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ALESEP: Part II
A Computer Program for the Analysis of Leading Edge Separation Bubbles on Infinite Swept Wings

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ALESEP: PART II- A Computer Program for the Analysis of Leading Edge Separation Bubbles on Infinite Swept Wings

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SUMMARY

A program called ALESEP is presented for the analysis of the inviscid-viscous interaction which occurs due to the presence of a closed laminar-transitional separation bubble on an airfoil or infinite swept wing. The ALESEP code provides an iterative solution of the boundary layer equations expressed in an inverse formulation coupled to a Cauchy integral representation of the inviscid flow. This interaction analysis is treated as a local perturbation to a known solution obtained from a global airfoil analysis; hence, part of the required input to the ALESEP code are the reference displacement thickness and tangential velocity distributions. Special windward differencing may be used in the reversed flow regions of the separation bubble to accurately account for the flow direction in the discretization of the streamwise convection of momentum. The ALESEP code contains a forced transition model based on a streamwise intermittency function, a natural transition model based on a solution of the integral form of the turbulent kinetic energy equation, and an empirical natural transition model. In addition, wall suction may be applied to the boundary layer to either control its growth or alleviate the separation bubble. Complete documentation of the two-dimensional code was originally given in NASA Contract Report 172310. An updated set of instructions for the input, output, and program usage for both two-dimensional airfoils and infinite swept wings is given herein along with a sample case.

LIST OF SYMBOLS

a	Structural coefficient
c	Airfoil chord
c_f	Skin friction coefficient
$\mathcal{D}$	Damping factor applied to mixing and dissipation lengths
$\tilde{f}$	Perturbation stream function
F	Velocity ratio, u/u_e
g	Total enthalpy ratio, H/H_e
H	Total enthalpy
ℓ	Mixing length or ratio of local to edge density times molecular viscosity product
L	Reference length or dissipation length
m	Perturbation mass flow
n	Coordinate normal to reference displacement surface
N	Coordinate measured normal to reference displacement surface from the body surface
Pr	Prandtl number
Pr_T	Turbulent Prandtl number
$\bar{q}$	Magnitude of fluctuating velocities
Re	Reference Reynolds number
Re_θ	Local momentum thickness Reynolds number
$\bar{R}_\theta$	Correlated momentum thickness Reynolds number
R_T	Turbulent Reynolds number
s, S	Coordinates along reference displacement surface
Tu	Turbulence level
u	Velocity component normal to leading edge along the x-direction parallel to reference displacement surface

v	Velocity component along the y-direction normal to reference displacement surface
V	Transformed normal velocity in Prandtl transposition theorem
w	Velocity component tangent to leading edge along the z-direction
W	Velocity ratio, w/w_e
x	Coordinate direction normal to leading edge
X	Coordinate direction (absolute frame) parallel to free stream direction
y	Coordinate direction normal to surface
z	Coordinate direction tangent to leading edge
Z	Coordinate direction (absolute frame) perpendicular to free stream direction in reference plane of airfoil surface
α	Windward differencing weighting operator
β	Pressure gradient parameter
δ	Boundary layer thickness
δ^*	Displacement thickness
δ_T	Stress thickness
ϵ	Eddy viscosity coefficient
κ	von Karman constant
Λ	Sweep angle
η	Transformed normal coordinate
ν	Kinematic viscosity coefficient
μ	Molecular viscosity coefficient
ξ	Transformed tangential coordinate
ϕ	Velocity potential
ρ	Density
ψ	Stream function
ω	Interaction relaxation parameter

Subscripts

e	Edge of boundary layer
I	Inviscid
ref	Reference solution
t_1	Start of transition
t_2	End of transition
T	Turbulent
v	Viscous
∞	Free stream
1	Start of interaction region
2	End of interaction region

Superscripts

'	Perturbation quantity
+	Inner wall non-dimensionalized coordinate
k	Global inviscid-viscous iteration counter

GENERAL DESCRIPTION

Introduction

It was pointed out by Tani (Ref. 1) that airfoils at moderate incidence angles, prior to either leading edge stall or thin airfoil stall, experience local separation bubbles just downstream of the peak suction (minimum pressure) regions. Figure 1 shows a schematic diagram of an airfoil leading edge bubble which occurs if the Reynolds number is sufficiently low so that the boundary layer remains laminar up to the minimum pressure point. Downstream of this point, separation occurs almost immediately since laminar boundary layers, in contrast with turbulent flows, are extremely sensitive to adverse pressure gradients. A separation bubble forms in which a recirculating streamline pattern is bounded by a shear layer. Since shear layer flows tend to be highly unstable to flow disturbances, transition from laminar to turbulent flow generally occurs in this shear layer. Further downstream, the turbulent mixing between the shear layer flow with the lower dead air region results in entrainment of higher energy air which energizes the flow near the surface thereby resulting in flow reattachment with subsequent turbulent boundary layer flow downstream. As shown in Fig. 1, the initial position of the separation bubble is characterized by a pressure plateau followed by a pressure recovery region after the transition process is initiated, but prior to flow reattachment.

Technical Approach

The approach taken in the ALESEP code for the analysis of closed leading edge separation bubbles is based on an inviscid-viscous interaction technique in which the boundary layer equations are solved iteratively with an inviscid analysis through displacement thickness coupling. Experimental studies (Refs. 2-5) have shown that these closed transitional separation bubbles occupy only a few percent of the airfoil chord. Since the resultant interaction is highly localized, the leading edge transitional bubble problem is treated as a linear perturbation to a known global airfoil solution. The use of a perturbation approach permits an accurate analysis of the flow field structure in this region in contrast with the extremely difficult problem of trying to resolve this small scale phenomena while simultaneously solving the global airfoil flow field. In contrast with previous perturbation treatments of this problem, the approach taken in ALESEP accounts for the influence of the global viscous airfoil flow on the local interaction analysis. A detailed discussion of the approach taken in the ALESEP technique can be found in Refs. 6-9.

The local inviscid analysis in the ALESEP procedure assumes that the disturbance field induced by the presence of a transitional separation bubble can be treated as a small disturbance to the global airfoil flow. An asymptotic analysis is presented in Ref. 8 which formally shows that under a particular limiting condition, the disturbance field induced by the transitional displacement surface can be represented by a distribution of

sources placed along a reference displacement surface as shown in Fig. 2. The reference displacement surface is usually defined as the displacement thickness which would exist in the local region due to an attached turbulent boundary layer. It, as well as the reference velocity distribution, are obtained from an airfoil analysis code such as that presented in Refs. 10 or 11 in which instantaneous transition from laminar to turbulent flow is assumed to occur at the predicted laminar separation point. Calculation of the perturbation velocity which occurs due to the difference between the separation bubble displacement thickness and the reference displacement surface as shown in Fig. 2, is performed through a Cauchy integral of the chordwise distributed sources using potential flow considerations. Upon integration of this Cauchy integral for the perturbed velocity, the local inviscid velocity distribution, u_e , due to the interaction with the separation bubble is determined by adding the perturbation velocity and the reference velocity solution. For infinite swept wings, the two-dimensional Cauchy integral analysis remains unchanged along a line perpendicular to the wing leading edge since the spanwise component of the boundary layer edge velocity is constant and therefore, is unaffected by the viscous displacement thickness.

The viscous solution technique used in ALESEP is an extension of the inverse boundary layer procedure presented by Carter (Ref. 12). In this procedure, a perturbation stream function is introduced into the boundary layer equations for the simplification of boundary conditions. The continuity equation is eliminated and the stream function definition is subsequently added to the governing equation set which also include the momentum and energy equations. The governing equations are solved for the local perturbation stream function, two velocity ratios, total enthalpy ratio, and viscous edge velocity, u_e , for a prescribed streamwise distribution of perturbation mass flow, $m = \rho_e u \delta_e^*$. The numerical solution of the governing equations is obtained using an implicit finite difference technique which is first order accurate in the streamwise direction and second order accurate in the normal direction.

Since the boundary layer equations are parabolic, an instability will arise when the solution marching direction is opposite to the flow direction. Reyhner and Flugge Lotz (FLARE) (Ref. 13) have shown that this instability is easily avoided by assuming that the streamwise convection terms are zero in reversed flow regions. It is apparent, however, that a loss of accuracy in the converged solution is incurred due to the negligence of the streamwise convection terms. As an improvement to the FLARE approximation, a windward finite difference operator may be used in the ALESEP code to calculate the streamwise gradient terms in reversed flow regions. The effects of using the more accurate windward differencing scheme are described in detail in Refs. 8 and 9.

The transition from laminar to turbulent flow in the separated shear layer may be modeled using one of three possible techniques available in the ALESEP code. A simple forced transition model in which the onset and length of transition are specified may be used in conjunction with either the Cebeci-Smith (Ref. 14) or the McDonald-Fish-Kreskovsky (Refs. 15 and 16) turbulence models. The forced transition model is based on the

streamwise intermittency distribution which was established by Dhawan and Narasimha (Ref. 17). The natural transition model of McDonald and Fish (Ref. 15) may also be used with the McDonald-Fish-Kreskovsky turbulence model to automatically predict the transition location. Finally, a correlation developed by Roberts (Ref. 18) using data from several transitional separation bubble experiments may be used to predict the instantaneous transition location. Details of these transition and turbulence models in conjunction with the ALESEP inviscid-viscous interaction technique may be found in Refs. 6-9.

A wall suction distribution may be input by the user to control the boundary layer growth or to investigate the effects of suction on a separation bubble. With this option, the amount of suction required to alleviate a separation bubble on an airfoil or infinite swept wing can be determined. Technical details of the wall suction boundary condition can be found in Ref. 9.

The present interaction iteration procedure is based on the inviscid-viscous iteration technique presented by Carter (Ref. 19) and is adopted to the present scheme as outlined in Fig. 3. The key feature of this iteration procedure is that the update formula permits the inverse boundary layer analysis to be directly linked to the inviscid analysis which accounts for displacement thickness effects. It was found by Kwon and Pletcher (Ref. 20) that convergence could be accelerated by making several inner loop passes through the Cauchy integral and the update formula with the boundary layer prediction of the edge velocity frozen at its current global iteration value. This technique is used in the present interaction iteration and has been found to significantly accelerate the global convergence rate of the scheme.

USER INSTRUCTIONS

Code Description

A flow chart of the ALESEP code is shown in Fig. 4. The code has been written to allow for one of two possible modes of operation to be performed. The first mode allows for a direct finite difference boundary layer calcuation for a prescribed edge velocity distribution. The second mode allows for an inviscid-viscous interaction calculation for a prescribed reference displacement surface and reference edge velocity distribution.

The ALESEP code is written in FORTRAN IV language and takes 206,000 octal word storage locations. Typically 20-40 global inviscid-viscous iterations are required to reduce residuals in inviscid-viscous edge velocities to 10^{-3}. On a Cyber 175 computer using the Cebeci-Smith turbulence model, a two-dimensional inviscid-viscous interaction calculation takes approximately 12 seconds per iteration. Using the McDonald-Fish-Kreskovsky turbulence model, an interaction calculation takes approximately 80 seconds per iteration. This increase in computing time is a result of the iterative solution of the turbulent kinetic energy equation required for this model. An inviscid-viscous interaction calculation on an infinite swept wing using the Cebeci-Smith turbulence model typically takes 17 seconds per iteration.

Input Description

The input to the ALESEP code is read in five separate blocks. The first block is a namelist file, MASTER, used to define parameters which control the mode of operation, the chordwise computational grid, and input/output options. The second block of input contains the prescribed reference pressure, reference displacement surface, free stream turbulence level and wall suction distributions. The third input block is a namelist file, INPUT, which defines the controlling parameters for the boundary layer solution procedure. The fourth block is used to define experimental data which may be used in subsequent plots of the results. Finally, the last block of information required for inviscid-viscous interaction cases is the chordwise velocity ratio, perturbation stream function, total enthalpy ratio, spanwise velocity ratio and eddy viscosity profiles at the inital station of the interaction region and the initial guess of the perturbation mass flow distribution.

The first three blocks of input information are necessary to execute a direct boundary layer calculation. The input variable, IFIN, located in the MASTER namelist must be set to 2 and INVRSE in the INPUT namelist must be set to 0. The computational grid is determined by the following variables:

Chordwise - IGRID, AK1, AK2, DS, MMAX, SSWTCH, SPIVOT, IPIVOT, AKI1, AKI2, IVGINX, IMAX (namelist MASTER)

Normal - DETA, AK, NMAX1 (namelist Input)

A laminar similarity solution is used at the initial station with a free stream Mach number, AMES, and gradient, BETAS = $(1/M_e)(dM_e/d\xi)$ prescribed in namelist INPUT. The user has a choice of transition and turbulence models through the definition of variables, STRANS, KTRAN, TRNLEN, and ITRBMD located in namelist INPUT. For ITRBMD = 0, the Cebeci-Smith turbulence model is used with transition occurring according to specified values of STRANS, KTRAN, and TRNLEN. For ITRBMD = 1 or 2, the McDonald-Fish or McDonald-Fish-Kreskovsky natural transition turbulence model is used and transition is predicted automatically.

For an inviscid-viscous interaction calculation, input blocks 1, 2, 3 and 5 are necessary. The input variable, IFIN, located in namelist MASTER, must be set to 3 and INVRSE in the INPUT namelist must be set to 1. A total of IQUIT global inviscid-viscous iterations are performed. The structure of the computational grid is determined by the same variables previously mentioned for a direct boundary layer calculation with some required constraints which are discussed below. Velocity ratios, perturbation stream funtion, total enthalpy ratio and viscosity profiles at the initial station of the interaction region are required in the fifth input block (NSTART=1 in INPUT namelist) and are obtained from a direct boundary layer calculation extending from the leading edge to the initial station of the inviscid-viscous interaction calculation located somewhat ahead of the laminar separation point. For INTERP=0 in namelist INPUT, the values of AK and NMAX1 which define the computational grid in the normal direction in namelist INPUT should be the same as that used in the direct boundary layer calculation. The value of DETA in namelist INPUT should be the value used in the direct boundary layer calculation scaled by $\sqrt{2\xi/\rho_e u_e r_0}\,\delta^*$ due to the different definitions of the normal coordinate used in the direct and inverse boundary layer formulations. This scaling is performed automatically in subroutine CONVRT at the last computational station of the direct boundary layer calculation when IPRNEW has been set to 1. The value of DETA for the interaction calculation can then be found in the converted profile information for the last station printed out at the end of the direct boundary layer calculation. The value of XCO in namelist INPUT for the interacting calculation should be defined as the value of XC at the last computational station of the direct calculation. The value of AHO also in namelist INPUT should be defined as the value of AH at the last computational station of the direct calculation scaled by the inverse over direct DETA ratio. As in the direct calculation, the user has a choice of transition and turbulence models through definition of the input variables STRANS, KTRAN, TRNLEN, and ITRBMD. In addition to the models described in the direct boundary layer calculation, a forced transition model may be used with the McDonald-Fish (Ref. 15) or McDonald-Fish-Kreskovsky (Ref. 16) turbulence models by setting KTRAN=IQUIT and defining STRANS and TRNLEN. To use the natural transition model of McDonald and Fish with these turbulence models, KTRAN must be set to 0. Special windward differencing may be used in the reverse flow region of the separation bubble through definition of IWINDD and IWINDG in namelist INPUT. Detailed results using the different turbulence models and windward differencing scheme may be found in Refs. 6-9.

Detailed Input Description

Input Block 1:

The first block of input is read in from subroutine Main in a namelist called MASTER. This information defines the chordwise computational mesh and parameters controlling input and output.

INPLT	Number of global iterations between calls to plotting routines.
IQUIT	Total number of global inviscid-viscous iterations to be computed. Set IQUIT=1 for a direct boundary layer calculation.
RFDT	Relaxation factor applied to the perturbation mass flow in the inviscid-viscous update procedure.
RFVN	Relaxation factor for the injection velocity to represent viscous effects (inactive, set = 1.0).
MMAX	Total number of chordwise grid points used in the boundary layer calculation.
SSWTCH	Arclength location measured from the nose of the body where the boundary layer calculation is initiated.
IPLOT	Value of the global iteration counter at which the plot subroutines are first called.
AK1	The ratio of adjacent grid sizes used in generating the boundary layer grid in the chordwise direction beginning at SSWTCH.
AK2	The ratio of adjacent grid sizes at SSTING where SSTING > SSWTCH.
SSTING	Location where secondary boundary layer stretching, AK2, in the chordwise direction is initiated.
DS	Increment in arclength used at start of boundary layer mesh which begins at SSWTCH.
IVT1	Index in the inviscid chordwise arrays where the tangential velocity VT is read into program (inactive, set = 0).
IVT2	Last index where VT (I) is read into program (inactive, set = 0).
ISMOTH	If equals zero, no smoothing is used; if equals 1, the smoothed VT distribution is used.

MIT2 — Inactive, set = 0.

SSTOP — Arclength location measured along the reference surface where the calculation is terminated downstream.

ITEK — Inactive, set = 0.

IAXI — If equals 0, two dimensional or infinite swept wing flow; if equals 1, axisymmetric flow.

IFIN — If equals 1, program terminates after initial inviscid calculation (this initial inviscid calculation is made with no boundary layer effect). If equals 2, program terminates after initial inviscid calculation and one pass through boundary layer solver. If equals 3, program operates in full interactive mode and terminates after IQUIT iterations.

IFILET — If equals 1, the offset distance between the circular arc, hard surface and a cubic filet coordinate surface will be computed (set = 0).

XT1
XT2
XSTING
YSTING
RADIUS
THICK
XLO — Inactive, set = 0.

IWRPMF — If equals 0, bypass. If equals 1, the perturbation mass flow distribution is written to unit 13 for later restart.

CHORD — Reference length which allows rescaling the original chordwise distance measured from the nose to an alternate coordinate system measured from another location located at distance XOR from the nose.

XOR — Chordwise location in the original coordinate where the origin of the new coordinate x/c is located. Both XOR and CHORD are used to shift and rescale the axial coordinate used in the program.

SIO — Shift factor which allows the inviscid calculation to start at a downstream location on an open nose body where the flow is not disturbed near the nose. SIO is the distance from the original nose of the body to the downstream location where the inviscid calculation is started (set = 0).

IPLTX — If equals zero, bypass. If equals 1, then the program generates a plot file which will later generate the plots on a TEKTRONICS unit for studying the resuts of individual iterations. The user may select the global iteration(s) for which plots are to be generated.

NDCP — If equals 0, bypass. If equals 1, then experimental CP data versus x/c will be read into the program and plotted on CALCOMP plot from subroutine PLOTCP.

NDDT — If equals 0, bypass. If equals 1, then experimental displacement thickness distribution versus x/c will be read into the program and plotted along with the computed displacement thickness distribution.

NDCF — If equals 0, bypass. If equals 1, then experimental skin friction data versus x/c will be read into the program and plotted along with the computed skin friction distribution.

NDUE — If equals 0, bypass. If equals 1, experimental tangential velocity data versus x/c will be read in and plotted along with the tangential velocity computed solution.

IPRINT(I) — Array containing global iteration values at which station output is printed (array length = 100).

IGRID — If equals 0, inviscid and boundary layer mesh are generated by their own parameters.

If equals 1, inviscid mesh is set by its own parameters (IMAX, SINO, AKI1, AKI2, SPIVOT, IPIVOT, IVGINX - as described below) and boundary layer mesh is set equal to the inviscid mesh for S > SSWTCH.

If equals -1, inviscid mesh is set equal to the mesh at which geometry is input (i.e., XO, YO, SO) and boundary layer mesh is set equal to inviscid mesh for S > SSWTCH.

If equals -2, inviscid mesh is set equal to the mesh at which geometry is input and boundary layer mesh is generated by its own parameters.

IMAX — Maximum number of points in chordwise direction for the inviscid mesh.

SINO — The arclength at first point in inviscid mesh, or SI(1).

AKI1 — Ratio of adjacent grid sizes used in generating the inviscid grid in the chordwise direction between SINO and SPIVOT.

AKI2 — Ratio of adjacent grid sizes used in generating the inviscid grid in the chordwise direction for S > SPIVOT.

SPIVOT — Arclength at which geometric progression constant changes from AKI1 to AKI2.

IPIVOT — Chordwise mesh index at SPIVOT.

IVGINX — If equals 0, uniform inviscid mesh; if equals 1, a variable mesh using AKI1, AKI2 is used.

LOADDT — If equals 0, reference displacement thickness, DTO = 0; if equals 1, DTO is read in the second input block.

LOADSI — If equals 0, compute arclength from XO, YO; if equals 1, arclength is read in the second input block.

LOADCP — If equals 0, compute CPO using Cauchy integral; if equals 1, CPO is read in the second input block.

SWPANG — Sweep angle (degrees) of infinite swept wing; should be 0.0 for two-dimensional calculations.

Input Block 2:

The second block of input is read in from subroutine INVO in a formated block. This block of information contains the reference displacement surface, reference velocity, edge turbulence level, and wall suction distributions.

