,IBS,ISB,JSR,NIM1,NJM1,ND,ND1,NE,NE1MATVAL
4,AF,NIP2,NTR
COMMON /TRCPRT/ VTRS(5),ITR(5,25),TRS(5,25)
EQUIVALENCE(YZ,TO)
DC 60 MAT = 1,NMAT
CALL GENVAL
DC 10 I = 1,NF
CH=CHAN*(BMAX-FRY(IRS+I)+Y7)
TFRY(I) = A-B*(CH-1.0)/(CH+1.0)
TFRX(I) = X0*(FRX(IRS+I)-XZ)+ANG*TFRY(I)*TOP*ATAN(AF*TFRY(I))
10 CONTINUE
DC 20 I = 1,NTR
J = ITH(MAT,I)
TRZ = FRX(IRS+J)+TRS(MAT,I)*(FRX(IRS+J+1)-FRX(IRS+J))
TRN = FRY(IRS+J)+TRS(MAT,I)*(FRY(IRS+J+1)-FRY(IRS+J))
TWB(I,2) = WB(IRS+J,2)+TRS(MAT,I)*(WB(IRS+J+1,2)-WB(IRS+J,2))
TWB(I,3) = WB(IRS+J,3)+TRS(MAT,I)*(WB(IRS+J+1,3)-WB(IRS+J,3))
CH=CHAN*(BMAX-TRR+YZ)
TWB(I,1) = A-B*(CH-1.0)/(CH+1.0)
20 TWB(I+100,1) = X0*(TRZ-XZ)+ANG*TWB(I,1)*TOP*ATAN(AF*TWB(I,1))
IF (MAT.NE.1) GO TO 30
WRITE(2) AKT,NMAT,NF,(TFRX(I),TFRY(I),I=1,NF),NTR,(TWB(I+100,1),
1TWB(I,1),I=1,NTR),(TWB(I,2),TWB(I,3),I=1,NTR)
GO TO 40
30 CONTINUE
WRITE (2) NF,(TFRX(I),TFRY(I),I = 1,NF),NTR,(TWB(I+100,1),TWB(I,1)
1,I = 1,NTR),(TWB(I,2),TWB(I,3),I = 1,NTR)
40 CONTINUE
YCM = 0.99+YC
N = 0
DC 50 J = 2,NJ
JJ = IJS+(J-1)*NIP2
DC 50 I = 1,NI
IF (L(JJ+I),EQ,0) GO TO 50
YIELD = W(JJ+I,5)**2+W(JJ+I,6)**2+W(JJ+I,7)**2+W(JJ+I,5)*W(JJ+I,7)
IF (YIELD.LT.YCM) GO TO 50
N = N+1
TRZ = FLOAT(I-1)*AX
TRN = FLOAT(J-2)*AY
CH=CHAN*(BMAX-TRR+YZ)
TFRY(N) = A-B*(CH-1.0)/(CH+1.0)
TFRX(N) = X0*(TRZ-XZ)+ANG*TFRY(N)*TOP*ATAN(AF*TFRY(N))
IF (N.LT.100) GO TO 50
WRITE (2) N,(TFRX(K),TFRY(K),K = 1,N)

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N = 0
50 CONTINUE
  WRITE (2) N,(TFRX(K),TFRY(K),K = 1,N)
60 CONTINUE
  RETURN
END
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PLTOUT51
PLTOUT52
PLTOUT53
PLTOUT54
PLTOUT55
PLTOUT56
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SUBROUTINE OUTPUT	OTPT	2
COMMON// W(2200,7),L(2200)	INTVAL	2
COMMON/RNDCRS/ WBI(109,8,7),PRI(109,8),IND(109,9),	BNDCHS	2
1 WBJ(78,8,7),PRJ(78,8),JND(78,9)	BNDCRS	3
COMMON /BNDVAL/ WR(600,7),FRX(600),FRY(600),FRS(600)	BNDVAL	2
COMMON /MATARP/ NMAT,IMAT(12,5),FMAT(23,5),MAT	MATARP	2