ITITLE — Card 1: A brief title for the configuration (12A6).

IXY — Card 2: Number of points at which inviscid input including reference solution is read in. (I3)

XO — Card 3: Cartesian distance in horizontal direction.

YO — Cartesian distance in vertical direction.

SO — Arclength measured from stagnation point.

CPO — Pressure coefficient, $(P - P_\infty)/\frac{1}{2}\rho_\infty Q_\infty^2$, from reference solution.

DTO — Displacement thickness from reference solution.

TUO — Edge turbulence level.

RVWO — Wall suction level, $\rho v_w/\rho_\infty Q_\infty$

NOTE: IXY values of XO, YO, SO, CPO, DTO, TUO, RVWO are read in (4F10.7, form E10.5, 2F10.7 format.

GAM — Card 4: γ, the specific heat ratio.

AMINF — M_∞, freestream Mach number; set to 0.0 for incompressible flow.

NOTE: GAM, AMINF are read in with 2F10.7 format.

Input Block 3:

The third block of input is read in from subroutine TURBID in a namelist called INPUT. The information in this block is used to define the computational grid in the normal direction, the reference free stream flow conditions, the transition and turbulence model, and further output parameters.

NMAX1 — Total number of grid points which are used across the boundary layer in the normal direction.

NMXOLD — Total number of grid points in the initial profile of the interaction calculation.

DETA — Increment in the transformed normal grid spacing, $\Delta\eta$, adjacent to the wall.

AK — Ratio of adjacent step sizes in the eta, η, direction which is used to generate the mesh across the boundary layer. A uniform mesh (AK=1) is not currently allowed.

INVRSE — If equals 0, then a direct boundary layer calculation is to be performed; if equals 1, then an interacting boundary layer calculation is to be performed.

JPFMAX — Total number of points used in the initial guess for the perturbation mass flow distribution, PMFIN to be read in the fifth input block. In the case of restart, i.e., if IRESTR equal to 1, then JPFMAX should be set equal to MMAX.

IRESTR — If equals 0, bypass; if equals 1, then a restart capability is used. In this case, the input array for PMFIN obtained from a previous calculation are read from unit 12.

INTERP — If equals 0, bypass; if equals 1, then profiles at the initial interaction station are to be interpolated onto the interaction grid (set = 0).

IPRNEW — If equals 0, bypass. If equals 1, the computed profiles at M=MMAX from a direct boundary layer calculation are converted from direct variables to inverse variables. Principally, this involves a change in the stream function and in the transformed normal coordinate eta, η.

NSTART — If equals 0, program is initiated with the solution of the self-similar equations. If equals 1, profiles for the velocity ratios, stream function, total enthalpy ratio, and viscosity versus eta, η, are read from the fifth input block.

NQMAX — Maximum number of column iterations which can be used in the boundary layer solution procedure.

NPRRES — If equals 0, bypass; if equals 1, boundary layer residual information will be printed.

MFIG(I) — Array of index values of the chordwise stations where profiles in the boundary layer solution are printed (array length = 100).

JMAX — The maximum number of boundary layer profiles to be printed out. If JMAX equals zero, then there will be no profiles printed, in which case, MFIG is set to a hundred zeros.

ITPRO — Global iteration counter at which detailed boundary layer residual and profile information is printed out.

PMFO — Multiplicative factor which is used to rescale the perturbation mass flow.

AHO — Initial value of the static temperature integral across the boundary layer which appears explicitly in the boundary layer equations. This parameter is needed when NSTART = 1, i.e., the boundary layer solution is initiated with specified profiles instead of internally generated self-similar solutions.

XCO — Initial value of the transformed (Levy Lees) ξ variable which is needed when NSTART = 1.

RESG — Maximum change in the dependent variable allowed between successive column iterations in the boundary layer calculation. Typical value used is 10^{-4}.

IPLOT(I) — Array containing an index to determine which plots are desired by the user (array length = 8). If IPLOT(I) is equal to 0, plot is bypassed; if IPLOT(I) is equal to 1, then the plot is made. The following order is used in the plotting subroutine. Plot #1 is DT (*, displacement thickness) versus x/c. Plot #2 is CF versus x/c. Plot #3 is UE (VT, the inviscid tangential velocity) versus x/c. Plot #4 is Beta (pressure gradient parameter) versus x/c. Plot #5 is VN versus x/c. Plots #6, 7 and 8 control the plotting of profiles across the boundary layer.

WAKCON, SWK1, SWK2 — The Clauser constant in the Cebeci-Smith eddy viscosity law is varied linearly from 0.0168 at S=SWK1 to 0.0168/WAKCON at S=SWK2 (set WAKCON=1.0, SWK1=10000, SWK2=20000 to deactivate this option).

YORIGN(I) — Array containing the origin of the Y axis for each of the respective plots listed above (array length = 8).

YSCALE(I) — Array containing the scale factor for each of these plots (array length = 8). If the scale factor exceeds 1000, then the scale for these particular plots is determined automatically.

YIN(I) Array containing the number of inches for Y axis in each of the plots listed above (array length = 8).

XORIGN(I) Array containing the origin for X axis in each of these plots (array length = 8).

XSCALE(I) Array containing the scale factor for X axis (array length = 8); Again if this parameter exceeds 1000, the scale factor is determined automatically.

XIN(I) Array containing the number of inches used along the X axis in the respective plots (array length = 8).

XL Reference dimensional length used to convert the present X to a dimensional distance.

NDATA If equals 0, bypass; if equals 1, experimental data will be read from the fourth input block to be plotted with numerical results.

BETAS Value of the pressure gradient parameter, (1/M)(dM/dS), which is required in the self-similar solution.

AMES Value of the streamwise Mach number required in the self-similar solution; set to 0.0 for incompressible flow.

GW Value of the total enthalpy ratio at the wall.

TINFD Reference free stream temperature in degrees Rankine which is required in the Sutherland law for molecular viscosity.

PRT Turbulent Prandtl number.

PR Prandtl number.

REINF Reynolds number based on the reference (free stream) properties and based on the length which is used to nondimensionalize the coordinate used in the calculation.

STRANS Nondimensional distance along the body at which instantaneous transition is assumed to occur.

KTRAN For Cebeci-Smith turbulence model - (ITRBMD=0): equal to 0, fully laminar calculation; equal to 1, instantaneous transition occurs at STRANS; equal to 2, transition occurs over TRNLEN starting at STRANS; equal to 5, transition occurs instantaneously according to the Roberts transition correlation. For McDonald-Fish turbulence model - (ITRBMD=1,2): KTRAN is the global iteration number when the McDonald-Fish natural transition model begins to predict the transition location. Forced transition over TRNLEN starting at STRANS is used for all global iterations prior to KTRAN.

IWINDD — Global iteration number when convection windward difference operation is effective.

IWINDG — If equals 0, do not use windward differencing in energy equation; if equals 1, use windward differencing on convection terms in energy equation starting on the IWINDD global iteration.

IWINDS — If equals 0, do not use windward differencing on stream function; if equals 1, use windward differencing on stream function in momentum and energy equations starting on the IWINDD global iteration. This option is not recommended at this time (set = 0).

ITRBMD — If equals 0, Cebeci-Smith turbulence model; if equals 1, McDonald-Fish turbulence model; equals 2, McDonald-Fish-Kreskovsky turbulence model.

ALFSEP — Multiplication factor on the Clauser constant in the three-dimensional Cebeci-Smith turbulence model from the point of transition to downstream.

Input Block 4:

The fourth block of input is read in from subroutine TURBID in a formated block only when NDATA $\neq$ 0. This block of information contains experimental data which may be plotted along with the numerical results.

IDST
ICFST — Card 1: Number of experimental data points to be read for DTE, CFE, or U1 (I3). Data is read in order of DTE, CFE, and then U1.
IUST

J — Card 2: Index of experimental data point (I3).

XDTE
XCF — Cartesian distance in horizontal direction for experimental values of DTE, CFE or U1.
XU1

DTE — Experimental values of δ^* (NDDT $\neq$ 0)
CFE — Experimental values of C_f (NDCF =/0)
U1 — Experimental values of U_e^f NDUE = Ø)

NOTE: IDST, ICFST, or IUST values of
J, XDTE, XCF or XU1 and
DTE, CFE, or U1 are read in (I3, 2F8.4) format
Experimental data points are read in the order of
DTE(δ^*), CFE(C_f), followed by U1(U_e)

Input Block 5:

The fifth block of input is read in from subroutine TURBID in a formated block only when NSTART=1. This block of information contains profiles for the chordwise velocity ratio, perturbation stream function, total enthalpy ratio, and spanwise velocity ratio to be used at the initial station of the interaction calculation. For ITRBMD $\neq$ 0, the scalar quantities necessary to initialize the turbulent kinetic energy equation as well as the eddy viscosity profiles are also read in this block. The initial guess distribution for the perturbation mass flow parameter is also read in this formated block.

Values of PSI11, PSI12, PSI31, PSI32, EMFK, ALINF, AlMFK, DTINC, DELTU, and A2MA3 are read in 5F16.8 format when ITRBMD $\neq$ 0. These variables define the scalar quantities required for the McDonald-Fish-Kreskovsky turbulence model at the inital station of the interaction case. These values are stored in unit 14 of a direct boundary layer calculation when IPRNEW = 1. See the output description section for the definition of these variables.

NMAX values of YNI, EPSBB, and EPSHB in a 3E16.8 format are read next when ITRBMD $\neq$ 0. These arrays define the viscosity profiles for the McDonald-Fish-Kreskovsky turbulence model at the initial station. These values are stored in unit 14 of a direct boundary layer calculation when IPRNEW = 1. See the output description for the definition of these variables.

NMXOLD values of NN, ETABD, FBD, PSI, GBD and WBD are read in a I5, 5E16.8 format. These arrays define the chordwise velocity ratio, perturbation stream function, total enthalpy ratio and spanwise velocity ratio profiles at the initial station. These values are stored in unit 14 of a direct boundary layer calculation when IPRNEW = 1. See the output description section for the definition of these variables.

JPFMAX values of PMFIN in a 7F10.7 format followed by JPFMAX values of SPMF in the same format are read in to define the initial distribution of the perturbation mass flow.

Output Description

An example test case for a transitional separation bubble on a flat plate swept 26.5 degrees to the free stream is given in Appendix A. Detailed experimental data for this flow was obtained by Horton (Ref. 4) at a free stream velocity of 51.9 ft./sec and a unit Reynolds number of 2.77×10^4 per inch. The free stream turbulence level was .0025.

In this case, the reference pressure distribution was taken to be the invisid solution calculated by Woodward (Ref. 21) for Horton's configuration. A direct boundary layer calculation was run from the leading edge stagnation point of the flat plate to x=7.0 inches using the reference pressure distribution as the edge boundary condition. The chordwise velocity ratio, perturbation stream function, total enthalpy ratio, and spanwise velocity ratio profiles were taken at x=7.0 inches from the direct calculation and used as initial profiles for the interacting calculation. The reference displacement thickness was calculated from a fully turbulent direct boundary layer calculation using the reference pressure distribution as the edge boundary condition. A total of 91 grid points were distributed evenly between x=7.0 and x=16.0 inches in the interaction calculation. The three-dimensional Cebeci-Smith turbulence model as described in Ref. 22 was used with transition being predicted with the Roberts transition correlation. Windward differencing was used in this calculation although a similar calculation using the FLARE approximation was found to give nearly the same results. A comparison between the predicted experimental pressure and displacement thickness distributions is shown in Figs. 5a and 5b. The predicted skin friction distributions are shown in Fig. 5c. Further comparisons of predicted results using the ALESEP technique with experimental data may be found in Refs. 6-9.

The notation used in the output of the ALESEP code conforms to that used in the description of the governing equations in Refs. 6-9. A dictionary of the variables used in the output can be found in the following section.

Reference Distribution Output

XO, YO
XB, YB — Input Cartesian coordinates of body shape.

SO — Input arclength.

CPO — Input reference pressure coefficient.

DTO — Input reference displacement thickness.

TUO, TUB — Input boundary layer edge turbulence level.

RVWO, RVWB — Input wall suction level, $\rho v_w / \rho_\infty Q_\infty$

VT — Input boundary layer edge velocity at same location as input body coordinates.

SI — Body arclength measured from stagnation point at nose of body to same location as input body coordinates.

XOC — Shifted and rescaled value of chordwise coordinate, XO. XOC = (XO - XOR)/CHORD

PMF, PMFB — Input perturbation mass flow paramter, $m = \rho_e u_e r_o^i \delta^*$ (interacting case only).

S — Body arclength measured from stagnation point to boundary layer computational stations.

SPMF — Body arclength measured from stagnation point to boundary layer stations where perturbation mass flow is defined.

XOCBL — Same as XOC, but measured from stagnation point to boundary layer computational stations.

RO — If flow is axisymmetric, RO is the body radius; for 2-D or infinite swept wing flow, RO=1.

VTBL — Boundary layer edge velocity at boundary layer computational stations.

Similarity Solution Output

NQ — Boundary layer column iteration counter.

RES1 — Maximum change in dependent variable between two successive column iterations.

AHO — Static temperature integral, h.

FNW — Normalized wall shear, $\left.\frac{\partial F}{\partial \eta}\right|_{\eta = 0}$ where $F = u/u_e$

ETA — Transformed coordinate normal to surface, η .

F — Chordwise velocity ratio, $u/u_e = F$.

SF — Transformed stream function, $\tilde{f}$.

G — Total enthalpy ratio, $H/H_e = G$.

W — Spanwise velocity ratio, $w/w_e = W$

Initial Profiles

If NSTART equals 0, then the initial profile is the same as the laminar self-similar solution. If NSTART equals 1, then the initial profiles are

the same as those which are read in (ETABD = ETA, FBD = F, PSI = SF, GBD = G, WBD = W). Note however that if INTERP equals 1, then these profiles have been interpolated onto a new η-mesh.

Station Output (Summary Chart No. 1)

M — Chordwise station index

PMF — In direct calculation, this is $\sqrt{2\xi}$ where ξ is the streamwise Levy Lees variable; in an interacting case this is the prescribed distribution of perturbation mass flow, $m = \rho_e u_e r_o^1 \delta^*$.

PMFCHK — This is $\rho_e u_e r_o^i \delta^*$; in an inverse calculation, this quantity is a check to see that the computed velocity profiles give the same displacement thickness as that prescribed and thus, in the interacting mode, PMFCHK should always be equal to PMF.

BETA — Pressure gradient parameter, $\beta = (1/M_e)(dM_e/d\xi)$.

BETCHK — Calculated pressure gradient parameter (interacting case only).

UEP — Boundary layer edge velocity. In direct mode, UEP is the same as the prescribed VTBL; in the inverse mode, it is computed as part of the solution.

AMACH — Boundary layer edge Mach number.

AH — Static temperature integral, $h = \int_0^\infty (T/T_e - 1)d\eta$.

CF — Chordwise component of skin friction coefficient based on free stream dynamic head, $C_f = \tau_{w_x}{}^*/\frac{1}{2}\rho_\infty^* Q_\infty^{*2}$ where asterisk denotes dimensional quantity.

CFZ — Spanwise component of skin friction coefficient based on free stream dynamic head, $C_{fz} = \tau_{w_z}^*/\frac{1}{2}\rho_\infty^* Q_\infty^{*2}$

ALPHW — Angle of limiting streamline relative to chordwise direction (degrees)

NMCH — Index where inner and outer edge viscosity laws are matched (Cebeci-Smith turbulence model).

RTHETA — Reynolds number based on momentum thickness.

McDonald-Fish-Kreskovsky Turbulence Model Output (ITRBMD $\neq$ 0)

MREF — Reference free stream Mach number. Same as AMINF in third input block.

TREFD	Reference free stream static temperature. Same as TINFD in INPUT namelist.
TREF	Nondimensional reference free stream static temperature.
REYREF	Reference free stream Reynolds number. Same as REINF in INPUT namelist.
ME2	Boundary layer edge Mach number at current streamwise station.
UE2	Nondimensional boundary layer edge velocity at current streamwise station.
TE2	Nondimensional boundary layer edge temperature at current streamwise station.
RHOE2	Nondimensional boundary layer edge density at current streamwise station.
TU2	Boundary layer edge turbulence level at current streamwise station.
RO2	Geometry coefficient, RO, at current streamwise station.
QE2	Boundary layer edge perturbation velocity magnitude at current streamwise station.
MUE2	Nondimensional boundary layer edge molecular viscosity at current streamwise station.
ME1	Boundary layer edge Mach number at previous streamwise station.
UE1	Nondimensional boundary layer edge velocity at previous streamwise station.
TE1	Nondimensional boundary layer edge temperature at previous streamwise station.
RHOE1	Nondimensional boundary layer edge density at previous streamwise station.
RO1	Geometry coefficient, RO, at previous streamwise station.
QE1	Boundary layer edge perturbation velocity magnitude at previous streamwise station.
ACLINF	Free stream dissipation length, L, at current streamwise station.
ALINFN	Free stream mixing length, ℓ, at current streamwise station.

ALINFO	Free stream mixing length, ℓ, at previous streamwise station.
A1MFKN	Structural coefficient, a_1, at current streamwise station.
A1MFKO	Structural coefficient, a_1, at previous streamwise station.
A2MFK	Structural coefficient, a_2, at current streamwise station.
A3MFK	Structural coefficient, a_3, at current streamwise station.
BLTHK	Boundary layer thickness at current streamwise station scaled by $\sqrt{R_{e_\infty}}$.
DELIN	Inner boundary layer thickness at current streamwise station.
DELTU2	Value of turbulent displacement thickness, δ_τ, at current streamwise station.
DELTU1	Value of turbulent displacement thickness, δ_τ, at previous streamwise station.
DTINC2	Incompressible displacement thickness at current streamwise station.
VEDGE	Nondimensional boundary layer edge normal velocity component, v_e, at current streamwise station.
NDELTU	Index of normal grid point where DELTU2 is located.
NINNER	Index of normal grid point where DELIN is located.
PSI11N	Value of first set of terms of the ϕ_1 integral in turbulent kinetic energy equation at current streamwise station.
PSI12N	Value of second set of terms of the ϕ_1 integral in the turbulent kinetic energy equation of the current streamwise station.
PSI110	Value of first set of terms of the ϕ_1 integral in the turbulent kinetic energy equation at the previous streamwise station.
PSI120	Value of second set of terms of the ϕ_1 integral in the turbulent kinetic energy equation at the previous streamwise station.
PSI21N	Value of the ϕ_2 integral in the turbulent kinetic energy equation at the current streamwise station.
PSI31N	Value of the first set of terms of the ϕ_3 integral in the turbulent kinetic energy equation at the current streamwise station.
PSI32N	Value of the second set of terms of the ϕ_3 integral in the turbulent kinetic energy equation at the current streamwise station.

EMFK — Value of the source term, E, in the turbulent kinetic energy equation at the current streamwise station.

RTAU — Value of the turbulent Reynolds number, R_τ, at the current streamwise station.

RTHEAT — Value of the correlated momentum thickness Reynolds number, $\tilde{R}_\theta$, at the current streamwise station.

A2MA3N — Value of the difference of structural coefficient, a_2-a_3, at the current streamwise station.

Profile Output

ETA — Transformed normal coordinate, η .

YBL — Nondimensional physical distance from surface.

F2 — Chordwise velocity ratio, u/u_e.

SF2 — Transformed stream function, $\tilde{f}$.

G2 — Total enthalpy ratio, H/H_e.

EPSBAR — $1 + \epsilon/\mu$ where ϵ is the eddy viscosity coefficient and μ is the molecular viscosity coefficient.

RHOMUR — $\ell = \rho\mu/\rho_e\mu_e$.

T — Static temperature ratio, T/T_e.

W2 — Spanwise velocity ratio, w/w_e

BETZ — Streamline angle relative to free stream direction (degrees).

ALPHZ — Streamline angle relative to chordwise direction (degrees).

For ITRBMD $\neq$ 0, the following additional profiles are printed:

YN — Nondimensional physical distance from the surface scaled by $\sqrt{Re_\infty}$

YPLUS — Nondimensional scaled distance from the surface, $y+ = y\sqrt{\tau/\rho/\nu}$

DUDY — Nondimensional velocity normal gradient, $\partial F/\partial YN$

TAU — Shear stress, $(\mu+\mu_T)\,\partial u/\partial YN$

DAMP — Damping factor squared, $\mathcal{D}^2$.

FUN — Local mixing length distribution in normal direction.

FMFK — McDonald-Kreskovsky function, f_τ, on mixing length formula.

Station Output (Summary Chart No. 2)

M — Chordwise index.

XLE — Cartesian coordinate of station location.

S — Chordwise arclength location

DT* — Scaled displacement thickness, $\delta^* \sqrt{Re_\infty}$.

THETA* — Scaled momentum thickness, $\theta \sqrt{Re_\infty}$.

CPBLBR — Cp obtained from interacting boundary layer calculation referenced to chordwise dynamic head, $Cp = (P^*-P_\infty^*)/\frac{1}{2}\rho_\infty U_\infty^{2*}$ free stream.