COMMON /MATVAL/ AX,AY,CFL,VIS,VIST,MU,YC,RHO,X0,P0,T0,XZ,A,R,ABL,DMATVAL	DMATVAL	2
1 ARL,CHAN,HMAX,FACT,ANG,AF,SBH,AL,AS,AK,HAL,HAS,HAK,GAL,GAS,GAH,DAXMATVAL	DAXMATVAL	3
2,DAX,HMAX,HMAX,DAX2,DAX2,HMAX,ODAXY,DTR,HALFHU,THTCHU,FRYCHU,ODVMMATVAL	ODVMMATVAL	4
3U,IREOTM,NJ,NJ,NFMAT,IS,JS,IJS,IBS,ISB,JSP,NIM,NJM1,ND,ND1,NE,NE1MATVAL	NE1MATVAL	5
4,NF,NIP2,NTR	MATVAL	6
COMMON /TVALS/ ISTART,TMAX,TPRIN,TPRPL,TPLT,TSAVE,TCOMP,TZ	TVALS	2
COMMON /THCPRT/ NTRS(5),ITR(5,25),TRS(5,25)	THCPRT	2
COMMON /COMVAL/ KT,AKT,DT,DTHIN,ITER,NEIBR,IFOINT,EPP,EPS,EPS1,RD	COMVAL	2
1S,IOP,UAL,KMAX,PORG,PSCL,LE,LF	COMVAL	3
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	INTFC	2
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS	2
DIMENSION WOUT(8)	OTPT	13
EQUIVALENCE(YZ,T0)	OFAX	44
LOGICAL PDER	OTPT	14
R(Y)=A-R*(CHAN*(RMAX-Y+YZ)-1.0)/(CHAN*(RMAX-Y+YZ)+1.0)	OFAX	45
Z(X,Y) = X0*(X-XZ)+ANG*Y+TOP*ATAN(AF*Y)	OTPT	16
PDER = .FALSE.	OTPT	17
DC 100 MAT = 1,NMAT	OTPT	18
IPRINT = IMAT(11,MAT)	OTPT	19
JPRINT = IMAT(12,MAT)	OTPT	20
IF (MAT.NE.1) GO TO 10	OTPT	21
CALL SECOND (T1)	OTPT	22
RT = T1-TZ	OTPT	23
WRITE (6,170) AKT,DT,KT,RT	OTPT	24
GO TO 20	OTPT	25
10 WRITE (6,130) MAT	OTPT	26
20 CALL GENVAL	OTPT	27
WRITE (6,120)	OTPT	28
ZMIN = 1.0E6	OTPT	29
RMIN = ZMIN	OTPT	30
ZMAX = -ZMIN	OTPT	31
RMAX = ZMAX	OTPT	32
DC 40 I = 1,NF	OTPT	33
ZMIN = AMIN1(FRX(1BS+1),ZMIN)	OTPT	34
ZMAX = AMAX1(FRX(1BS+1),ZMAX)	OTPT	35
RMIN = AMIN1(FRY(1BS+1),RMIN)	OTPT	36
RMAX = AMAX1(FRY(1BS+1),RMAX)	OTPT	37
RR = R(FRY(1BS+1))	OTPT	38
ZZ = Z(FRX(1BS+1),RR)	OTPT	39
DC 30 KK = 1,7	OTPT	40
30 WOUT(KK) = WB(1BS+1,KK)	OTPT	41
WOUT(8) = PRS(WOUT(1),WOUT(4))*P0	OTPT	42
WOUT(1) = WOUT(1)*RHO	OTPT	43
WOUT(5) = WOUT(5)*P0	OTPT	44
WOUT(6) = WOUT(6)*P0	OTPT	45
WOUT(7) = WOUT(7)*P0	OTPT	46
40 WRITE (6,140) I,ZZ,RR,WOUT	OTPT	47
IF (IPRINT.EQ.0.OR,JPRINT.EQ.0) GO TO 70	OTPT	48
IB = INT(ZMIN*DAX)+2	OTPT	49
IE = INT(ZMAX*DAX)+1	OTPT	50

```