CPBL — C_p obtained from interacting boundary layer calculation, referenced to free stream dynamic head, $Cp = (P^*-P_\infty^*)/\frac{1}{2}\rho_\infty^* Q_\infty^{*2}$

UEP — u_e obtained from interacting boundary layer calculation.

QW — Heat transfer coefficient at the wall.

STAN — Stanton number.

STRINT — Intermittency parameter in chordwise direction.

CFX — Scaled chordwise skin friction coefficient, $c_f \sqrt{Re_\infty}$.

Summary of Convergence History

INTRAC — Interaction global iteration counter.

DDTMAX — Maximum change in DT.

RMSDT — Root mean square change in DT.

SMDT — Chordwise arclength location where DDTMAX occurs.

DUEMAX — Maximum change in UE.

RMSUE — Root mean square change in UE.

SMUE — Chordwise arclength location for maximum change in UE.

DSFMAX Maximum change in perturbation stream function, $\tilde{f}$.

DFMAX Maximum change in velocity ratio, F.

DGMAX Maximum change in total enthalpy ratio, G.

Brief Description of Files

The following files are used to write information for plotting, restart, and interaction purposes.

Unit Number	Purpose
8	Write velocity and temperature profiles to be used for plotting purposes later on (TURBID).
9	Write stream function profile to be used for plotting purposes later on (TURBID).
10	Write eddy viscosity coefficient profile to be used for plotting purposes later on (TURBID).
12	Read information for restart run (TURBID).
13	Write information for later restart (WR13).
14	Write the profiles in inverse variables from a direct boundary layer run at the last chordwise station (CONVRT).
17	Write the weak interaction solution from a direct boundary layer run for use as a reference solution (TURBID).
18	Direct access file to store information for windward differencing scheme (TURBID).
22	Write station quantities for Tektronics plotting (WR22).

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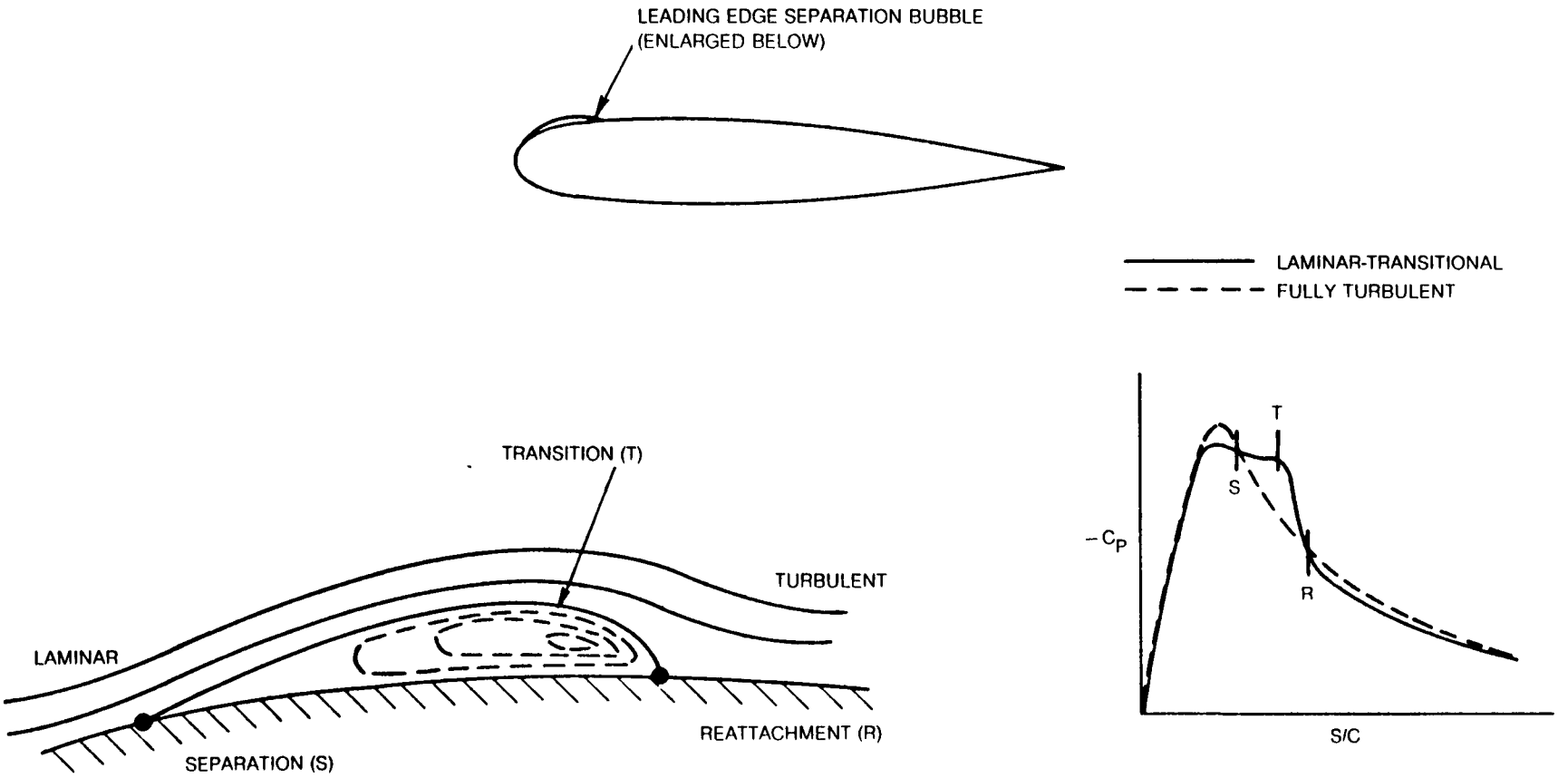

Fig. 1 Schematic diagram of airfoil laminar-transitional separation bubble and pressure distribution

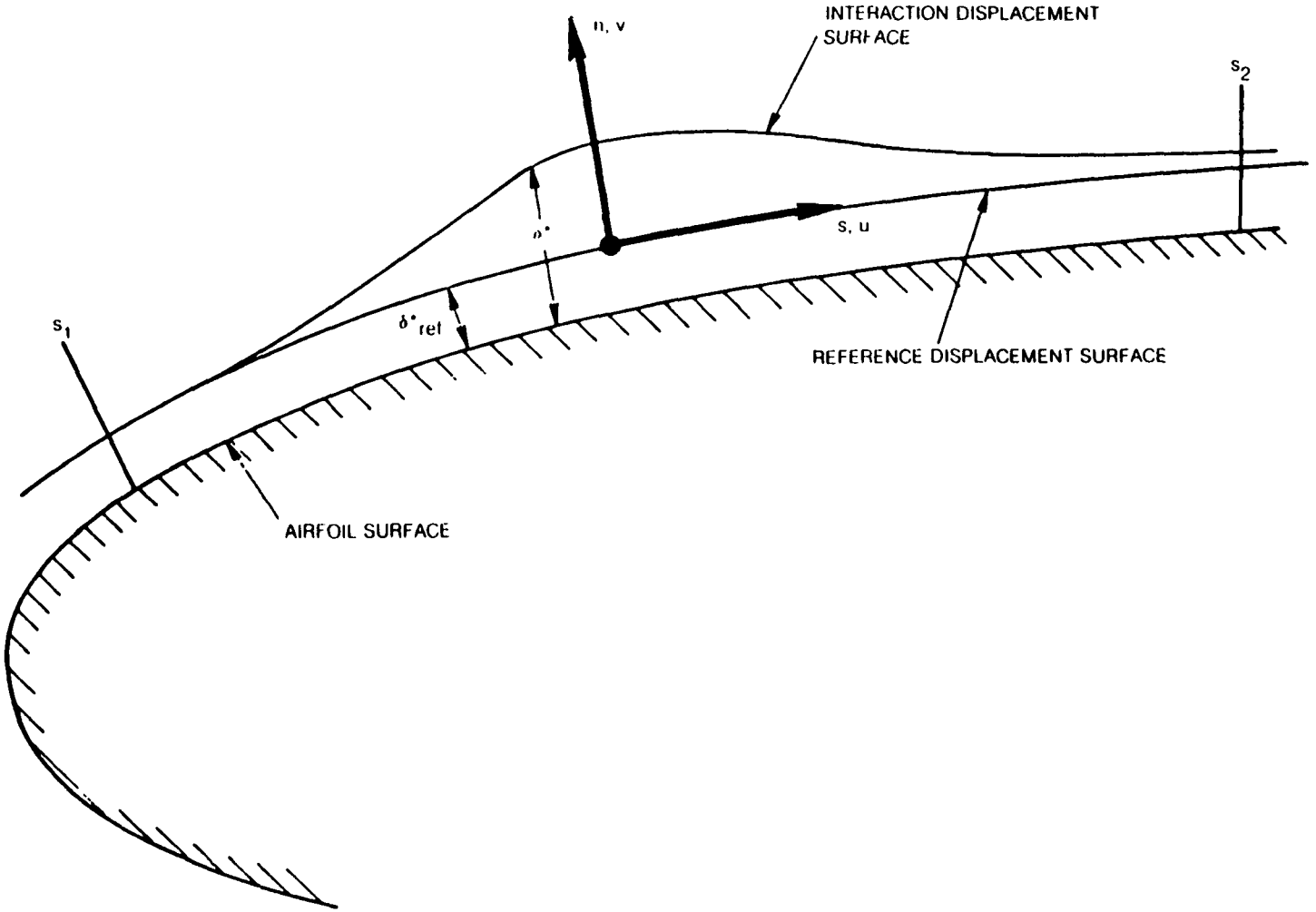

Fig. 2 Local interaction region coordinate system

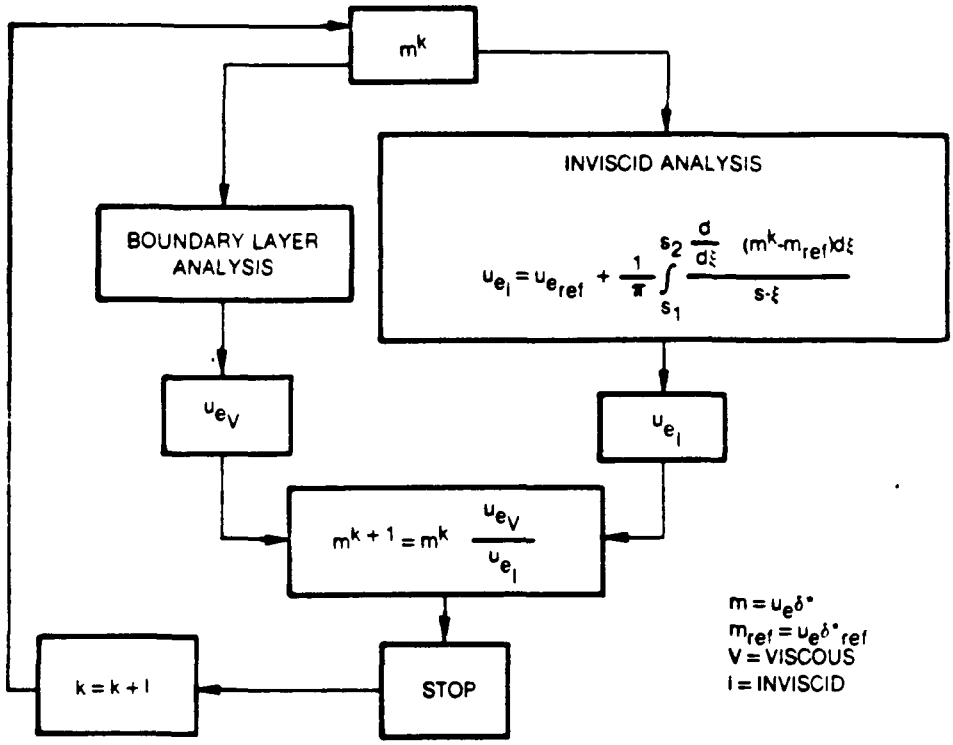

Fig. 3 Inviscid-viscous iteration procedure

82-6-7-3

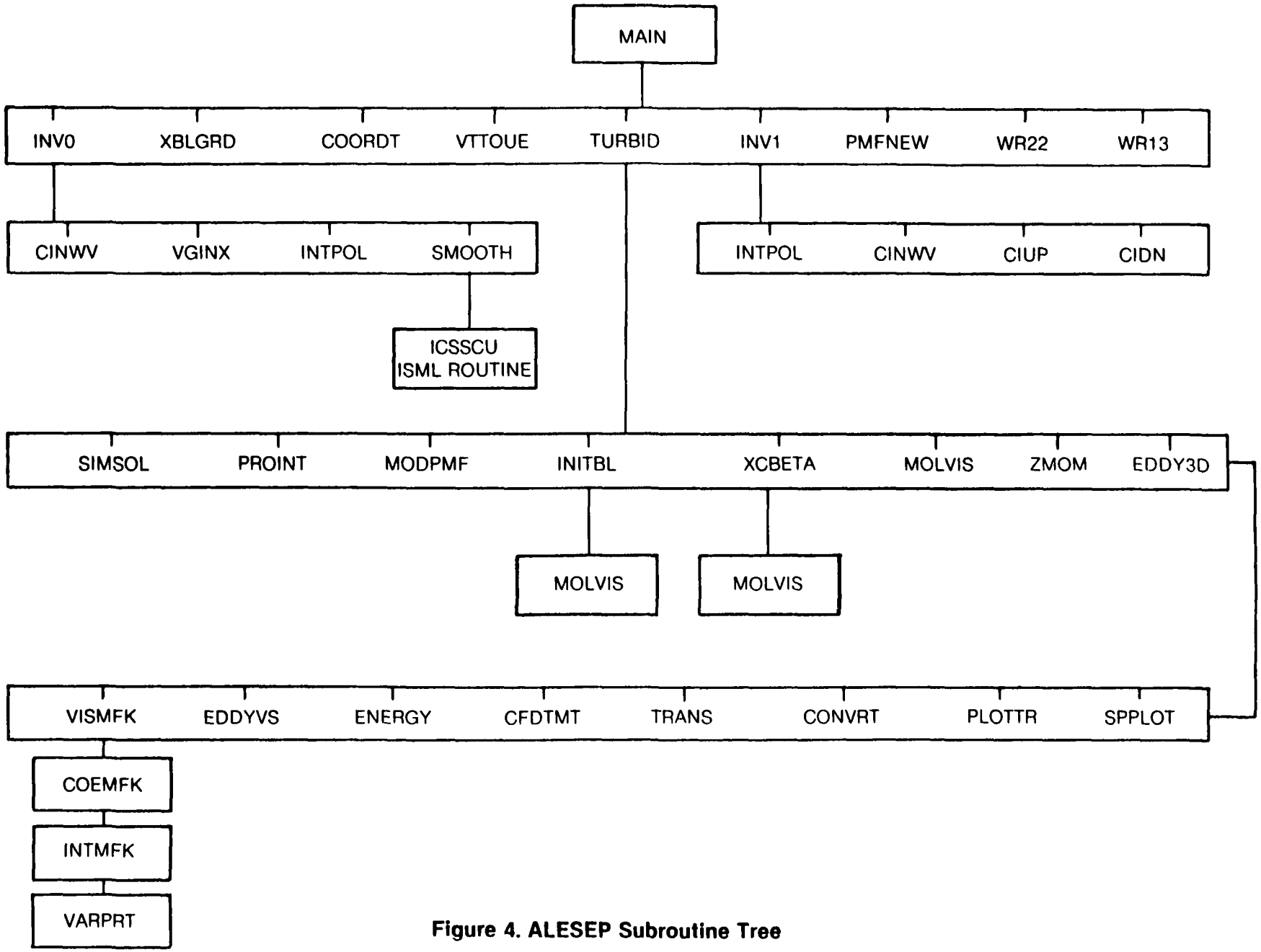

Figure 4. ALESEP Subroutine Tree

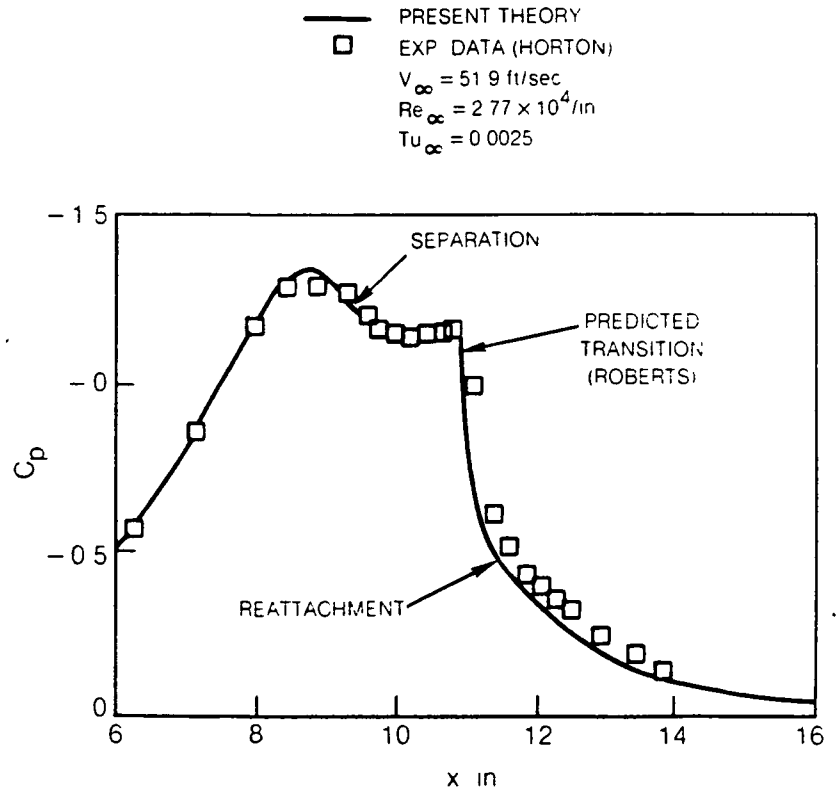

Figure 5a. Predicted Pressure Distribution

85-8-88-3

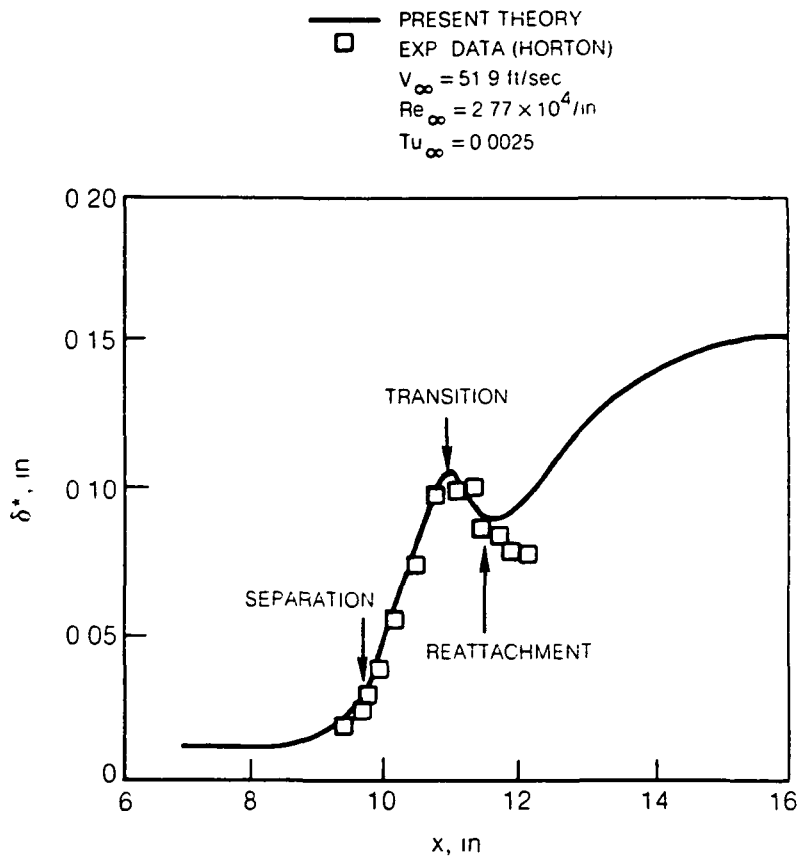

Figure 5b. Predicted Displacement Thickness Distribution

85-8-88-2

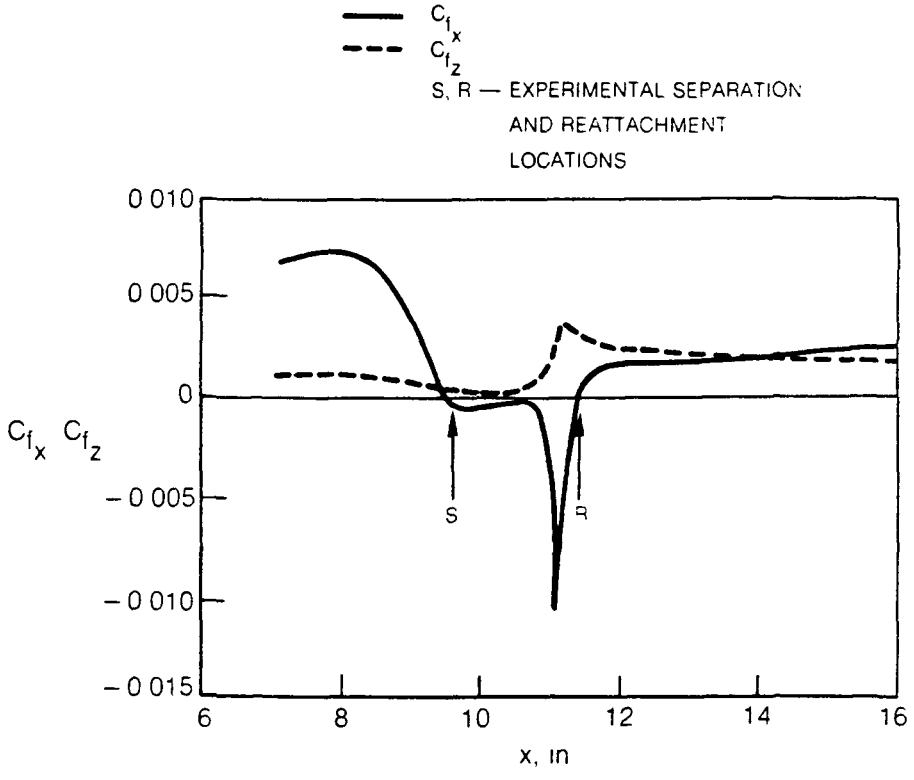

Figure 5c. Predicted Skin Friction Distributions

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5.40C0C0	.CC0000	.000000	-.364306.17654-001	.C02500	.00
5.500000	.CC0000	.000000	-.384224.17588-001	.C02500	.00
5.60C0C0	.CC0000	.000000	-.404556.17525-001	.C02500	.00
5.70C0C0	.CC0000	.000000	-.425462.17459-001	.C02500	.00
5.800000	.CC0000	.000000	-.447453.17376-001	.C02500	.00
5.90C0C0	.CC0000	.000000	-.471030.17266-001	.C02500	.00
6.00C00C	.CC0000	.000000	-.495939.17141-001	.C02500	.00
6.100000	.CC0000	.000000	-.521725.17016-001	.C02500	.00
6.20C0C0	.CC0000	.000000	-.548323.16892-001	.C02500	.00
6.30C0C0	.CC0000	.000000	-.576019.16762-001	.C02500	.00
6.40C000	.CC0000	.000000	-.604924.16624-001	.C02500	.00
6.50C0C0	.CC0000	.000000	-.634757.16489-001	.C02500	.00
6.60C0C0	.CC0000	.000000	-.665423.16356-001	.C02500	.00
6.700000	.CC0000	.000000	-.697292.16219-001	.C02500	.00
6.80C000	.CC0000	.000000	-.730799.16070-001	.C02500	.00
6.900000	.CC0000	.000000	-.765653.15919-001	.C02500	.00
7.000000	.CC0000	.000000	-.801264.15777-001	.C02500	.00
7.10C000	.CC0000	.000000	-.837140.15652-001	.C02500	.00
7.20C0C0	.CC0000	.000000	-.872957.15549-001	.C02500	.00
7.30C0C0	.CC0000	.000000	-.908661.15463-001	.C02500	.00
7.400000	.CC0000	.000000	-.944498.15389-001	.C02500	.00
7.500000	.CC0000	.000000	-.980881.15318-001	.C02500	.00
7.60C000	.CC0000	.000000	-1.018345.15243-001	.C02500	.00
7.70C0C0	.CC0000	.000000	-1.057284.15157-001	.C02500	.00
7.80C0C0	.CC0000	.000000	-1.097335.15071-001	.C02500	.00

ORIGINAL PAGE IS
OF POOR QUALITY

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14.000001    .CC0000    .000000  -.131884.17592+000    .C02500    .00
14.100001    .CC0000    .000000  -.125654.17775+000    .C02500    .00
14.200001    .CC0000    .000000  -.119530.17965+000    .C02500    .00
14.300001    .CC0000    .000000  -.113554.18156+000    .C02500    .00
14.400001    .CC0000    .000000  -.107775.18341+000    .C02500    .00
14.500001    .CC0000    .000000  -.102127.18528+000    .C02500    .00
14.600001    .CC0000    .000000  -.096567.18722+000    .C02500    .00
14.700001    .CC0000    .000000  -.091186.18909+000    .C02500    .00
14.800001    .CC0000    .000000  -.086246.19058+000    .C02500    .00
14.900001    .CC0000    .000000  -.081988.19144+000    .C02500    .00
15.000001    .CC0000    .000000  -.078291.19186+000    .C02500    .00
15.100001    .CC0000    .000000  -.074952.19209+000    .C02500    .00
15.200001    .CC0000    .000000  -.071867.19220+000    .C02500    .00
15.300001    .CC0000    .000000  -.068932.19230+000    .C02500    .00
15.400001    .CC0000    .000000  -.066052.19245+000    .C02500    .00
15.500001    .CC0000    .000000  -.063187.19270+000    .C02500    .00
15.600001    .CC0000    .000000  -.060357.19299+000    .C02500    .00
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15.900001    .CC0000    .000000  -.052663.19355+000    .C02500    .00
16.000001    .CC0000    .000000  -.050316.19369+000    .C02500    .00
1.4          .00
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NMXOLD=100,
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AK=1.09,
INVRSE=1,
JPFMAX=2,
IRESTR=0,
INTERP=0,
IPRNEW=1,
NSTART=1,
MFIG(1)=6,11,16,21,22,23,24,25,26,27,28,29,30,31,32,33,
        34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,
        49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,
        64,65,66,67,68,69,70,71,76,81,86,91,42*0,
NQMAX=10,
NPRRES=0,
JMAX=32,
ITPRO=100,
PMFO=1.0,
AMO=0.,
XCO=6.6912675,
RESG=.1E-03,
IPLOT(1)=1,1,0,0,0,1,0,0,
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YSCALE(1)=.01,7*1.,
YIN(1)=8*4.,
XORIGN(1)=0.,0.,0.,0.,0.,0.,0.,0.,
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XIN=6.,6.,6.,5*6.,
XL=1.0,
NDATA=1,
BETAS=1.0,
AMES=0.00,
GW=1.0,
TINFO=530.,
PRT=0.95,
PR=0.72,
RLINF=2.77241+04,
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IWINDC=50,
IWINDG=0,
IWINDS=0,
ITRBMD=0,
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 2   9.6768    .0248
 3   9.7548    .0305
 4   9.9338    .0395
 5  10.2023    .0561
 6  10.4707    .0747
 7  10.7392    .0981
 8  11.0077    .0996
 9  11.2762    .1007
10  11.4104    .0863
11  11.4999    .0872
12  11.6342    .0846
13  11.8131    .0799
14  12.0816    .0774
29
 1   0.0000    .0000
 2    .8949    .8378
 3   2.2373    .9038
 4   3.5797    .9612
 5   4.4747   1.0074
 6   5.3696   1.0756
 7   6.2645   1.1687
 8   7.1595   1.2884
 9   8.0097   1.4034
10   8.4768   1.4436
11   8.9046   1.4457
12   9.3390   1.4379
13   9.6205   1.4152
14   9.7954   1.4016
15  10.0546   1.3958
16  10.2575   1.3936
17  10.4885   1.3967
18  10.7082   1.3967
19  10.9336   1.4038
20  11.1421   1.3159
21  11.4182   1.1877
22  11.6210   1.1488
23  11.8689   1.1136
24  12.0887   1.0968
25  12.3080   1.0773
26  12.5394   1.0645
27  12.9902   1.0252
28  13.4522    .9987
29  13.8715    .9726
   1   .00000000        .00000000        .00000000        .10000000+001   .00000000
   2   .28944524-003    .25158711-003    .17381574-003    .10000000+001   .12053039-003
   3   .60494056-003    .52576268-003    .36318003-003    .10000000+001   .25190852-003
   4   .94883045-003    .82454946-003    .56947441-003    .10000000+001   .39511067-003
   5   .13230705-002    .11501503-002    .79420145-003    .10000000+001   .55120102-003
   6   .17322460-002    .15049640-002    .10385950-002    .10000000+001   .72133950-003
   7   .21775934-002    .18916026-002    .13056311-002    .10000000+001   .90679044-003
   8   .26630221-002    .23129130-002    .15906402-002    .10000000+001   .11099320-002
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10	.37688771-002	.32721891-002	.22567483-002	.10000000+001	.15694305-002
11	.43975213-002	.38171989-002	.26317998-002	.10000000+001	.18312097-002
12	.50827434-002	.44110030-002	.30401599-002	.10000000+001	.21165489-002
13	.58296356-002	.50579447-002	.34847427-002	.10000000+001	.24275686-002
14	.66437481-002	.57627492-002	.39687091-002	.10000000+001	.27665802-002
15	.75311306-002	.65305560-002	.44954857-002	.10000000+001	.31361028-002
16	.84983776-002	.73669544-002	.50687857-002	.10000000+001	.35388823-002
17	.95526769-002	.82780216-002	.56926303-002	.10000000+001	.39779121-002
18	.10701863-001	.92703634-002	.63713716-002	.10000000+001	.44564544-002
19	.11954476-001	.10351159-001	.71097165-002	.10000000+001	.49780656-002
20	.13319824-001	.11528208-001	.79127525-002	.10000000+001	.55466216-002
21	.14808054-001	.12809982-001	.87859726-002	.10000000+001	.61663475-002
22	.16430224-001	.14205679-001	.97353040-002	.10000000+001	.68418487-002
23	.18198389-001	.15725281-001	.10767134-001	.10000000+001	.75781448-002
24	.20125690-001	.17379619-001	.11888339-001	.10000000+001	.83807075-002
25	.22226447-001	.19180438-001	.13106313-001	.10000000+001	.92555006-002
26	.24516273-001	.21140467-001	.14428996-001	.10000000+001	.10209025-001
27	.27012182-001	.23273498-001	.15864898-001	.10000000+001	.11248366-001
28	.29732725-001	.25594461-001	.17423128-001	.10000000+001	.12381247-001
29	.32698115-001	.28119511-001	.19113416-001	.10000000+001	.13616086-001
30	.35930391-001	.30866112-001	.20946132-001	.10000000+001	.14962060-001
31	.39453571-001	.33853135-001	.22932301-001	.10000000+001	.16429169-001
32	.43293838-001	.37100944-001	.25083613-001	.10000000+001	.18028315-001
33	.47479729-001	.40631499-001	.27412422-001	.10000000+001	.19771381-001
34	.52042350-001	.44468451-001	.29931739-001	.10000000+001	.21671316-001
35	.57015607-001	.48637244-001	.32655206-001	.10000000+001	.23742238-001
36	.62436456-001	.53165216-001	.35597064-001	.10000000+001	.25999532-001
37	.68345184-001	.58081687-001	.38772089-001	.10000000+001	.28459966-001
38	.74785695-001	.63418059-001	.42195515-001	.10000000+001	.31141816-001
39	.81805853-001	.69207891-001	.45882923-001	.10000000+001	.34065000-001
40	.89457826-001	.75486977-001	.49850094-001	.10000000+001	.37251225-001
41	.97798474-001	.82293393-001	.54112832-001	.10000000+001	.40724144-001
42	.10688978+000	.89667541-001	.58686717-001	.10000000+001	.44509534-001
43	.11679931+000	.97652148-001	.63586830-001	.10000000+001	.48635476-001
44	.12760069+000	.10629224+000	.68827388-001	.10000000+001	.53132566-001
45	.13937420+000	.11563507+000	.74421316-001	.10000000+001	.58034129-001
46	.15220733+000	.12572999+000	.80379731-001	.10000000+001	.63376458-001
47	.16619543+000	.13662825+000	.86711319-001	.10000000+001	.69199068-001
48	.18144247+000	.14838273+000	.93421623-001	.10000000+001	.75544967-001
49	.19806173+000	.16104756+000	.10051219+000	.10000000+001	.82460942-001
50	.21617674+000	.17467764+000	.10797960+000	.10000000+001	.89997864-001
51	.23592209+000	.18932800+000	.11581434+000	.10000000+001	.98211009-001
52	.25744452+000	.20505304+000	.12399962+000	.10000000+001	.10716038+000
53	.28090397+000	.22190555+000	.13250986+000	.10000000+001	.11691102+000
54	.30647478+000	.23993556+000	.14130930+000	.10000000+001	.12753336+000
55	.33434695+000	.25918896+000	.15035032+000	.10000000+001	.13910348+000
56	.36472762+000	.27970587+000	.15957175+000	.10000000+001	.15170336+000
57	.39784255+000	.30151879+000	.16889716+000	.10000000+001	.16542103+000
58	.43393784+000	.32465046+000	.17823325+000	.10000000+001	.18035066+000
59	.47328168+000	.34911152+000	.18746835+000	.10000000+001	.19659233+000
60	.51616649+000	.37489794+000	.19647127+000	.10000000+001	.21425171+000
61	.56291091+000	.40198827+000	.20509055+000	.10000000+001	.23343923+000
62	.61386234+000	.43034088+000	.21315446+000	.10000000+001	.25426879+000
63	.66939940+000	.45989117+000	.22047186+000	.10000000+001	.27685584+000
64	.72993480+000	.49054899+000	.22683406+000	.10000000+001	.30131442+000
65	.79591838+000	.52219641+000	.23201829+000	.10000000+001	.32775319+000
66	.86784048+000	.55408605+000	.23579253+000	.10000000+001	.35620976+000
67	.94623557+000	.58784024+000	.23792218+000	.10000000+001	.38694335+000
68	.10316862+001	.62145109+000	.23817855+000	.10000000+001	.41982510+000
69	.11248274+001	.65528187+000	.23634920+000	.10000000+001	.45492516+000

70	.12263514+001	.68906954+000	.23224980+000	.1C00000C+C01	.49220134+000
71	.13370124+001	.72252853+000	.22573748+000	.1C00000C+C01	.53153458+000
72	.14576330+001	.7553555C+000	.21672514+000	.1CC00000+CC1	.57271665+0C0
73	.15891054+0C1	.78723466+000	.20519644+000	.1C000C0C+CC1	.61542659+000
74	.17324187+001	.81784322+000	.19122140+000	.1C00000C+0C1	.65921320+000
75	.18886258+001	.84685656+000	.17497243+000	.1C0C000C+CC1	.70348218+000
76	.20588916+001	.87395342+000	.15674044+000	.1C00000C+C01	.74749297+000
77	.22444813+001	.89882231+000	.13695005+000	.1C00000C+001	.79037119+000
78	.24467741+001	.92117117+C00	.11617013+000	.1C00000C+C01	.83114232+000
79	.26672732+001	.94074338+000	.95113028-001	.1CC0000C+CC1	.86879130+000
80	.29076173+0C1	.95734257+000	.74611649-001	.1C00000C+C01	.90235022+000
81	.31695923+001	.97086614+000	.55561945-001	.1C000C0C+C01	.93100992+000
82	.34551450+001	.9813427C+000	.38822565-001	.1CC0000C+C01	.95424275+000
83	.37663975+001	.98896192+000	.25077622-001	.1C00000C+CC1	.971912C6+000
84	.41056628+001	.99408121+000	.14691982-001	.1C0C000C+CC1	.98433354+000
85	.44754618+001	.99719513+000	.76118484-002	.1C00000C+C01	.99225223+000
86	.48785429+001	.9988654C+000	.33681542-002	.1CC0000C+CC1	.99671604+000
87	.53179013+001	.99962779+000	.12092218-002	.1CC0000C+001	.99886543+000
88	.57968017+001	.99990902+000	.32363459-003	.1CC0000C+C01	.99970594+000
89	.63188034+001	.99998607+000	.54355711-004	.1CC0000C+C01	.99995172+C00
90	.68877852+001	.99999931+000	.31068921-005	.1CC0000C+001	.99999727+000
91	.75079754+001	.10000C01+001	-.26822090-006	.1CC0000C+CC1	.10C000C4+001
92	.81839826+001	.10000000+001	.13411045-006	.1C000000+CC1	.10C00001+001
93	.892083C5+001	.10000000+001	.12665987-006	.1C0C000C+CC1	.10C00000+001
94	.97239947+001	.10000C0C+001	.12665987-006	.1C00000C+CC1	.10C00000+001
95	.10599444+002	.1000000C+001	.12293458-006	.1C000000+CC1	.1000C000+001
96	.11553683+002	.1000000C+001	.29802322-007	.1C000C0C+CC1	.10000000+001
97	.125938C4+002	.1000000C+001	.14156103-006	.1C0C000C+CC1	.10000000+001
98	.13727536+002	.1000000C+001	.13783574-006	.1C000000+0C1	.10C00000+0C1
99	.149633C4+002	.1000000C+001	.13783574-006	.1C0C000C+CC1	.10C00000+001
100	.16310291+002	.100000C0C+001	.13783574-006	.1C00000C+CC1	.1000000C+001