IF (IPRINT.GT.0) IE = MIN0(IF+IPRINT-1,IE)
IF (IPRINT.LT.0) IB = MAX0(IE+IPRINT+1,IB)
JB = INT(RMIN*DAY)+2
JE = INT(RMAX*DAY)+2
IF (JPRINT.GT.0) JE = MIN0(JE+JPRINT-1,JE)
IF (JPRINT.LT.0) JB = MAX0(JE+JPRINT+1,JB)
WRITE (6,150)
DC 60 J = JB,JE
WRITE(6,190) J
RR = R(FLOAT(J-2)*AV)
JJ = IJS*(J-1)*NIP2
DC 60 I = IR,IE
IF (L(JJ+1).EQ.0) GO TO 60
ZZ = Z(FLOAT(I-1)*AX,RR)
DC 50 KK = 1,7
50 WOUT(KK) = W(JJ+1,KK)
WOUT(8) = PRS(WOUT(1),WOUT(4))*P0
WOUT(1) = WOUT(1)*RW0
WOUT(5) = WOUT(5)*P0
WOUT(6) = WOUT(6)*P0
WOUT(7) = WOUT(7)*P0
WRITE (6,140) I,ZZ,RR,WOUT
60 CONTINUE
70 WRITE (6,160)
DC 90 I = 1,NTR
J = ITR(MAT,I)
TRZ = FRX(IRS+J)+TRS(MAT,I)*(FRX(IRS+J+1)-FRX(IRS+J))
TRM = FRY(IRS+J)+TRS(MAT,I)*(FRY(IRS+J+1)-FRY(IRS+J))
DC 80 KK = 1,KMAX
80 WOUT(KK) = WB(IRS+J,KK)+TRS(MAT,I)*(LB(IRS+J+1,KK)-WB(IRS+J,KK))
RR = R(TRR)
ZZ = Z(TRZ,RR)
WOUT(8) = PRS(WOUT(1),WOUT(4))*P0
WOUT(1) = WOUT(1)*RW0
WOUT(5) = WOUT(5)*P0
WOUT(6) = WOUT(6)*P0
WOUT(7) = WOUT(7)*P0
90 WRITE (6,140) I,ZZ,RR,WOUT
100 CONTINUE
DO 110 I = 1,NINFC
JE = 6*I
JB = JE-5
110 WRITE (6,180) (INFC(J),J = JB,JE)
RETURN
C
120 FOMHAT (1H0/5H0 PT.6X1HZ9X1HR9X3HRH011X1HU12X1HV12X1HE11X3HSZZ10X30TPT 95
1HSZR10X3HSRR11X1HP/4H09X3HCHS7X3HCHS7X5HGRAMS9X3HCHS10X3HCHS6X11H10TPTC1 2
20**12 ERGS2X12H10**12 DYNES1X12H10**12 DYNES1X12H10**12 DYNES1X12H0TPTC1 3
310**12 DYNES/30X5HCH**37X8HMICROSEC5X8HMICROSEC6X4HGRAM9X5HCH**28X0TPTC1 4
45HCH**28X5HCH**28X5HCH -2//) OTPTC1 5
130 FOMHAT (1H1//58X8HMATERIAL12) OTPT 97
140 FOMHAT (15,2F10,4,8E13,5) OTPT 98
150 FOMHAT (1H0/55X15HINTERIOR POINTS) OTPT 99
160 FOMHAT (1H0/54X16HTRACER PARTICLES) OTPT 100
170 FOMHAT (1H1/3H0T=E12,5,5X3HDT=E12,5,FX14,7H CYCLES5X13HELAPSED TIMOTPT 101
1E+8,3/3X12HMICROSECONDS8X12HMICROSECONDS35X7HSECONCS//1H057X10HMAOTPTC1 6

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2TERIAL 1)	OTPTC1 7
180 FCHMAT (9H0MATERIAL12,11H FROM POINT14,9H TO POINT14,31H HAS AN IN	OTPT 103