2.528 29.75
7.0 16.C0

HORTON SWEPT FLAT PLATE - TURBULENT INTERACTING

I	XO	YO	SO	CPO	DTO	TUO	RVWO
1	.CC000	.00000	.00000	.80090	.00000	.00250	.0C000
2	.10000	.00000	.10000	.74007	.00201	.00250	.00000
3	.20000	.00000	.20000	.59361	.00239	.00250	.00000
4	.30000	.00000	.30000	.43730	.00285	.00250	.0C000
5	.40000	.00000	.40000	.31774	.00344	.00250	.0C000
6	.50000	.00000	.50000	.23818	.00410	.00250	.0C000
7	.60000	.00000	.60000	.18668	.00479	.00250	.0C000
8	.70000	.00000	.70000	.15028	.00546	.00250	.0C000
9	.80000	.00000	.80000	.12155	.00608	.00250	.00000
10	.90000	.00000	.90000	.09883	.00667	.00250	.0C000
11	1.00000	.00000	1.00000	.08132	.00726	.00250	.0C000
12	1.10000	.00000	1.10000	.06824	.00786	.00250	.0C000
13	1.20000	.00000	1.20000	.05854	.00846	.00250	.0C000
14	1.30000	.00000	1.30000	.05069	.00904	.00250	.0C000
15	1.40000	.00000	1.40000	.04358	.00959	.00250	.0C000
16	1.50000	.00000	1.50000	.03684	.01011	.00250	.0C000
17	1.60000	.00000	1.60000	.03042	.01060	.00250	.0CCC0
18	1.70000	.00000	1.70000	.02417	.01107	.00250	.00000
19	1.80000	.00000	1.80000	.01769	.01151	.00250	.0C000
20	1.90000	.00000	1.90000	.01061	.01192	.00250	.00000
21	2.00000	.00000	2.00000	.00302	.01229	.00250	.00000
22	2.10000	.00000	2.10000	-.00487	.01263	.00250	.0C000
23	2.20000	.00000	2.20000	-.01281	.01296	.00250	.00000
24	2.30000	.00000	2.30000	-.02063	.01329	.00250	.0C0C0
25	2.40000	.00000	2.40000	-.02830	.01361	.00250	.00000
26	2.50000	.00000	2.50000	-.03591	.01392	.00250	.00000
27	2.60000	.00000	2.60000	-.04353	.01422	.00250	.0C000
28	2.70000	.00000	2.70000	-.05120	.01451	.00250	.00000
29	2.80000	.00000	2.80000	-.05892	.01478	.00250	.0C000
30	2.90000	.00000	2.90000	-.06670	.01505	.00250	.0C000
31	3.00000	.00000	3.00000	-.07456	.01531	.00250	.0C000
32	3.10000	.00000	3.10000	-.08255	.01556	.00250	.0C000
33	3.20000	.00000	3.20000	-.09073	.01579	.00250	.0C000
34	3.30000	.00000	3.30000	-.09909	.01601	.00250	.0C000
35	3.40000	.00000	3.40000	-.10757	.01623	.00250	.00000
36	3.50000	.00000	3.50000	-.11619	.01643	.00250	.0C000
37	3.60000	.00000	3.60000	-.12502	.01663	.00250	.0C000
38	3.70000	.00000	3.70000	-.13410	.01681	.00250	.00000
39	3.80000	.00000	3.80000	-.14337	.01698	.00250	.0C000
40	3.90000	.00000	3.90000	-.15288	.01714	.00250	.0C000
41	4.00000	.00000	4.00000	-.16285	.01729	.00250	.00000
42	4.10000	.00000	4.10000	-.17350	.01740	.00250	.00000
43	4.20000	.00000	4.20000	-.18476	.01750	.00250	.00000
44	4.30000	.00000	4.30000	-.19637	.01759	.00250	.00000
45	4.40000	.00000	4.40000	-.20823	.01768	.00250	.00000
46	4.50000	.00000	4.50000	-.22037	.01776	.00250	.00000
47	4.60000	.00000	4.60000	-.23283	.01783	.00250	.00000
48	4.70000	.00000	4.70000	-.24558	.01790	.00250	.0C000
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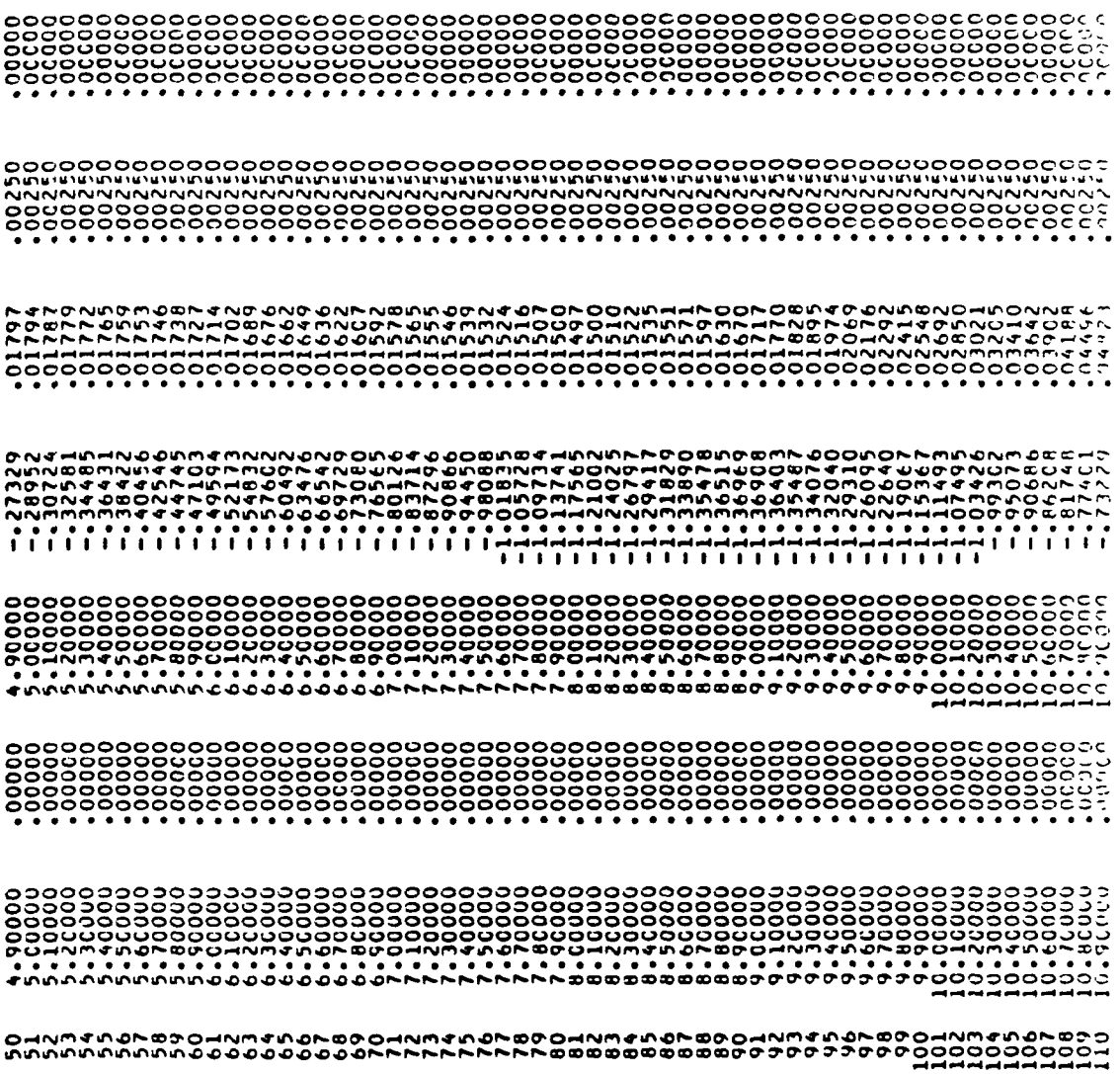

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128	12.70000	.00000	12.70000	-.25828	.13424	.00250	.00000
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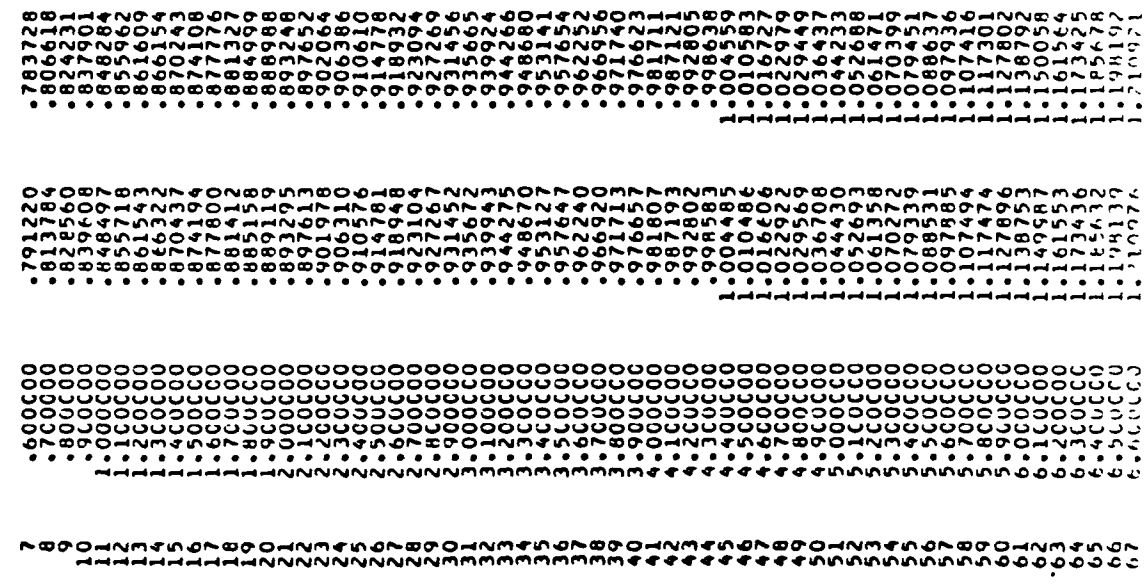

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87	8.600000	1.462655	1.462809
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139	13.800001	.972439	.972491
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142	14.100001	.962563	.962581
143	14.200001	.959392	.959394
144	14.300001	.956276	.956275
145	14.400001	.953216	.953248
146	14.500001	.950220	.950281
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148	14.700001	.944548	.944507
149	14.800001	.941997	.941888
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151	15.000001	.937681	.937656
152	15.100001	.935864	.935874
153	15.200001	.934192	.934224
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6	.500000	.003073	.003076
7	.600000	.003672	.003756
8	.700000	.004264	.004403
9	.800000	.004847	.005009
10	.900000	.005420	.005591
11	1.000000	.005982	.006162
12	1.100000	.006533	.006728
13	1.200000	.007071	.007288
14	1.300000	.007595	.007829
15	1.400000	.008106	.008345
16	1.500000	.008602	.008835
17	1.600000	.009083	.009307
18	1.700000	.009549	.009760
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20	1.900000	.010438	.010592
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22	2.100000	.011270	.011338
23	2.200000	.011666	.011693
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26	2.500000	.012776	.012731
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28	2.700000	.013459	.013389
29	2.800000	.013785	.013708
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31	3.000000	.014406	.014325
32	3.100000	.014702	.014622
33	3.200000	.014989	.014911
34	3.300000	.015268	.015192
35	3.400000	.015537	.015467
36	3.500000	.015797	.015736
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38	3.700000	.016292	.016252
39	3.800000	.016527	.016500
40	3.900000	.016753	.016741
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42	4.100000	.017177	.017180
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49	4.800000	.018374	.018482
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51	5.000000	.018632	.018729
52	5.100000	.018747	.018809
53	5.200000	.018853	.018887
54	5.300000	.018951	.018970
55	5.400000	.019041	.019057
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57	5.600000	.019197	.019241
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63	6.200000	.019508	.019621
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79	7.800000	.020356	.020764
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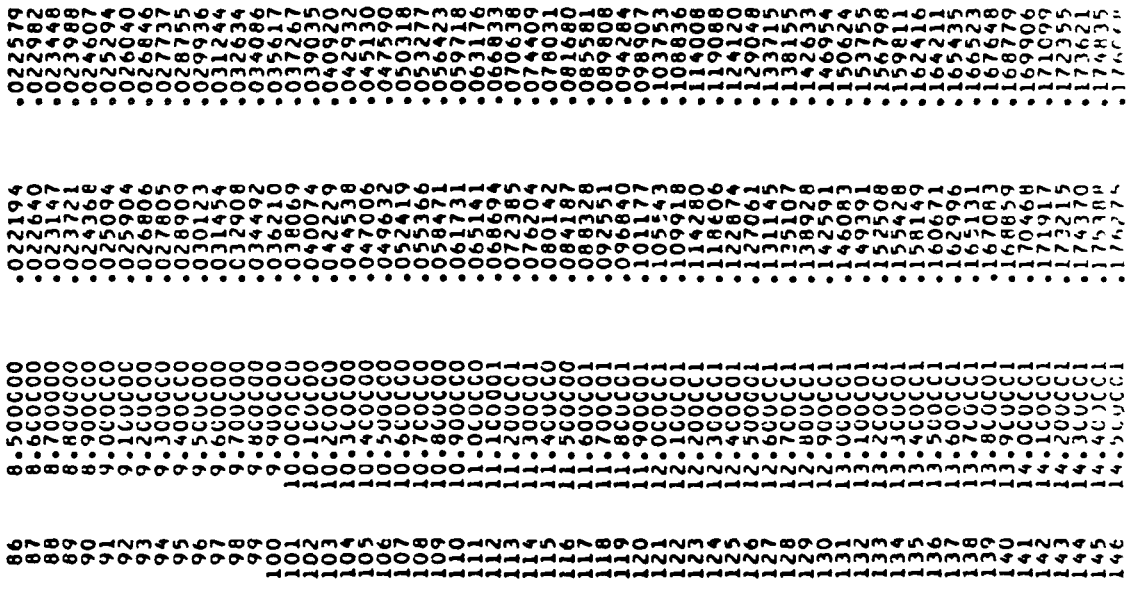

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152	15.100C01	.179209	.179772
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154	15.300C01	.179453	.179349
155	15.400C01	.179477	.179191
156	15.500C01	.179448	.179128
157	15.600C01	.179376	.179103
158	15.700C01	.179270	.179070
159	15.800C01	.179137	.178960
160	15.900C01	.178988	.178819
161	16.000C01	.178830	.178702

SMOOTHED REFERENCE SOLUTION ON COMPUTATIONAL MESH

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2	.10000	.10000	.00000	.22912	.00063	.00250	.00000
3	.20000	.20000	.00000	.42767	.00125	.00250	.00000
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5	.40000	.40000	.00000	.68733	.00247	.00250	.00000
6	.50000	.50000	.00000	.75297	.00307	.00250	.00000
7	.60000	.60000	.00000	.79122	.00367	.00250	.00000
8	.70000	.70000	.00000	.81378	.00426	.00250	.00000
9	.80000	.80000	.00000	.82856	.00485	.00250	.00000
10	.90000	.90000	.00000	.83961	.00542	.00250	.00000
11	1.00000	1.00000	.00000	.84850	.00598	.00250	.00000
12	1.10000	1.10000	.00000	.85572	.00653	.00250	.00000
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16	1.50000	1.50000	.00000	.87419	.00860	.00250	.00000
17	1.60000	1.60000	.00000	.87780	.00908	.00250	.00000
18	1.70000	1.70000	.00000	.88141	.00955	.00250	.00000
19	1.80000	1.80000	.00000	.88516	.01000	.00250	.00000
20	1.90000	1.90000	.00000	.88912	.01044	.00250	.00000
21	2.00000	2.00000	.00000	.89329	.01086	.00250	.00000
22	2.10000	2.10000	.00000	.89761	.01127	.00250	.00000
23	2.20000	2.20000	.00000	.90198	.01167	.00250	.00000
24	2.30000	2.30000	.00000	.90631	.01205	.00250	.00000
25	2.40000	2.40000	.00000	.91058	.01242	.00250	.00000
26	2.50000	2.50000	.00000	.91478	.01278	.00250	.00000
27	2.60000	2.60000	.00000	.91895	.01312	.00250	.00000
28	2.70000	2.70000	.00000	.92310	.01346	.00250	.00000
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32	3.10000	3.10000	.00000	.93994	.01470	.00250	.00000
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34	3.30000	3.30000	.00000	.94867	.01527	.00250	.00000
35	3.40000	3.40000	.00000	.95313	.01554	.00250	.00000
36	3.50000	3.50000	.00000	.95765	.01580	.00250	.00000
37	3.60000	3.60000	.00000	.96224	.01605	.00250	.00000
38	3.70000	3.70000	.00000	.96692	.01629	.00250	.00000
39	3.80000	3.80000	.00000	.97171	.01653	.00250	.00000

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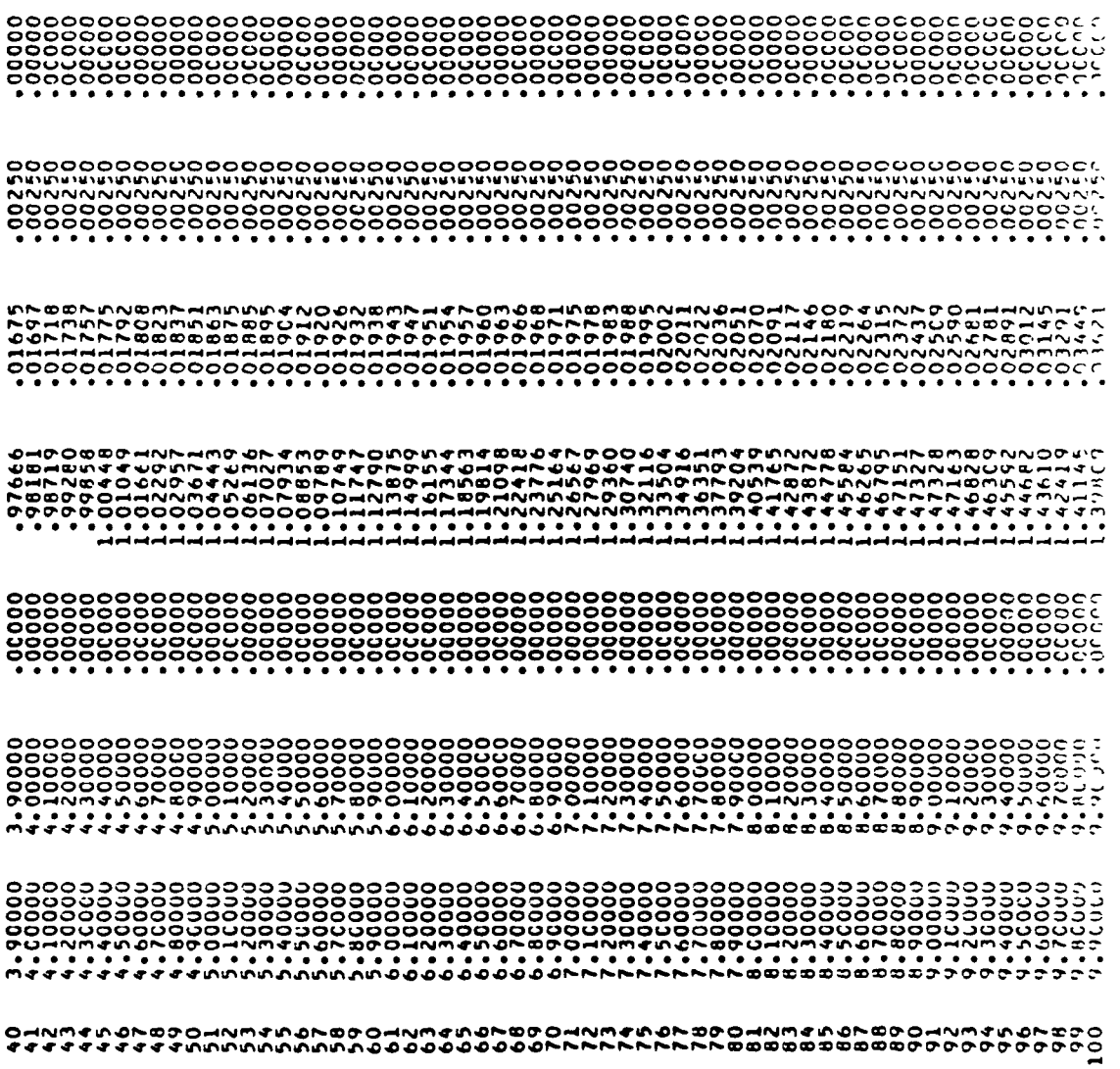

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114	11.30000	11.30000	.00000	1.17687	.07620	.00250	.00000
115	11.40000	11.40000	.00000	1.16349	.08014	.00250	.00000
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131	13.00000	13.00000	.00000	1.00906	.14608	.00250	.00000
132	13.10000	13.10000	.00000	1.00324	.14939	.00250	.00000
133	13.20000	13.20000	.00000	.99778	.15251	.00250	.00000
134	13.30000	13.30000	.00000	.99267	.15543	.00250	.00000
135	13.40000	13.40000	.00000	.98793	.15815	.00250	.00000
136	13.50000	13.50000	.00000	.98359	.16067	.00250	.00000
137	13.60000	13.60000	.00000	.97962	.16300	.00250	.00000
138	13.70000	13.70000	.00000	.97593	.16513	.00250	.00000
139	13.80000	13.80000	.00000	.97244	.16708	.00250	.00000
140	13.90000	13.90000	.00000	.96907	.16886	.00250	.00000
141	14.00000	14.00000	.00000	.96579	.17047	.00250	.00000
142	14.10000	14.10000	.00000	.96256	.17192	.00250	.00000
143	14.20000	14.20000	.00000	.95939	.17322	.00250	.00000
144	14.30000	14.30000	.00000	.95628	.17437	.00250	.00000
145	14.40000	14.40000	.00000	.95322	.17539	.00250	.00000
146	14.50000	14.50000	.00000	.95022	.17628	.00250	.00000
147	14.60000	14.60000	.00000	.94731	.17704	.00250	.00000
148	14.70000	14.70000	.00000	.94455	.17768	.00250	.00000
149	14.80000	14.80000	.00000	.94200	.17822	.00250	.00000
150	14.90000	14.90000	.00000	.93971	.17864	.00250	.00000
151	15.00000	15.00000	.00000	.93768	.17897	.00250	.00000
152	15.10000	15.10000	.00000	.93586	.17921	.00250	.00000
153	15.20000	15.20000	.00000	.93419	.17937	.00250	.00000
154	15.30000	15.30000	.00000	.93261	.17945	.00250	.00000
155	15.40000	15.40000	.00000	.93106	.17948	.00250	.00000
156	15.50000	15.50000	.00000	.92954	.17945	.00250	.00000
157	15.60000	15.60000	.00000	.92805	.17938	.00250	.00000
158	15.70000	15.70000	.00000	.92661	.17927	.00250	.00000
159	15.80000	15.80000	.00000	.92523	.17914	.00250	.00000
160	15.90000	15.90000	.00000	.92391	.17899	.00250	.00000
161	16.00000	16.00000	.00000	.92262	.17883	.00250	.00000

*** STREAMWISE LOCATIONS OF BOUNDARY LAYER CALCULATION, BODY RADIUS, FROM SUBROUTINE XBLGRD ***

M	S	XOCBL	RO
1	.7C0010UCE+01	.70001C00E+01	.100C0000E+01
2	.71000C00E+01	.71000000E+01	.100C000CE+01
3	.72C00C0CE+01	.72000000E+01	.100C0000E+01
4	.73C0000CE+01	.73000000E+01	.100C0000E+01
5	.74000000E+01	.74000C00E+01	.100C0C00E+01
6	.75C0000CE+01	.75000000E+01	.100C0000E+01
7	.76000000E+01	.76000000E+01	.100C0000E+01
8	.77C00C0CE+01	.77000C00E+01	.100C0000E+01
9	.78000000E+01	.78000000E+01	.100C0000E+01
10	.79000000E+01	.79000000E+01	.100C000CE+01
11	.8CC0000CE+01	.80000C00E+01	.100C0C00E+01
12	.81CC000CE+01	.81000C00E+01	.100C0000E+01
13	.82000000E+01	.82000C00E+01	.100C0000E+01
14	.83C0000CE+01	.83000000E+01	.100C0000E+01
15	.84000000E+01	.84000000E+01	.100000000E+01
16	.85CC0C0CE+01	.85000000E+01	.100C0000E+01
17	.86000C0CE+01	.86000000E+01	.100C0000E+01
18	.87000000E+01	.87000000E+01	.100C0C00E+01
19	.88000C00E+01	.88000000E+01	.1C0C0C00E+01
20	.89C000U0E+01	.89000000E+01	.100C0000E+01
21	.9CC00C0CE+01	.90000C00E+01	.100C0000E+01
22	.91C0000CE+01	.91000000E+01	.100C0000E+01
23	.92C0000CE+01	.92000000E+01	.100C0000E+01
24	.93C0C0CCE+01	.93000000E+01	.1C0C000CE+01
25	.940C0C0CE+01	.94000000E+01	.100C0000E+01
26	.95C00C0CE+01	.95000C00E+01	.100C0000E+01
27	.96000C0CE+01	.96000000E+01	.100C0000E+01
28	.97CC0C0CE+01	.97000000E+01	.100C0000E+01
29	.98C0000CE+01	.98000C00E+01	.100C0000E+01
30	.99000000E+01	.99000000E+01	.1C0C0000E+01
31	.1C000C0CE+02	.10000000E+02	.100C0000E+01
32	.1C100C0CE+02	.10100000E+02	.100C0000E+01
33	.1C2C0C0CE+02	.10200000E+02	.100C0000E+01
34	.1C300C0CE+02	.10300000E+02	.100C0000E+01
35	.1C400C0CE+02	.10400000E+02	.100C0000E+01
36	.1C5C0C0CE+02	.10500000E+02	.100C0000E+01
37	.1C6C000CE+02	.10600000E+02	.100C0000E+01
38	.1C7C0000E+02	.10700000E+02	.100C0000E+01
39	.1C800C0CE+02	.10800000E+02	.100C0000E+01
40	.1C9C0C0CE+02	.10900000E+02	.100C0000E+01
41	.11000000E+02	.11000000E+02	.100C0C00E+01
42	.11100001E+02	.11100C01E+02	.100C0000E+01
43	.11200001E+02	.11200001E+02	.100C0C00E+01
44	.11300001E+02	.11300001E+02	.1C0C0C00E+01
45	.11400C0CE+02	.11400000E+02	.1C0C0C00E+01
46	.11500000E+02	.11500000E+02	.100C0000E+01
47	.11600001E+02	.11600001E+02	.100C0C00E+01
48	.11700001E+02	.11700C01E+02	.100C0000E+01
49	.11800001E+02	.11800001E+02	.100C0C0CE+01
50	.11900001E+02	.11900C01E+02	.100C000CE+01
51	.12CC0C01E+02	.12000001E+02	.100C000CE+01
52	.12100001E+02	.12100C01E+02	.100C0000E+01
53	.12200001E+02	.12200001E+02	.100CC0CCE+01
54	.12300001E+02	.12300001E+02	.1C0C000CE+01
55	.12400001E+02	.12400001E+02	.1C0C0000E+01
56	.12500C01E+02	.12500C01E+02	.1C0C0C0CE+01
57	.12600001E+02	.12600001E+02	.100C0C0CE+01

58	.12700001E+02	.12700001E+02	.10000000E+01
59	.12800001E+02	.12800001E+02	.10000000E+01
60	.12900001E+02	.12900001E+02	.10000000E+01
61	.13000001E+02	.13000001E+02	.10000000E+01
62	.13100001E+02	.13100001E+02	.10000000E+01
63	.13200001E+02	.13200001E+02	.10000000E+01
64	.13300001E+02	.13300001E+02	.10000000E+01
65	.13400001E+02	.13400001E+02	.10000000E+01
66	.13500001E+02	.13500001E+02	.10000000E+01
67	.13600001E+02	.13600001E+02	.10000000E+01
68	.13700001E+02	.13700001E+02	.10000000E+01
69	.13800001E+02	.13800001E+02	.10000000E+01
70	.13900001E+02	.13900001E+02	.10000000E+01
71	.14000001E+02	.14000001E+02	.10000000E+01
72	.14100001E+02	.14100001E+02	.10000000E+01
73	.14200001E+02	.14200001E+02	.10000000E+01
74	.14300001E+02	.14300001E+02	.10000000E+01
75	.14400001E+02	.14400001E+02	.10000000E+01
76	.14500001E+02	.14500001E+02	.10000000E+01
77	.14600001E+02	.14600001E+02	.10000000E+01
78	.14700001E+02	.14700001E+02	.10000000E+01
79	.14800001E+02	.14800001E+02	.10000000E+01
80	.14900001E+02	.14900001E+02	.10000000E+01
81	.15000001E+02	.15000001E+02	.10000000E+01
82	.15100001E+02	.15100001E+02	.10000000E+01
83	.15200001E+02	.15200001E+02	.10000000E+01
84	.15300001E+02	.15300001E+02	.10000000E+01
85	.15400001E+02	.15400001E+02	.10000000E+01
86	.15500001E+02	.15500001E+02	.10000000E+01
87	.15600001E+02	.15600001E+02	.10000000E+01
88	.15700001E+02	.15700001E+02	.10000000E+01
89	.15800001E+02	.15800001E+02	.10000000E+01
90	.15900001E+02	.15900001E+02	.10000000E+01
91	.16000001E+02	.16000001E+02	.10000000E+01

T(I),I=1,ISTOP ** TANGENTIAL SURFACE VELOCITY **

.35952428E-02	.22911628E+00	.42766905E+00	.58156935E+00	.68733008E+00	.75296780E+00	.79122039E+00	.81378386E+00
.82856048E+00	.83960789E+00	.84849675E+00	.85571814E+00	.86154337E+00	.86632233E+00	.87043710E+00	.87419363E+00
.87780016E+00	.88141172E+00	.88515811E+00	.88911939E+00	.89329450E+00	.89761289E+00	.90197768E+00	.90631049E+00
.91057642E+00	.91478054E+00	.91894770E+00	.92310363E+00	.92726711E+00	.93145198E+00	.93567222E+00	.93994286E+00
.94427475E+00	.94867005E+00	.95312667E+00	.95764676E+00	.96223973E+00	.96692040E+00	.97171252E+00	.97665733E+00
.98180679E+00	.98719317E+00	.99280204E+00	.99858288E+00	.10044849E+01	.10104857E+01	.10166059E+01	.10229216E+01
.10295694E+01	.10367080E+01	.10444295E+01	.10526934E+01	.10613582E+01	.10702724E+01	.10793392E+01	.10885311E+01
.10978852E+01	.11074945E+01	.11174738E+01	.11278964E+01	.11387535E+01	.11499874E+01	.11615527E+01	.11734355E+01
.11856316E+01	.11981389E+01	.12109758E+01	.12241809E+01	.12377605E+01	.12516379E+01	.12656655E+01	.12796869E+01
.12936001E+01	.13073969E+01	.13211638E+01	.13350430E+01	.13491572E+01	.13635144E+01	.13779315E+01	.13920392E+01
.14053905E+01	.14176451E+01	.14287166E+01	.14387234E+01	.14477834E+01	.14558382E+01	.14626549E+01	.14679477E+01
.14715069E+01	.14732666E+01	.14732836E+01	.14716280E+01	.14682773E+01	.14630887E+01	.14559218E+01	.14468212E+01
.14360966E+01	.14241867E+01	.14114538E+01	.13960875E+01	.13841596E+01	.13697093E+01	.13547567E+01	.13392783E+01
.13232223E+01	.13065923E+01	.12895251E+01	.12722727E+01	.12551142E+01	.12382752E+01	.12219061E+01	.12061282E+01
.11910791E+01	.11768720E+01	.11634948E+01	.11507810E+01	.11385136E+01	.11265515E+01	.11148664E+01	.11034958E+01
.10924871E+01	.10818934E+01	.10717768E+01	.10621868E+01	.10531398E+01	.10446277E+01	.10366250E+01	.10290893E+01
.10219846E+01	.10153058E+01	.10090646E+01	.10032384E+01	.99778013E+00	.99266861E+00	.98792853E+00	.98358672E+00
.97961516E+00	.97593045E+00	.97243892E+00	.96907142E+00	.96578685E+00	.96256321E+00	.95939241E+00	.95627552E+00
.95321594E+00	.95022016E+00	.94731256E+00	.94454766E+00	.94199685E+00	.93970923E+00	.93768096E+00	.93586354E+00
.93419198E+00	.93260577E+00	.93106196E+00	.92954239E+00	.92805258E+00	.92661074E+00	.92523042E+00	.92390699E+00
.92261716E+00							

INTRAC= 1

VTBL(M),M=1,MMAX

.12656795E+01	.12796869E+01	.12936001E+01	.13073969E+01	.13211638E+01	.13350430E+01	.13491572E+01	.13635144E+01
.13779315E+01	.13920392E+01	.14053905E+01	.14176451E+01	.14287160E+01	.14387234E+01	.14477834E+01	.14558382E+01
.14626549E+01	.14679477E+01	.14715069E+01	.14732666E+01	.14732830E+01	.14716280E+01	.14682773E+01	.14630887E+01
.14559218E+01	.14468212E+01	.14360966E+01	.14241870E+01	.14114538E+01	.13980875E+01	.13841596E+01	.13697093E+01
.13547567E+01	.13392783E+01	.13232223E+01	.13065923E+01	.12895251E+01	.12722727E+01	.12551142E+01	.12382752E+01
.12219061E+01	.12061282E+01	.11910791E+01	.11768720E+01	.11634948E+01	.11507810E+01	.11385136E+01	.11265515E+01
.11148664E+01	.11034958E+01	.10924871E+01	.10818934E+01	.10717768E+01	.10621868E+01	.10531398E+01	.10446277E+01
.10366256E+01	.10290893E+01	.10219846E+01	.10153058E+01	.10090646E+01	.10032384E+01	.99778013E+00	.99266861E+00
.98792853E+00	.98358672E+00	.97961516E+00	.97593045E+00	.97243892E+00	.96907142E+00	.96578685E+00	.96256321E+00
.95939241E+00	.95627552E+00	.95321594E+00	.95022010E+00	.94731256E+00	.94454766E+00	.94199685E+00	.93970923E+00
.93768096E+00	.93586354E+00	.93419198E+00	.93260577E+00	.93106196E+00	.92954239E+00	.92805258E+00	.92661074E+00
.92523042E+00	.92390699E+00	.92261716E+00					

PMFWI(M),M=1,MMAX (WITHOUT RESCRT SCALING)

.19783874E-01	.19783874E-01	.19828457E-01	.19881594E-01	.19945349E-01	.20022006E-01	.20114104E-01	.20224461E-01
.20356184E-01	.20512669E-01	.20697579E-01	.20914826E-01	.21168553E-01	.21463148E-01	.21803260E-01	.22193818E-01
.22640024E-01	.23147334E-01	.23721430E-01	.24366194E-01	.25093683E-01	.25904112E-01	.26805827E-01	.27805257E-01
.28908858E-01	.30123045E-01	.31454133E-01	.32906318E-01	.34491651E-01	.36209994E-01	.38068936E-01	.40073671E-01
.42228860E-01	.44538473E-01	.47005615E-01	.49632330E-01	.52419435E-01	.55366409E-01	.58471350E-01	.61730981E-01
.65140668E-01	.68694485E-01	.72385107E-01	.76202088E-01	.80141731E-01	.84187246E-01	.88328360E-01	.92551076E-01
.96839735E-01	.10117684E+00	.10554322E+00	.10995822E+00	.11428004E+00	.11860616E+00	.12287388E+00	.12706083E+00
.13114545E+00	.13510747E+00	.13892832E+00	.14259146E+00	.14608279E+00	.14939104E+00	.15250792E+00	.15542802E+00
.15814878E+00	.16067051E+00	.16299629E+00	.16513149E+00	.16708309E+00	.16885901E+00	.17046758E+00	.17191709E+00
.17321548E+00	.17437016E+00	.17538802E+00	.17627543E+00	.17703843E+00	.17768295E+00	.17821512E+00	.17864167E+00
.17897013E+00	.17920880E+00	.17936663E+00	.17945290E+00	.17947704E+00	.17944843E+00	.17937628E+00	.17926959E+00
.17913717E+00	.17898771E+00	.17882978E+00					

INITIAL GUESS CN PMF

.25280CCGE+01	.29750000E+02

SPMF

.700C0C00E+01	.16000000E+02

INTERPOLATED PMF DISTRIBUTION FROM INITIAL GUESS ONTO CCMPUTATIONAL MESH

.25283025E+01	.28304667E+01	.31329333E+01	.34354000E+01	.37378667E+01	.40403333E+01	.43428000E+01	.46452667E+01
.49477333E+01	.52502000E+01	.55526667E+01	.58551333E+01	.61576000E+01	.64600667E+01	.67625333E+01	.70650000E+01
.73674667E+01	.76699333E+01	.79724000E+01	.82748667E+01	.85773333E+01	.88798000E+01	.91822667E+01	.94847333E+01
.97872000E+01	.10089667E+02	.10392133E+02	.10694600E+02	.10997067E+02	.11299533E+02	.11602000E+02	.11904467E+02
.12206933E+02	.12509400E+02	.12811867E+02	.13114333E+02	.13416800E+02	.13719267E+02	.14021733E+02	.14324200E+02
.14626667E+02	.14929133E+02	.15231603E+02	.15534070E+02	.15836533E+02	.16139000E+02	.16441470E+02	.16743936E+02
.17046403E+02	.17348870E+02	.17651336E+02	.17953803E+02	.18256270E+02	.18558736E+02	.18861203E+02	.19163670E+02
.19466136E+02	.19768603E+02	.20071070E+02	.20373536E+02	.20676003E+02	.20978470E+02	.21280936E+02	.21583403E+02
.21885870E+02	.22188336E+02	.22490803E+02	.22793270E+02	.23095736E+02	.23398203E+02	.23700670E+02	.24003136E+02
.24305603E+02	.24608070E+02	.24910536E+02	.25213003E+02	.25515470E+02	.25817936E+02	.26120403E+02	.26422870E+02
.26725336E+02	.27027803E+02	.27330270E+02	.27632736E+02	.27935203E+02	.28237670E+02	.28540136E+02	.28842603E+02
.29145070E+02	.29447536E+02	.29750003E+02					

*** INITIAL PROFILES ***

N	ETA(N)	F1(N)	SF1(N)	G1(N)	T(N)	W1(N)
1	.0C000E+00	.00000E+00	.00000E+00	1.0CCC0E+00	1.00000E+00	.00000E+00
2	2.89445E-04	2.51587E-04	1.73816E-04	1.0CCC0E+00	1.00000E+00	1.20530E-04
3	6.04941E-04	5.25763E-04	3.63180E-04	1.0CCC0E+00	1.00000E+00	2.51909E-C4
4	9.48830E-04	8.24549E-04	5.69474E-04	1.0CCCCE+00	1.00000E+00	3.95111E-04
5	1.32367E-03	1.15015E-03	7.94201E-04	1.0CCC0E+00	1.00000E+00	5.51201E-04
6	1.73225E-03	1.50496E-03	1.03900E-03	1.0CCC0E+00	1.00000E+00	7.21340E-C4
7	2.17759E-03	1.89160E-03	1.30563E-03	1.0CCC0E+00	1.00000E+00	9.06790E-04
8	2.66302E-03	2.31291E-03	1.59604E-03	1.0CCC0E+00	1.00000E+00	1.10893E-03
9	3.19214E-03	2.77198E-03	1.91232E-03	1.0CCCCE+00	1.00000E+00	1.32927E-03
10	3.76888E-03	3.27219E-03	2.25675E-03	1.0CCC0E+00	1.00000E+00	1.56943E-C3
11	4.39752E-03	3.81720E-03	2.63180E-03	1.0CCC0E+00	1.00000E+00	1.83121E-03
12	5.08274E-03	4.41100E-03	3.04016E-03	1.0CCC0E+00	1.00000E+00	2.11655E-03
13	5.82964E-03	5.05794E-03	3.48474E-03	1.0CCCCE+00	1.00000E+00	2.42757E-03
14	6.64375E-03	5.76275E-03	3.96871E-03	1.0CCC0E+00	1.00000E+00	2.76658E-03
15	7.53113E-03	6.53056E-03	4.49549E-03	1.0CCC0E+00	1.00000E+00	3.13610E-03
16	8.49838E-03	7.36695E-03	5.06879E-03	1.0CCC0E+00	1.00000E+00	3.53888E-03
17	9.55268E-03	8.27802E-03	5.69263E-03	1.0CCC0E+00	1.00000E+00	3.97791E-03
18	1.07019E-02	9.27036E-03	6.37137E-03	1.0CCC0E+00	1.00000E+00	4.45645E-03
19	1.19545E-02	1.03512E-02	7.10972E-03	1.0CCC0E+00	1.00000E+00	4.97807E-03
20	1.33198E-02	1.15282E-02	7.91275E-03	1.0CCC0E+00	1.00000E+00	5.54662E-03
21	1.48081E-02	1.28100E-02	8.78597E-03	1.0CCC0E+00	1.00000E+00	6.16635E-03
22	1.64302E-02	1.42057E-02	9.73530E-03	1.0CCC0E+00	1.00000E+00	6.84185E-03
23	1.81984E-02	1.57253E-02	1.07671E-02	1.0CCC0E+00	1.00000E+00	7.57814E-03
24	2.01257E-02	1.73796E-02	1.18883E-02	1.0CCC0E+00	1.00000E+00	8.38071E-C3
25	2.22264E-02	1.91804E-02	1.31063E-02	1.0CCC0E+00	1.00000E+00	9.25550E-03
26	2.45163E-02	2.11405E-02	1.44290E-02	1.0CCC0E+00	1.00000E+00	1.02090E-02
27	2.70122E-02	2.32735E-02	1.58649E-02	1.0CCC0E+00	1.00000E+00	1.12484E-02
28	2.97327E-02	2.55945E-02	1.74231E-02	1.0CCC0E+00	1.00000E+00	1.23812E-02
29	3.26981E-02	2.81195E-02	1.91134E-02	1.0CCC0E+00	1.00000E+00	1.36161E-C2
30	3.59304E-02	3.08661E-02	2.09461E-02	1.0CCC0E+00	1.00000E+00	1.49621E-02
31	3.94536E-02	3.38531E-02	2.29323E-02	1.0CCC0E+00	1.00000E+00	1.64292E-02
32	4.32938E-02	3.71009E-02	2.50836E-02	1.0CCC0E+00	1.00000E+00	1.80283E-02
33	4.74797E-02	4.06315E-02	2.74124E-02	1.0CCC0E+00	1.00000E+00	1.97714E-02
34	5.20423E-02	4.44685E-02	2.99317E-02	1.0CCC0E+00	1.00000E+00	2.16713E-02
35	5.70156E-02	4.86372E-02	3.26552E-02	1.0CCC0E+00	1.00000E+00	2.37422E-02
36	6.24365E-02	5.31652E-02	3.55971E-02	1.0CCC0E+00	1.00000E+00	2.59995E-02
37	6.83452E-02	5.80817E-02	3.87721E-02	1.0CCC0E+00	1.00000E+00	2.84600E-02
38	7.47857E-02	6.34181E-02	4.21955E-02	1.0CCC0E+00	1.00000E+00	3.11418E-02
39	8.18058E-02	6.92079E-02	4.58829E-02	1.0CCC0E+00	1.00000E+00	3.40650E-02
40	8.94578E-02	7.54870E-02	4.98501E-02	1.0CCC0E+00	1.00000E+00	3.72512E-02
41	9.77985E-02	8.22934E-02	5.41128E-02	1.0CCCCE+00	1.00000E+00	4.07241E-02
42	1.06890E-01	8.96675E-02	5.86867E-02	1.0CCC0E+00	1.00000E+00	4.45095E-02
43	1.16799E-01	9.76521E-02	6.35868E-02	1.0CCC0E+00	1.00000E+00	4.86355E-02
44	1.27601E-01	1.06292E-01	6.88274E-02	1.0CCC0E+00	1.00000E+00	5.31326E-C2
45	1.39374E-01	1.15635E-01	7.44213E-02	1.0CCC0E+00	1.00000E+00	5.80341E-02
46	1.52207E-01	1.25730E-01	8.03797E-02	1.0CCC0E+00	1.00000E+00	6.33765E-C2
47	1.66195E-01	1.36628E-01	8.67113E-02	1.0CCC0E+00	1.00000E+00	6.91991E-02
48	1.81442E-01	1.48383E-01	9.34216E-02	1.0CCC0E+00	1.00000E+00	7.55450E-02
49	1.98062E-01	1.61048E-01	1.00512E-01	1.0CCC0E+00	1.00000E+00	8.24609E-02
50	2.16177E-01	1.74678E-01	1.07980E-01	1.0CCC0E+00	1.00000E+00	8.99979E-C2
51	2.35922E-01	1.89328E-01	1.15814E-01	1.0CCC0E+00	1.00000E+00	9.82110E-02
52	2.57444E-01	2.05053E-01	1.24000E-01	1.0CCC0E+00	1.00000E+00	1.07160E-C1
53	2.80904E-01	2.21906E-01	1.32510E-01	1.0CCCCE+00	1.00000E+00	1.16911E-01
54	3.06475E-01	2.39936E-01	1.41309E-01	1.0CCC0E+00	1.00000E+00	1.27533E-C1
55	3.34347E-01	2.59189E-01	1.50350E-01	1.0CCCCE+00	1.00000E+00	1.39103E-C1
56	3.64728E-01	2.79706E-01	1.59572E-01	1.0CCCCE+00	1.00000E+00	1.51703E-C1
57	3.97842E-01	3.01519E-01	1.68897E-01	1.0CCCCE+00	1.00000E+00	1.65421E-C1