1TERFACE WITH MATERIAL12,11H FROM POINT14,9H TO POINT14)	OTPT 104
190 FORMAT(1H059X13)	OTPTC1 8
END	OTPT 105

SUBROUTINE SAVE	SAVE 2
COMMON// W(2200,7),L(2200)	INTVAL 2
COMMON /BNDVAL/ WB(600,7),FRX(600),FRY(600),FRS(600)	BNDVAL 2
COMMON/SCRCH/ TWB(300,7),TFRX(300),TFRY(300)	SCRCH 2
COMMON /ZONES/ NBEG(5,3),NEND(5,3),ARCSIZ(5,3),DISMAX(5,3),DISMIN(5,3)	ZONES 2
COMMON /MATARR/ NHAT,IMAT(12,5),FMAT(23,5),MAT	ZONES 3
COMMON /COMVAL/ KT,AKT,DT,DTMIN,ITER,NEIBR,IPOINT,ERR,EPS,EPS1,RDI	MATARR 2
15, TOP, DAL, KMAX, PORG, PSCL, LB, LF	COMVAL 2
COMMON /TRCPRT/ NTRS(5),ITR(5,25),TRS(5,25)	COMVAL 3
COMMON /INTFC/ NINFC,INFC(60),NONIN(20,5)	TRCPRT 2
REWIND 1	INTFC 2
WRITE (1) KT,AKT,DTMIN	SAVE 11
NIN6 = 6*NINFC	SAVE 12
WRITE (1) NINFC,NIN6,(INFC(I),I = 1,NIN6)	SAVE 13
DO 30 MAT = 1,NMAT	SAVE 14
NTR = NTRS(MAT)	SAVE 15
NF = NEND(MAT,3)	SAVE 16
NI = IMAT(1,MAT)	SAVE 17
NIP2 = NI+2	SAVE 18
IJS = IMAT(6,MAT)	SAVE 19
IRS = IMAT(7,MAT)	SAVE 20
AX = FMAT(1,MAT)	SAVE 21
DAX = 1.0/AX	SAVE 22
AY = FMAT(2,MAT)	SAVE 23
DAY = 1.0/AY	OFAX 46
YZ = FMAT(11,MAT)	OFAX 47
XZ = FMAT(12,MAT)	OFAX 48
ZMIN = 1.0E6	SAVE 25
RMIN = ZMIN	SAVE 26
ZMAX = -ZMIN	SAVE 27
RMAX = ZMAX	SAVE 28
DO 10 I = 1,NF	SAVE 29
ZMIN = AMIN1(FRX(IRS+I),ZMIN)	SAVE 30
ZMAX = AMAX1(FRX(IRS+I),ZMAX)	SAVE 31
RMIN = AMIN1(FRY(IRS+I),RMIN)	SAVE 32
10 RMAX = AMAX1(FRY(IRS+I),RMAX)	SAVE 33
IB = INT(ZMIN*DAX)*2	SAVE 34
IE = INT(ZMAX*DAX)*1	SAVEC1 1
JB = INT(RMIN*DAY)*3	SAVEC1 2
IF(RMIN,LE,1.0E-4) JB=1	OFAX 49
JE = INT(RMAX*DAY)*2	OFAX 50
NI = IE-IB+1	SAVEC1 4
NJ = JE-JB+1	SAVE 39
ZDF = FLOAT(1-IB)*AX	SAVE 40
XZ = XZ+ZDF	SAVE 41
RDF = FLOAT(1-JB)*AY	SAVE 42
YZ = YZ+RDF	OFAX 51
DO 20 I = 1,NF	OFAX 52
TFRY(I) = FRY(IRS+I)*RDF	SAVE 43
20 TFRX(I) = FRX(IRS+I)+ZDF	OFAX 53
WRITE (1) (NBEG(MAT,I),NEND(MAT,I),ARCSIZ(MAT,I),I = 1,3),XZ,NI,NJ	SAVE 44
1,NF,YZ	SAVE 45
IT1 = IRS+1	OFAX 54
IT2 = IRS+NF	SAVEC1 6
WRITE(1) ((WB(I,KK),KK=1,KMAX),FRS(I),I=IT1,IT2),(TFRX(I),TFRY(I),	SAVEC1 7
	SAVEC1 8