58	4.33938E-01	3.24650E-01	1.78233E-01	1.0C0C0E+00	1.00000E+00	1.80351E-01
59	4.73282E-01	3.49112E-01	1.87468E-01	1.0C0C0E+00	1.00000E+00	1.96592E-01
60	5.16166E-01	3.74898E-01	1.96471E-01	1.0C0C0E+00	1.00000E+00	2.14252E-01
61	5.62911E-01	4.01988E-01	2.05091E-01	1.0C0C0E+00	1.00000E+00	2.33439E-01
62	6.13862E-01	4.30341E-01	2.13154E-01	1.0C0C0E+00	1.00000E+00	2.54269E-01
63	6.69399E-01	4.59891E-01	2.20472E-01	1.0C0C0E+00	1.00000E+00	2.76856E-01
64	7.29935E-01	4.90549E-01	2.26834E-01	1.0C0C0E+00	1.00000E+00	3.01314E-01
65	7.95918E-01	5.22196E-01	2.32018E-01	1.0C0C0E+00	1.00000E+00	3.27753E-01
66	8.67840E-01	5.54686E-01	2.35793E-01	1.0C0C0E+00	1.00000E+00	3.56270E-01
67	9.46235E-01	5.87840E-01	2.37922E-01	1.0C0C0E+00	1.00000E+00	3.86943E-01
68	1.03169E+00	6.21451E-01	2.38179E-01	1.0C0C0E+00	1.00000E+00	4.19825E-01
69	1.12483E+00	6.55282E-01	2.36349E-01	1.0C0C0E+00	1.00000E+00	4.54926E-01
70	1.22635E+00	6.89070E-01	2.32250E-01	1.0C0C0E+00	1.00000E+00	4.92201E-01
71	1.33701E+00	7.22529E-01	2.25737E-01	1.0C0C0E+00	1.00000E+00	5.31535E-01
72	1.45763E+00	7.55356E-01	2.16725E-01	1.0C0C0E+00	1.00000E+00	5.72717E-01
73	1.58911E+00	7.87235E-01	2.05196E-01	1.0C0C0E+00	1.00000E+00	6.15427E-01
74	1.73242E+00	8.17843E-01	1.91221E-01	1.000C0E+00	1.00000E+00	6.59213E-01
75	1.88863E+00	8.46857E-01	1.74972E-01	1.0C0C0E+00	1.00000E+00	7.03482E-01
76	2.05884E+00	8.73953E-01	1.56740E-01	1.000C0E+00	1.00000E+00	7.47493E-01
77	2.24448E+00	8.98822E-01	1.36950E-01	1.000C0E+00	1.00000E+00	7.90371E-01
78	2.44677E+00	9.21171E-01	1.16170E-01	1.000C0E+00	1.00000E+00	8.31142E-01
79	2.66727E+00	9.40743E-01	9.51130E-02	1.000C0E+00	1.00000E+00	8.68791E-01
80	2.90762E+00	9.57343E-01	7.46116E-02	1.000C0E+00	1.00000E+00	9.02350E-01
81	3.16959E+00	9.70866E-01	5.55619E-02	1.000C0E+00	1.00000E+00	9.31010E-01
82	3.45514E+00	9.81343E-01	3.88226E-02	1.0C0C0E+00	1.00000E+00	9.54243E-01
83	3.76640E+00	9.88962E-01	2.50776E-02	1.0C0C0E+00	1.00000E+00	9.71912E-01
84	4.10566E+00	9.94081E-01	1.46920E-02	1.000C0E+00	1.00000E+00	9.84334E-01
85	4.47546E+00	9.97195E-01	7.61185E-03	1.000C0E+00	1.00000E+00	9.92252E-01
86	4.87854E+00	9.98865E-01	3.36815E-03	1.000C0E+00	1.00000E+00	9.96716E-01
87	5.31790E+00	9.99628E-01	1.20922E-03	1.0C0C0E+00	1.00000E+00	9.98865E-01
88	5.79680E+00	9.99909E-01	3.23635E-04	1.000C0E+00	1.00000E+00	9.99706E-01
89	6.31880E+00	9.99986E-01	5.43557E-05	1.000C0E+00	1.00000E+00	9.99952E-01
90	6.88778E+00	9.99999E-01	3.10689E-06	1.0C0C0E+00	1.00000E+00	9.99997E-01
91	7.50797E+00	1.00000E+00	-2.68221E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00
92	8.18398E+00	1.00000E+00	1.34110E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00
93	8.92083E+00	1.00000E+00	1.26660E-07	1.000C0E+00	1.00000E+00	1.00000E+00
94	9.72399E+00	1.0C0C0E+00	1.26660E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00
95	1.05994E+01	1.00000E+00	1.22935E-07	1.000C0E+00	1.00000E+00	1.00000E+00
96	1.15537E+01	1.00000E+00	2.98023E-08	1.0C0C0E+00	1.00000E+00	1.00000E+00
97	1.25938E+01	1.00000E+00	1.41561E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00
98	1.37275E+01	1.00000E+00	1.37836E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00
99	1.49633E+01	1.00000E+00	1.37836E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00
100	1.63103E+01	1.00000E+00	1.37836E-07	1.0C0C0E+00	1.00000E+00	1.00000E+00

INTRAC= 1

M = 1 S(1) = 7.C0010E+00 PMF(1) = 2.5283CE+00 UEP(1) = 1.26568E+00 AH(1) = .00000E+00 AMACH = .00000E+00 XC = 6.69127E+00

*** INVERSE B.L. CALCULATIONS - SUMMARY CHART NO. 1 ***

M	XOCBL(M)	NO	PMF(M)	PMFCHK(M)	BETA(M)	BETCHK	UEP(M)	AMACH(M)	AH(M)	CF(M)	CFZ(M)	ALPHW(M)	NMCH	RTHETA(M)
2	7.1C00	3	.2830E+01	.2830E+01	-.3652E-01	-.3652E-01	1.2598	.0000	.0000E+00	.4213E-02	.9590E-03	.1282E+02	0	205.80
3	7.2C00	3	.3133E+01	.3133E+01	-.5335E-01	-.5335E-01	1.2512	.0000	.0000E+00	.3020E-02	.8607E-03	.1591E+02	0	215.18
4	7.3C0C	3	.3435E+01	.3435E+01	-.5661E-01	-.5661E-01	1.2420	.0000	.0000E+00	.2242E-02	.7847E-03	.1929E+02	0	224.37
5	7.4C00	3	.3738E+01	.3738E+01	-.5551E-01	-.5551E-01	1.2330	.0000	.0000E+00	.1692E-02	.7224E-03	.2312E+02	0	233.22
6	7.5CC0	3	.4040E+01	.4040E+01	-.5278E-01	-.5278E-01	1.2244	.0000	.0000E+00	.1285E-02	.6698E-03	.2752E+02	0	241.70
7	7.6CC0	3	.4343E+01	.4343E+01	-.4949E-01	-.4949E-01	1.2163	.0000	.0000E+00	.9764E-03	.6245E-03	.3260E+02	0	249.82
8	7.7CCC	3	.4645E+01	.4645E+01	-.4609E-01	-.4609E-01	1.2087	.0000	.0000E+00	.7364E-03	.5849E-03	.3846E+02	0	257.59
9	7.8CCC	3	.4949E+01	.4949E+01	-.4281E-01	-.4281E-01	1.2016	.0000	.0000E+00	.5471E-03	.5501E-03	.4516E+02	0	265.04

.14102904E+01	.13007079E+01	.12069280E+01	.11627404E+01	.11417472E+01	.11286471E+01	.11179508E+01	.11080579E+01
.10984005E+01	.10888030E+01	.10792487E+01	.10697839E+01	.10604758E+01	.10513932E+01	.10425926E+01	.10341135E+01
.10259854E+01	.10182259E+01	.10108447E+01	.10038538E+01	.99726064E+00	.99106638E+00	.98526212E+00	.97983984E+00
.97479495E+00	.97012053E+00	.96579748E+00	.96179279E+00	.95806813E+00	.95458720E+00	.95132029E+00	.94824363E+00
.94533599E+00	.94259805E+00	.94001078E+00	.93757549E+00	.93529542E+00	.93318073E+00	.93124518E+00	.92949805E+00
.92793624E+00	.92654519E+00	.92530289E+00	.92418632E+00	.92317511E+00	.92225605E+00	.92141961E+00	.92067406E+00
.91998559E+00	.91948157E+00	.91878626E+00					

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
90	-.88800E-03	.60502E-04	.11000E+02	-.26630E-03	.98338E-05	.97000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
91	-.76605E-03	.51952E-04	.10200E+02	-.23675E-03	.86086E-05	.97000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
92	-.66869E-03	.44448E-04	.10100E+02	-.21003E-03	.75195E-05	.97000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
93	-.58295E-03	.37877E-04	.10100E+02	-.18593E-03	.65532E-05	.97000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
94	-.50675E-03	.32138E-04	.10100E+02	-.16444E-03	.56976E-05	.96000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
95	-.44089E-03	.27139E-04	.10000E+02	-.14544E-03	.49415E-05	.96000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX

96	-.38257E-03	.22797E-04	.10000E+02	-.12835E-03	.42747E-05	.96000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
97	-.33091E-03	.19038E-04	.10000E+02	-.11301E-03	.36880E-05	.96000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
98	-.28553E-03	.15800E-04	.99000E+01	-.99271E-04	.31735E-05	.96000E+01	-I	-I	-I

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
99	-.24660E-03	.13016E-04	.99000E+01	-.86985E-04	.27228E-05	.96000E+01	-I	-I	-I

INTRAC=100

M = 1 S(1) = 7.00010E+00 PMF(1) = 2.52830E+00 UEP(1) = 1.26568E+00 AH(1) = .00000E+00 AMACH = .00000E+00 XC = 6.69127E+00

*** INVERSE B.L. CALCULATIONS - SUMMARY CHART NO. 1 ***

M	XOCBL(M)	NO	PMF(M)	PMFCHK(M)	BETA(M)	BETCHK	UEP(M)	AMACH(M)	AH(M)	CF(M)	CFZ(M)	ALPHW(M)	NPCH	RTHETA(M)
2	7.1000	2	.2536E+01	.2536E+01	.8505E-01	.8505E-01	1.2794	.0000	.0000E+00	.6696E-02	.1118E-02	.9481E+01	0	197.29
3	7.2000	2	.2546E+01	.2546E+01	.8291E-01	.8291E-01	1.2932	.0000	.0000E+00	.6785E-02	.1119E-02	.9365E+01	0	197.91
4	7.3000	2	.2557E+01	.2557E+01	.8062E-01	.8062E-01	1.3068	.0000	.0000E+00	.6869E-02	.1120E-02	.9259E+01	0	198.62
5	7.4000	2	.2569E+01	.2569E+01	.7886E-01	.7886E-01	1.3204	.0000	.0000E+00	.6956E-02	.1121E-02	.9151E+01	0	199.40
6	7.5000	2	.2581E+01	.2581E+01	.7757E-01	.7757E-01	1.3341	.0000	.0000E+00	.7052E-02	.1122E-02	.9040E+01	0	200.21

PROFILES AT M= 6 S(M)=R 7.50000E+00 INVRSE= 1 PMF(M)= 2.58140E+00 BETA(M)= 7.75679E-02

N	ETA(N)	YBL(N)	F2(N)	SF2(N)	G2(N)	EPSBAR(N)	RHOMUR(N)	T(N)
1	.00000E+00	-I	.00000E+00	.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
2	2.89445E-04	3.36372E-06	2.46453E-04	1.66068E-04	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
3	6.04941E-04	7.03018E-06	5.15037E-04	3.46869E-04	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
4	9.48830E-04	1.10266E-05	8.07735E-04	5.43904E-04	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
5	1.32367E-03	1.53827E-05	1.12671E-03	7.58547E-04	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
6	1.73225E-03	2.01309E-05	1.47430E-03	9.92360E-04	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
7	2.17759E-03	2.53064E-05	1.85308E-03	1.24704E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
8	2.66302E-03	3.09477E-05	2.26584E-03	1.52444E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
9	3.19214E-03	3.70967E-05	2.71560E-03	1.82655E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
10	3.76888E-03	4.37991E-05	3.20568E-03	2.15556E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
11	4.39752E-03	5.11048E-05	3.73967E-03	2.51384E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
12	5.08274E-03	5.90679E-05	4.32149E-03	2.90394E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
13	5.82964E-03	6.77478E-05	4.95539E-03	3.32866E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
14	6.64375E-03	7.72084E-05	5.64601E-03	3.79103E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
15	7.52113E-03	8.75213E-05	6.39841E-03	4.29431E-03	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00

87	1.00000E+00	-3.92730E-09	1.75564E+01
88	1.00000E+00	-2.71096E-08	1.75564E+01
89	1.00000E+00	-2.59788E-09	1.75564E+01
90	1.00000E+00	1.14897E-09	1.75564E+01
91	1.00000E+00	-7.02582E-09	1.75564E+01
92	1.00000E+00	-2.58098E-09	1.75564E+01
93	1.00000E+00	1.57389E-09	1.75564E+01
94	1.00000E+00	-3.68435E-11	1.75564E+01
95	1.00000E+00	1.32922E-10	1.75564E+01
96	1.00000E+00	1.35049E-09	1.75564E+01
97	1.00000E+00	2.59533E-11	1.75564E+01
98	1.00000E+00	-6.19827E-10	1.75564E+01
99	1.00000E+00	5.29244E-11	1.75564E+01
100	1.00000E+00	.00000E+00	1.75564E+01

M	XOCEL(M)	NU	PMF(M)	PMFCHK(M)	BETA(M)	BETCHK	UEP(M)	AMACH(M)	AH(M)	CF(M)	CFZ(M)	ALPHW(M)	NMCH	RTHETA(M)
42	11.1000	8	.2204E+02	.2204E+02	-.5967E+00	-.5955E+00	1.3007	.0000	.0000E+00	-.1071E-01	.2323E-02	-.1223E+02	67	773.91

PROFILES AT M= 42 S(M)=R 1.11000E+01 INVRSE= 1 PMF(M)= 2.20399E+01 BETA(M)= -5.96731E-01

N	ETA(N)	YBL(N)	F2(N)	SF2(N)	G2(N)	EPSBAR(N)	RHOMUR(N)	T(N)
1	.00000E+00	-1	.00000E+00	.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
2	2.89445E-04	2.94552E-05	-3.35116E-03	-1.48170E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
3	6.04941E-04	6.15613E-05	-6.97632E-03	-3.08406E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
4	9.48830E-04	9.65570E-05	-1.08950E-02	-4.81561E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
5	1.32367E-03	1.34702E-04	-1.51277E-02	-6.68520E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
6	1.73225E-03	1.76281E-04	-1.96954E-02	-8.70198E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
7	2.17759E-03	2.21601E-04	-2.46198E-02	-1.08754E-01	1.00000E+00	1.00001E+00	1.00000E+00	1.00000E+00
8	2.66302E-03	2.71001E-04	-2.99232E-02	-1.32145E-01	1.00000E+00	1.00002E+00	1.00000E+00	1.00000E+00
9	3.19214E-03	3.24846E-04	-3.56279E-02	-1.57302E-01	1.00000E+00	1.00004E+00	1.00000E+00	1.00000E+00
10	3.76888E-03	3.83537E-04	-4.17562E-02	-1.84307E-01	1.00000E+00	1.00008E+00	1.00000E+00	1.00000E+00
11	4.39752E-03	4.47511E-04	-4.83300E-02	-2.13259E-01	1.00000E+00	1.00015E+00	1.00000E+00	1.00000E+00
12	5.08274E-03	5.17242E-04	-5.53703E-02	-2.44244E-01	1.00000E+00	1.00025E+00	1.00000E+00	1.00000E+00
13	5.82964E-03	5.93249E-04	-6.28967E-02	-2.77345E-01	1.00000E+00	1.00043E+00	1.00000E+00	1.00000E+00
14	6.64375E-03	6.76096E-04	-7.09264E-02	-3.12632E-01	1.00000E+00	1.00070E+00	1.00000E+00	1.00000E+00
15	7.53113E-03	7.66400E-04	-7.94740E-02	-3.50162E-01	1.00000E+00	1.00113E+00	1.00000E+00	1.00000E+00
16	8.49838E-03	8.64831E-04	-8.85498E-02	-3.89974E-01	1.00000E+00	1.00177E+00	1.00000E+00	1.00000E+00
17	9.55268E-03	9.72121E-04	-9.81588E-02	-4.32083E-01	1.00000E+00	1.00272E+00	1.00000E+00	1.00000E+00
18	1.07019E-02	1.08907E-03	-1.08300E-01	-4.76472E-01	1.00000E+00	1.00412E+00	1.00000E+00	1.00000E+00
19	1.19545E-02	1.21654E-03	-1.18962E-01	-5.23088E-01	1.00000E+00	1.00613E+00	1.00000E+00	1.00000E+00
20	1.33198E-02	1.35548E-03	-1.30125E-01	-5.71830E-01	1.00000E+00	1.00899E+00	1.00000E+00	1.00000E+00
21	1.48081E-02	1.50693E-03	-1.41757E-01	-6.22546E-01	1.00000E+00	1.01299E+00	1.00000E+00	1.00000E+00
22	1.64302E-02	1.67201E-03	-1.53807E-01	-6.74966E-01	1.00000E+00	1.01852E+00	1.00000E+00	1.00000E+00
23	1.81984E-02	1.85195E-03	-1.66211E-01	-7.28897E-01	1.00000E+00	1.02602E+00	1.00000E+00	1.00000E+00
24	2.01257E-02	2.04808E-03	-1.78882E-01	-7.83856E-01	1.00000E+00	1.03606E+00	1.00000E+00	1.00000E+00
25	2.22264E-02	2.26186E-03	-1.91713E-01	-8.39393E-01	1.00000E+00	1.04925E+00	1.00000E+00	1.00000E+00
26	2.45163E-02	2.49488E-03	-2.04573E-01	-8.94934E-01	1.00000E+00	1.06628E+00	1.00000E+00	1.00000E+00
27	2.70122E-02	2.74888E-03	-2.17311E-01	-9.49810E-01	1.00000E+00	1.08785E+00	1.00000E+00	1.00000E+00
28	2.97327E-02	3.02573E-03	-2.29753E-01	-1.00327E+00	1.00000E+00	1.11462E+00	1.00000E+00	1.00000E+00
29	3.26981E-02	3.32750E-03	-2.41712E-01	-1.05450E+00	1.00000E+00	1.14714E+00	1.00000E+00	1.00000E+00
30	3.59304E-02	3.65643E-03	-2.52984E-01	-1.10264E+00	1.00000E+00	1.18580E+00	1.00000E+00	1.00000E+00
31	3.94536E-02	4.01496E-03	-2.63359E-01	-1.14679E+00	1.00000E+00	1.23080E+00	1.00000E+00	1.00000E+00
32	4.32938E-02	4.40577E-03	-2.72615E-01	-1.18603E+00	1.00000E+00	1.28222E+00	1.00000E+00	1.00000E+00
33	4.74797E-02	4.83174E-03	-2.80522E-01	-1.21941E+00	1.00000E+00	1.34036E+00	1.00000E+00	1.00000E+00
34	5.20423E-02	5.29605E-03	-2.86831E-01	-1.24592E+00	1.00000E+00	1.40664E+00	1.00000E+00	1.00000E+00
35	5.70156E-02	5.80215E-03	-2.91259E-01	-1.26443E+00	1.00000E+00	1.48578E+00	1.00000E+00	1.00000E+00
36	6.24365E-02	6.35380E-03	-2.93486E-01	-1.27369E+00	1.00000E+00	1.59000E+00	1.00000E+00	1.00000E+00
37	6.83452E-02	6.95510E-03	-2.93181E-01	-1.27243E+00	1.00000E+00	1.74388E+00	1.00000E+00	1.00000E+00
38	7.47857E-02	7.61051E-03	-2.90102E-01	-1.25979E+00	1.00000E+00	1.98306E+00	1.00000E+00	1.00000E+00
39	8.18058E-02	8.32491E-03	-2.84223E-01	-1.23582E+00	1.00000E+00	2.34323E+00	1.00000E+00	1.00000E+00