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1I=1,NF),FMAT(22,MAT)
WRITE (1) NTR,(ITR(MAT,I),THS(MAT,I),I = 1,NTR)
DO 25 J=JB,JE
JJ=IJS+(J-1)*NIP2
IT1=JJ+IB
IT2=JJ+IE
25 WRITE(1) ((W(I,KK),KK=1,KMAX),L(I),I=IT1,IT2)
30 CONTINUE
END FILE 1
RETURN
END

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```

SAVEC1 9
SAVE 49
SAVEC110
SAVEC111
SAVEC112
SAVEC113
SAVEC114
SAVE 52
SAVE 53
SAVE 54
SAVE 55

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SUBROUTINE FRAME	FRME	2
COMMON /COMPLY/ IX0,IY0,IXN,IYN,IPEN,IMAX,JMAX,NP,MAXP,M(2000),FLAG	FRME	3
IG,XS,YS	FRME	4
DIMENSION L(121), ICHAR(37)	FRME	5
LOGICAL IPEN,FLAG	FRME	6
DATA IBLNK/1H /	FRME	7
DATA ICHAR/1H*,1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,1HK,1HL,1HMF	FRME	8
1,1HN,1HO,1HP,1HQ,1HR,1HS,1HT,1HU,1HV,1HW,1HX,1HY,1HZ,1HO,1HI,1H2,1FRME	FRME	9
2H3,1H4,1H5,1H6,1H7,1H8,1H9/	FRME	10
WRITE (6,50)	FRME	11
N = 1	FRME	12
JT = IMAX*JMAX	FRME	13
DO 30 I = 1,IMAX	FRME	14
JT = JT-JMAX	FRME	15
DO 10 J = 1,JMAX	FRME	16
10 L(J) = IBLNK	FRME	17
20 MN = M(N)/64	FRME	18
IF (MN,LT,JT) GO TO 30	FRME	19
JJ = MN-JT	FRME	20
K = M(N)-MN*64	FRME	21
L(JJ) = ICHAR(K+1)	FRME	22
N = N+1	FRME	23
IF (N,LE,NP) GO TO 20	FRME	24
WRITE (6,60) L	FRME	25
GO TO 40	FRME	26
30 WRITE (6,60) L	FRME	27
40 CALL RESET	FRME	28
RETURN	FRME	29
	FRME	30
50 FORMAT (1H1)	FRME	31
60 FORMAT (1H ,121A1)	FRME	32
END	FRME	33

SUBROUTINE PRN1S (N,M)
CALL RESET
RETURN
END

PLTS 2
PLTS 3
PLTS 4
PLTS 5

SUBROUTINE RESET	RSET	2
COMMON /COMPLT/ IX0,IY0,IXN,IYN,IPEN,IMAX,JMAX,NP,MAXP,M(2000),FLAG	RSET	3
IG,XS,YS	RSET	4
LOGICAL IPEN,FLAG	RSET	5
IX0 = 1	RSET	6
IY0 = 1	RSET	7
IXN = 1	RSET	8
IYN = 1	RSET	9
IPEN = .TRUE.	RSET	10
FLAG = .TRUE.	RSET	11
NP = 0	RSET	12
RETURN	RSET	13
END	RSET	14

SUBROUTINE PRNT (X,Y,JP)	PRNT	2
COMMON /COMPLY/ IX0,IY0,IXN,IYN,IPEN,IMAX,JMAX,NP,MAXP,N(2000),FLAG	PRNT	3
10 XS,YS	PRNT	4
LOGICAL IPEN,FLAG	PRNT	5
IX = IFIX(XS*X)+IX0	PRNT	6
IY = IFIX(YS*Y)+IY0	PRNT	7
IP = JP	PRNT	8
IF (IABS(IP).EQ.2) IPEN = .TRUE.	PRNT	9
IF (IABS(IP).EQ.3) IPEN = .FALSE.	PRNT	10
IF (.NOT.IPEN) GO TO 40	PRNT	11
IF = MIN0(IY,IYN)	PRNT	12
IL = MAX0(IY,IYN)	PRNT	13
JF = MIN0(IX,IXN)	PRNT	14
JL = MAX0(IX,IXN)	PRNT	15
IF (IF.GT.IMAX.OR,IL.LT.1.OR,JF.GT.JMAX.CR,JL.LT.1) GO TO 40	PRNT	16
IDX = IX-IXN	PRNT	17
IF (IABS(IDX).GT,IABS(IDY)) GO TO 20	PRNT	18
IF (IDY.EQ.0) GO TO 40	PRNT	19
IF = MAX0(IF,1)	PRNT	20
IL = MIN0(IL,IMAX)	PRNT	21
DC 10 I = IF,IL	PRNT	22
J = IXN+(IDX*(I-IYN))/IDY	PRNT	23
IF (J.LT.1.OR,J.GT.JMAX) GO TO 10	PRNT	24
CALL SETPT (I,J,0)	PRNT	25
IF (.NOT.FLAG) GO TO 40	PRNT	26
10 CONTINUE	PRNT	27
GO TO 40	PRNT	28
20 CONTINUE	PRNT	29
JF = MAX0(JF,1)	PRNT	30
JL = MIN0(JL,JMAX)	PRNT	31
DC 30 J = JF,JL	PRNT	32
I = IYN+(IDY*(J-IXN))/IDX	PRNT	33
IF (I.LT.1.OR,I.GT.IMAX) GO TO 30	PRNT	34
CALL SETPT (I,J,0)	PRNT	35
IF (.NOT.FLAG) GO TO 40	PRNT	36
30 CONTINUE	PRNT	37
40 IXN = IX	PRNT	38
IYN = IY	PRNT	39
IF (IP.GT.0) RETURN	PRNT	40
IX0 = IXN	PRNT	41
IY0 = IYN	PRNT	42
RETURN	PRNT	43
END	PRNT	44
	PRNT	45

SUBROUTINE SETPT (I,J,ICHR)	STPT	2
COMMON /COMPT/ IX0,IY0,IXN,IYN,IPEN,IMAX,JMAX,NP,MAXP,M(2000),FLAG	STPT	3
IG,XS,YS	STPT	4
LOGICAL IPEN,FLAG	STPT	5
N = (JMAX*(I-1)+J)*64	STPT	6
CALL SEEK (M,NP,N,K)	STPT	7
IF (K,GT,0) RETURN	STPT	8
NP = NP+1	STPT	9
IF (NP,GT,MAXP) GO TO 30	STPT	10
K = -K+1	STPT	11
IF (K,GT,NP) GO TO 20	STPT	12
LL = NP	STPT	13
DO 10 L = K,NP	STPT	14
LL = LL-1	STPT	15
10 M(LL+1) = M(LL)	STPT	16
20 M(K+1) = N+ICHR	STPT	17
RETURN	STPT	18
30 NP = NP-1	STPT	19
IF (FLAG) WRITE (6,40) NP	STPT	20
FLAG = .FALSE.	STPT	21
RETURN	STPT	22
	STPT	23
40 FORMAT (1H1///25H0ATTEMPT TO SET MORE THAN 16,384 PRAT POINTS, REMA	STPT	24
1IVING POINTS IGNORED)	STPT	25
END	STPT	26

SUBROUTINE SMBOL (X,Y,ISYMB)	SMBL	2
COMMON /COMPLT/ IX0,IY0,IXN,IYN,IPEN,IMAX,JMAX,NP,MAXP,M(2000),FLAG	SMBL	3
1G,XS,YS	SMBL	4
LOGICAL IPEN,FLAG	SMBL	5
IXN = IFIX(XS*X)+IX0	SMBL	6
IYN = IFIX(YS*Y)+IY0	SMBL	7
IF (IXN.LT.1.OR.IXN.GT.JMAX.OR.IYN.LT.1.OR.IYN.GT.IMAX) RETURN	SMBL	8
CALL SETPT (IYN,IXN,ISYMB)	SMBL	9
RETURN	SMBL	10
END	SMBL	11

```

SUBROUTINE SEEK (A,NP,PP,K)
  DIMENSION A(1)
  INTEGER A,P,PP
  IT = NP
  IF (IT,EQ,0) GO TO 30
  IB = 1
  P = PP
  IF ((P-A(1))/64) 10,20,30
10 IF ((P-A(IT))/64) 40,50,60
20 I = 1
  GC TO 100
30 I = -1
  GC TO 100
40 I = -IT-1
  GC TO 100
50 I = IT
  GC TO 100
60 IF (IT-IB,EQ,1) GO TO 90
  I = (IB+IT)/2
  IF ((P-A(I))/64) 70,100,80
70 IB = I
  GC TO 60
80 IT = I
  GC TO 60
90 I = -IT
100 K = 1
  RETURN
END

```

```

SEEK  2
SEEK  3
SEEK  4
SEEK  5
SEEK  6
SEEK  7
SEEK  8
SEEK  9
SEEK 10
SEEK 11
SEEK 12
SEEK 13
SEEK 14
SEEK 15
SEEK 16
SEEK 17
SEEK 18
SEEK 19
SEEK 20
SEEK 21
SEEK 22
SEEK 23
SEEK 24
SEEK 25
SEEK 26
SEEK 27
SEEK 28
SEEK 29

```

BLUCK DATA	BKDT	2
COMMON /COMPLY/ IXO,IYO,IXN,IYN,IPEN,IMAX,JMAX,NP,MAXP,4(2000),FLA	BKDT	3
1G,XS,YS	BKDT	4
DATA IMAX,JMAX,MAXP/61,121,2000/	BKDT	5
DATA XS,YS/10.0001,6.0001/	BKDT	6
END	BKDT	7

FUNCTION PRS (RHOO,EE)	PRS	2
COMMON /PRESS/ PDER,PR,PE,MATNO	PRESS	2
COMMON /EOSTP/ APL(10),HPL(10),APB(10),BPR(10),ALPH(10),BETA(10),EOSTP	EOSTP	3
1S(10),EZERO(10),ESPRM(10),RHOZRO(10),PHIN(10)	PRS	5
LOGICAL MIN	PRS	6
LOGICAL PDER	PRS	7
REAL MU	PRS	8
DATA APL,HPL,APB,BPR,ALPH,BETA,RHOZRO,EZERO,ES,ESPRM,PHIN/0.5,0.5,PRS	PRS	9
10.,0.,0.,0.5,0.0,0.0,0.0,0.0,0.0,0.0,1.50,1.04,1.50,1.10,1.63,0.0,0.0,0PRS	PRS	10
2.0,0.0,0.0,0.1,28,3.08,1.28,.068,0.75,0.0,0.0,0.0,0.0,0.0,0.1,05,2.50,PRS	PRS	11
31.05,0.04,0.65,0.0,0.0,0.0,0.0,0.0,0.0,0.0,5.0,10.0,5.0,5.0,5.0,0.0,0.0,0,PRS	PRS	12
40.0,0.0,0.0,5.0,10.0,5.0,5.0,5.0,0.0,0.0,0.0,0.0,0.0,0.0,7.8,17.04,8.0,1PRS	PRS	13
5.694,2.79,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.095,0.225,0.075,0.060,0.05,0.0,0,0PRS	PRS	14
6.0,0.0,0.0,0.0,0.0,0.0244,0.0111,0.0244,0.0320,0.03,0.0,0.0,0.0,0.0,0.0,0,0,PRS	PRS	15
70.102,0.056,0.102,0.180,0.15,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.035,-0.00371,-PRS	PRS	16
80.035,-0.0033,-0.035,0.0,0.0,0.0,0.0,0.0,0.0,0.0/	PRS	17
MAT(1)=TARGET, MAT(2)=PROJ, MAT(3)=PROJ SHEATH	PRS	18
	PRS	19
MAI = MATNO	PRS	20
ETA = RHOO	PRS	21
IF (ETA.GT.0.0) GO TO 10	PRS	22
ETA = -ETA	PRS	23
MIN = ,FALSE.	PRS	24
GO TO 20	PRS	25
10 MIN = ,TRUE.	PRS	26
20 CONTINUE	PRS	27
E = EE	PRS	28
R = ETA*RHOZRO(MAT)	PRS	29
MU = ETA-1.0	PRS	30
IF (ABS(MU).LT.1.0F-A) MU=0.0	PRS	31
EX = BPL(MAT)/(E/(EZERO(MAT)*ETA**2)+1.0)	PRS	32
IF (ETA.GE.1.0.OR.E.LE.ES(MAT)) GO TO 30	PRS	33
IF (E.GE.ESPRM(MAT)) GO TO 50	PRS	34
	PRS	35
COMPRESSION	PRS	36
30 PRSC = (APL(MAT)*EX)*E+R*(APB(MAT)*BPR(MAT)*MU)*MU	PRS	37
IF (MIN) PRSC = AMAX1(PRSC,PHIN(MAT))	PRS	38
IF (,NOT,PDER) GO TO 40	PRS	39
PRC = (APL(MAT)*EX)*E+(APB(MAT)*2.0*BPR(MAT)*MU)/RHOZRO(MAT)+2.0*(PRS	PRS	40
E*EX/ETA)**2/(EZERO(MAT)*BPL(MAT))	PRS	41
PEC = (APL(MAT)*EX-F*(EX/ETA)**2/(EZERO(MAT)*BPL(MAT)))*R	PRS	42
40 IF (ETA.LT.1.0.AND.E.GT.ES(MAT)) GO TO 50	PRS	43
PRB = PRSC/RHOZRO(MAT)	PRS	44
IF (,NOT,PDER) RETURN	PRS	45
PR = PRC	PRS	46
PE = PEC/RHOZRO(MAT)	PRS	47
RETURN	PRS	48
50 EY = EXP(-ALPH(MAT)*(MU/ETA)**2)	PRS	49
EZ = EXP(BETA(MAT)*MU/ETA)	PRS	50
PRSE = APL(MAT)*E+R*(E*R*EX+APB(MAT)*MU*F7)*EY	PRS	51
IF (MIN) PRSE = AMAX1(PRSE,PHIN(MAT))	PRS	52
IF (,NOT,PDER) GO TO 60	PRS	53
PRF = APL(MAT)*E-((F*R*FX+APB(MAT)*ML*EZ)*2.0*ALPH(MAT)*MU/(R*ETA+PRS	PRS	54
1*2)*E*EX+2.0*(E*EX/ETA)**2/(EZERO(MAT)*BPL(MAT))+(APB(MAT)/RHOZRO(PRS	PRS	55
2*MAI)*APB(MAT)*MU*ETA(MAT)/(ETA*R))*EZ)*FY	PRS	56

PRC = (APL(MAT)+(EX-E*(EX/ETA)**2/(EZERO(MAT)*BPL(MAT)))*EY)*R	PRS	57
60 IF (E.LT.ESPRM(MAT)) GO TO 70	PRS	58
PRS = PRSE/RHOZRO(MAT)	PRS	59
IF (,NOT,PDER) RETURN	PRS	60
PR = PHE	PRS	61
PE = PEE/RHOZRO(MAT)	PRS	62
RETURN	PRS	63
70 A = (E-ES(MAT))/(ESPRM(MAT)-ES(MAT))	PRS	64
B = (ESPRM(MAT)-E)/(ESPRM(MAT)-ES(MAT))	PRS	65
PRS = (A*PRSE+B*PRSC)/RHOZRO(MAT)	PRS	66
IF (,NOT,PDER) RETURN	PRS	67
PR = A*PRE+B*PRC	PRS	68
PE = (A*PEE+B*PEC)/RHOZRO(MAT)	PRS	69
RETURN	PRS	70
END	PRS	71