40	8.94578E-02	9.10361E-03	-2.75743E-01	-1.20154E+00	1.00000E+00	2.85211E+00	1.00000E+00	1.00000E+00
41	9.77985E-02	9.95239E-03	-2.64980E-01	-1.15840E+00	1.00000E+00	3.53316E+00	1.00000E+00	1.00000E+00
42	1.06890E-01	1.08776E-02	-2.52251E-01	-1.10787E+00	1.00000E+00	4.41356E+00	1.00000E+00	1.00000E+00
43	1.16799E-01	1.18860E-02	-2.37825E-01	-1.05121E+00	1.00000E+00	5.52727E+00	1.00000E+00	1.00000E+00
44	1.27601E-01	1.29852E-02	-2.21905E-01	-9.89415E-01	1.00000E+00	6.91626E+00	1.00000E+00	1.00000E+00
45	1.39374E-01	1.41833E-02	-2.04637E-01	-9.23247E-01	1.00000E+00	8.63111E+00	1.00000E+00	1.00000E+00
46	1.52207E-01	1.54893E-02	-1.86119E-01	-8.53297E-01	1.00000E+00	1.07308E+01	1.00000E+00	1.00000E+00
47	1.66195E-01	1.69128E-02	-1.66409E-01	-7.80013E-01	1.00000E+00	1.32836E+01	1.00000E+00	1.00000E+00
48	1.81442E-01	1.84644E-02	-1.45533E-01	-7.03744E-01	1.00000E+00	1.63674E+01	1.00000E+00	1.00000E+00
49	1.98062E-01	2.01556E-02	-1.23490E-01	-6.24763E-01	1.00000E+00	2.00701E+01	1.00000E+00	1.00000E+00
50	2.16177E-01	2.19991E-02	-1.00256E-01	-5.43303E-01	1.00000E+00	2.44896E+01	1.00000E+00	1.00000E+00
51	2.35922E-01	2.40084E-02	-7.57907E-02	-4.59570E-01	1.00000E+00	2.97342E+01	1.00000E+00	1.00000E+00
52	2.57444E-01	2.61987E-02	-5.00349E-02	-3.73771E-01	1.00000E+00	3.59225E+01	1.00000E+00	1.00000E+00
53	2.80904E-01	2.85860E-02	-2.29182E-02	-2.86136E-01	1.00000E+00	4.31839E+01	1.00000E+00	1.00000E+00
54	3.06475E-01	3.11882E-02	5.64188E-03	-1.96932E-01	1.00000E+00	5.16520E+01	1.00000E+00	1.00000E+00
55	3.34347E-01	3.40246E-02	3.57285E-02	-1.06515E-01	1.00000E+00	6.14151E+01	1.00000E+00	1.00000E+00
56	3.64728E-01	3.71162E-02	6.73772E-02	-1.54810E-02	1.00000E+00	7.25846E+01	1.00000E+00	1.00000E+00
57	3.97842E-01	4.04862E-02	1.00660E-01	7.55809E-02	1.00000E+00	8.53759E+01	1.00000E+00	1.00000E+00
58	4.33938E-01	4.41594E-02	1.35678E-01	1.66021E-01	1.00000E+00	1.00043E+02	1.00000E+00	1.00000E+00
59	4.73282E-01	4.81632E-02	1.72562E-01	2.55150E-01	1.00000E+00	1.16899E+02	1.00000E+00	1.00000E+00
60	5.16166E-01	5.25273E-02	2.11470E-01	3.42086E-01	1.00000E+00	1.36318E+02	1.00000E+00	1.00000E+00
61	5.62911E-01	5.72842E-02	2.52584E-01	4.25803E-01	1.00000E+00	1.58769E+02	1.00000E+00	1.00000E+00
62	6.13862E-01	6.24692E-02	2.96116E-01	5.05040E-01	1.00000E+00	1.84798E+02	1.00000E+00	1.00000E+00
63	6.69399E-01	6.81209E-02	3.42298E-01	5.78226E-01	1.00000E+00	2.15200E+02	1.00000E+00	1.00000E+00
64	7.29935E-01	7.42813E-02	3.91416E-01	6.43460E-01	1.00000E+00	2.50836E+02	1.00000E+00	1.00000E+00
65	7.95918E-01	8.09960E-02	4.43775E-01	6.98351E-01	1.00000E+00	2.90964E+02	1.00000E+00	1.00000E+00
66	8.67840E-01	8.83151E-02	4.98959E-01	7.39377E-01	1.00000E+00	3.42094E+02	1.00000E+00	1.00000E+00
67	9.46235E-01	9.62930E-02	5.59212E-01	7.64147E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
68	1.03169E+00	1.04989E-01	6.26188E-01	7.67416E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
69	1.12483E+00	1.14467E-01	6.95473E-01	7.43440E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
70	1.22635E+00	1.24799E-01	7.61027E-01	6.92538E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
71	1.33701E+00	1.36060E-01	8.18371E-01	6.21110E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
72	1.45763E+00	1.48335E-01	8.65614E-01	5.38104E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
73	1.58911E+00	1.61715E-01	9.02855E-01	4.51913E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
74	1.73242E+00	1.76298E-01	9.31217E-01	3.69042E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
75	1.88863E+00	1.92195E-01	9.52212E-01	2.93789E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
76	2.05889E+00	2.09522E-01	9.67384E-01	2.28461E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
77	2.24448E+00	2.28408E-01	9.78112E-01	1.73821E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
78	2.44677E+00	2.48994E-01	9.85550E-01	1.29565E-01	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
79	2.66727E+00	2.71433E-01	9.90608E-01	9.47354E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
80	2.90762E+00	2.95892E-01	9.93986E-01	6.80328E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
81	3.16959E+00	3.22551E-01	9.96203E-01	4.80529E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
82	3.45514E+00	3.51610E-01	9.97633E-01	3.34292E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
83	3.76640E+00	3.83285E-01	9.98541E-01	2.29401E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
84	4.10566E+00	4.17810E-01	9.99110E-01	1.55518E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
85	4.47546E+00	4.55442E-01	9.99462E-01	1.04310E-02	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
86	4.87854E+00	4.96461E-01	9.99678E-01	6.93208E-03	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
87	5.31790E+00	5.41172E-01	9.99808E-01	4.57072E-03	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
88	5.79680E+00	5.89907E-01	9.99886E-01	2.99388E-03	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
89	6.31880E+00	6.43028E-01	9.99933E-01	1.95028E-03	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
90	6.88778E+00	7.00930E-01	9.99960E-01	1.26471E-03	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
91	7.50797E+00	7.64043E-01	9.99977E-01	8.17064E-04	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
92	8.18398E+00	8.32837E-01	9.99986E-01	5.26166E-04	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
93	8.92083E+00	9.07822E-01	9.99992E-01	3.37880E-04	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
94	9.72399E+00	9.89555E-01	9.99995E-01	2.16240E-04	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
95	1.05994E+01	1.07864E+00	9.99997E-01	1.38173E-04	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
96	1.15537E+01	1.17575E+00	9.99998E-01	8.71879E-05	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
97	1.25938E+01	1.28160E+00	9.99999E-01	5.63626E-05	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
98	1.37275E+01	1.39697E+00	9.99999E-01	3.19236E-05	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
99	1.49633E+01	1.52273E+00	1.00000E+00	2.68853E-05	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00
100	1.63103E+01	1.[illegible]E+00	1.00000E+00	[illegible]	1.00000E+00	3.50149E+02	1.00000E+00	1.00000E+00

ORIGINAL PAGE IS OF POOR QUALITY

N	WZ(N)	BETZ(N)	ALPHZ(N)
1	.0C0C0E+00	-3.11681E+01	-1.22342E+01
2	2.12593E-03	-3.12111E+01	-1.22772E+01
3	4.44323E-03	-3.12583E+01	-1.23244E+01
4	6.96918E-03	-3.13101E+01	-1.23762E+01
5	9.72262E-03	-3.13671E+01	-1.24332E+01
6	1.27241E-02	-3.14297E+01	-1.24958E+01
7	1.59962E-02	-3.14986E+01	-1.25648E+01
8	1.95632E-02	-3.15745E+01	-1.26407E+01
9	2.34521E-02	-3.16582E+01	-1.27243E+01
10	2.76921E-02	-3.17504E+01	-1.28165E+01
11	3.23151E-02	-3.18522E+01	-1.29183E+01
12	3.73559E-02	-3.19645E+01	-1.30307E+01
13	4.28526E-02	-3.20888E+01	-1.31549E+01
14	4.88465E-02	-3.22262E+01	-1.32923E+01
15	5.53829E-02	-3.23782E+01	-1.34444E+01
16	6.25106E-02	-3.25467E+01	-1.36129E+01
17	7.02824E-02	-3.27335E+01	-1.37997E+01
18	7.87552E-02	-3.29408E+01	-1.40069E+01
19	8.79895E-02	-3.31708E+01	-1.42370E+01
20	9.80489E-02	-3.34263E+01	-1.44925E+01
21	1.09000E-01	-3.37102E+01	-1.47763E+01
22	1.20909E-01	-3.40256E+01	-1.50917E+01
23	1.33844E-01	-3.43759E+01	-1.54421E+01
24	1.47866E-01	-3.47650E+01	-1.58311E+01
25	1.63032E-01	-3.51968E+01	-1.62629E+01
26	1.79388E-01	-3.56755E+01	-1.67416E+01
27	1.96967E-01	-3.62056E+01	-1.72717E+01
28	2.15784E-01	-3.67918E+01	-1.78579E+01
29	2.35839E-01	-3.74394E+01	-1.85055E+01
30	2.57112E-01	-3.81542E+01	-1.92203E+01
31	2.79569E-01	-3.89431E+01	-2.00092E+01
32	3.03162E-01	-3.98145E+01	-2.08806E+01
33	3.27833E-01	-4.07793E+01	-2.18454E+01
34	3.53504E-01	-4.18513E+01	-2.29174E+01
35	3.80047E-01	-4.30476E+01	-2.41137E+01
36	4.07206E-01	-4.43863E+01	-2.54525E+01
37	4.34466E-01	-4.58804E+01	-2.69465E+01
38	4.60985E-01	-4.75288E+01	-2.85949E+01
39	4.85777E-01	-4.93169E+01	-3.03830E+01
40	5.08076E-01	-5.12296E+01	-3.22958E+01
41	5.27530E-01	-5.32643E+01	-3.43304E+01
42	5.44140E-01	-5.54345E+01	-3.65006E+01
43	5.58104E-01	-5.77682E+01	-3.88343E+01
44	5.69712E-01	-6.03044E+01	-4.13705E+01
45	5.79274E-01	-6.30924E+01	-4.41585E+01
46	5.87089E-01	-6.61912E+01	-4.72573E+01
47	5.93434E-01	-6.96695E+01	-5.07357E+01
48	5.98557E-01	-7.36055E+01	-5.46716E+01
49	6.02676E-01	-7.80833E+01	-5.91494E+01
50	6.05983E-01	-8.31863E+01	-6.42524E+01
51	6.08649E-01	-8.89830E+01	-7.00491E+01
52	6.10825E-01	-9.55038E+01	-7.65699E+01
53	6.12646E-01	-1.02710E+02	-8.37764E+01
54	6.14238E-01	6.95323E+01	8.84662E+01
55	6.15714E-01	6.14649E+01	8.03988E+01
56	6.17151E-01	5.34120E+01	7.23459E+01
57	6.18620E-01	4.56892E+01	6.46231E+01

58	6.20191E-01	3.85390E+01	5.74729E+01
59	6.21945E-01	3.20996E+01	5.10335E+01
60	6.23985E-01	2.64135E+01	4.53474E+01
61	6.26462E-01	2.14575E+01	4.03913E+01
62	6.29609E-01	1.71721E+01	3.61060E+01
63	6.33817E-01	1.34893E+01	3.24231E+01
64	6.39852E-01	1.03484E+01	2.92823E+01
65	6.49232E-01	7.71612E+00	2.66500E+01
66	6.63973E-01	5.60212E+00	2.45360E+01
67	6.86708E-01	3.90925E+00	2.28431E+01
68	7.19544E-01	2.57946E+00	2.15133E+01
69	7.60903E-01	1.63774E+00	2.05716E+01
70	8.06444E-01	1.04280E+00	1.99767E+01
71	8.50960E-01	6.97337E-01	1.96312E+01
72	8.90254E-01	4.99057E-01	1.94329E+01
73	9.22210E-01	3.76122E-01	1.93100E+01
74	9.46600E-01	2.90001E-01	1.92239E+01
75	9.64321E-01	2.23311E-01	1.91572E+01
76	9.76709E-01	1.69338E-01	1.91032E+01
77	9.85109E-01	1.25692E-01	1.90596E+01
78	9.90663E-01	9.11868E-02	1.90251E+01
79	9.94254E-01	6.46994E-02	1.89986E+01
80	9.96528E-01	4.49520E-02	1.89788E+01
81	9.97938E-01	3.06219E-02	1.89645E+01
82	9.98795E-01	2.04782E-02	1.89544E+01
83	9.99306E-01	1.34621E-02	1.89473E+01
84	9.99606E-01	8.71273E-03	1.89426E+01
85	9.99778E-01	5.56051E-03	1.89394E+01
86	9.99877E-01	3.50495E-03	1.89374E+01
87	9.99932E-01	2.18532E-03	1.89361E+01
88	9.99963E-01	1.34976E-03	1.89352E+01
89	9.99980E-01	8.27027E-04	1.89347E+01
90	9.99989E-01	5.03329E-04	1.89344E+01
91	9.99994E-01	3.04610E-04	1.89342E+01
92	9.99997E-01	1.83499E-04	1.89341E+01
93	9.99998E-01	1.10149E-04	1.89340E+01
94	9.99999E-01	6.58845E-05	1.89340E+01
95	1.00000E+00	3.94218E-05	1.89339E+01
96	1.00000E+00	2.32994E-05	1.89339E+01
97	1.00000E+00	1.43125E-05	1.89339E+01
98	1.00000E+00	7.56914E-06	1.89339E+01
99	1.00000E+00	6.42834E-06	1.89339E+01
100	1.00000E+00	.00000E+00	1.89339E+01

M	XOCBL(M)	NQ	PMF(M)	PMFCHK(M)	BETA(M)	BETCHK	UEP(M)	AMACH(M)	AH(M)	CF(M)	CFZ(M)	ALPHW(M)	NMCH	RTHETA(M)
43	11.2000	6	.1965E+02	.1965E+02	-.5966E+00	-.5970E+00	1.2070	.0000	.0000E+00	-.8065E-02	.3424E-02	-.2300E+02	70	1184.79

PROFILES AT M= 43 S(M)=R 1.12000E+01 INVRSE= 1 PMF(M)= 1.96542E+01 BETA(M)= -5.96617E-01

N	ETA(N)	YPL(N)	F2(N)	SF2(N)	G2(N)	EPSBAR(N)	RHOMUR(N)	T(N)
1	.00000E+00	-I	.00000E+00	.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
2	2.89445E-04	2.83072E-05	-2.61243E-03	-1.02488E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
3	6.04941E-04	5.91620E-05	-5.43798E-03	-2.13304E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
4	9.48830E-04	9.27937E-05	-8.49166E-03	-3.33027E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
5	1.32367E-03	1.29452E-04	-1.17891E-02	-4.62260E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
6	1.73225E-03	1.69410E-04	-1.53463E-02	-6.01620E-02	1.00000E+00	1.00000E+00	1.00000E+00	1.00000E+00
7	2.17759E-03	2.12964E-04	-1.91797E-02	-7.51736E-02	1.00000E+00	1.00001E+00	1.00000E+00	1.00000E+00
8	2.66302E-03	2.60438E-04	-2.33059E-02	-9.13243E-02	1.00000E+00	1.00001E+00	1.00000E+00	1.00000E+00
9	3.19214E-03	3.12185E-04	-2.77414E-02	-1.08677E-01	1.00000E+00	1.00002E+00	1.00000E+00	1.00000E+00
10	3.76888E-03	3.68590E-04	-3.25024E-02	-1.27292E-01	1.00000E+00	1.00004E+00	1.00001E+00	1.00001E+00

61	8.55732E-01	7.36546E+00	3.32675E+01
62	8.63381E-01	7.14215E+00	3.30442E+01
63	8.70735E-01	6.90994E+00	3.28120E+01
64	8.77810E-01	6.66902E+00	3.25711E+01
65	8.84623E-01	6.41972E+00	3.23218E+01
66	8.91187E-01	6.16245E+00	3.20645E+01
67	8.97516E-01	5.89775E+00	3.17998E+01
68	9.03624E-01	5.62629E+00	3.15283E+01
69	9.09525E-01	5.34881E+00	3.12508E+01
70	9.15230E-01	5.06617E+00	3.09682E+01
71	9.20752E-01	4.77931E+00	3.06813E+01
72	9.26103E-01	4.48924E+00	3.03913E+01
73	9.31296E-01	4.19703E+00	3.00991E+01
74	9.36342E-01	3.90380E+00	2.98058E+01
75	9.41249E-01	3.61071E+00	2.95127E+01
76	9.46028E-01	3.31900E+00	2.92210E+01
77	9.50685E-01	3.02989E+00	2.89319E+01
78	9.55224E-01	2.74468E+00	2.86467E+01
79	9.59648E-01	2.46471E+00	2.83667E+01
80	9.63958E-01	2.19123E+00	2.80933E+01
81	9.68140E-01	1.92619E+00	2.78282E+01
82	9.72228E-01	1.66835E+00	2.75704E+01
83	9.76314E-01	1.41282E+00	2.73149E+01
84	9.80391E-01	1.16090E+00	2.70629E+01
85	9.84334E-01	9.20842E-01	2.68229E+01
86	9.88004E-01	7.00935E-01	2.66030E+01
87	9.91265E-01	5.08481E-01	2.64105E+01
88	9.94008E-01	3.48776E-01	2.62508E+01
89	9.96168E-01	2.24221E-01	2.61263E+01
90	9.97742E-01	1.33852E-01	2.60359E+01
91	9.98789E-01	7.35376E-02	2.59756E+01
92	9.99415E-01	3.69279E-02	2.59390E+01
93	9.99749E-01	1.69210E-02	2.59190E+01
94	9.99904E-01	7.13255E-03	2.59092E+01
95	9.99967E-01	2.82755E-03	2.59049E+01
96	9.99990E-01	1.08706E-03	2.59031E+01
97	9.99997E-01	4.09043E-04	2.59024E+01
98	9.99999E-01	1.41667E-04	2.59022E+01
99	1.00000E+00	3.76019E-05	2.59021E+01
100	1.00000E+00	.00000E+00	2.59020E+01

M	XOCBL(M)	NO	PMF(M)	PMFCHK(M)	BETA(M)	BETCHK	UEP(M)	AMACH(M)	AH(M)	CF(M)	CFZ(M)	ALPHW(M)	NMCH	RTHETA(M)

XC(M),M=1,MMAX (LEVY-LEES STREAMWISE COORDINATE)

.66912675E+01	.68183962E+01	.69470260E+01	.70770230E+01	.72083816E+01	.73411038E+01	.74751989E+01	.76106798E+01
.77475512E+01	.78857949E+01	.80253579E+01	.81661515E+01	.83080633E+01	.84509733E+01	.85947632E+01	.87393110E+01
.88844790E+01	.90301045E+01	.91759984E+01	.93219520E+01	.94677451E+01	.96131532E+01	.97579554E+01	.99019521E+01
.10045067E+02	.10187101E+02	.10328356E+02	.10468977E+02	.10609166E+02	.10749072E+02	.10888792E+02	.11028386E+02
.11167892E+02	.11307334E+02	.11446731E+02	.11586096E+02	.11725448E+02	.11864823E+02	.12004316E+02	.12144175E+02
.12284756E+02	.12420311E+02	.12545698E+02	.12664189E+02	.12779421E+02	.12892951E+02	.13005292E+02	.13116602E+02
.13226934E+02	.13336303E+02	.13444714E+02	.13552173E+02	.13658694E+02	.13764295E+02	.13869001E+02	.13972843E+02
.14075855E+02	.14178071E+02	.14279531E+02	.14380272E+02	.14480333E+02	.14579755E+02	.14678577E+02	.14776837E+02
.14874574E+02	.14971825E+02	.15068626E+02	.15165011E+02	.15261009E+02	.15356646E+02	.15451946E+02	.15546929E+02
.15641613E+02	.15736015E+02	.15830150E+02	.15924034E+02	.16017682E+02	.16111110E+02	.16204336E+02	.16297378E+02
.16390254E+02	.16482983E+02	.16575580E+02	.16668059E+02	.16760431E+02	.16852707E+02	.16944895E+02	.17037005E+02
.17129042E+02	.17221020E+02	.17312938E+02					

*** INVERSE B.L. CALCULATIONS - SUMMARY CHART NO. 2 ***

M	XLE	S	DT*	THETA*	CPBLBR	CPBL	UEP	QW	STAN	STPNT	CFX

1	7.00010	7.00010	1.99758	-I	-1.00016	-.80104	1.26568	-I	-I	.00000	1.10157
2	7.10000	7.10000	1.98222	.92611	-1.04389	-.83606	1.27944	.00000	.00000	.00000	1.11499
3	7.20000	7.20000	1.96865	.91914	-1.08795	-.87135	1.29316	.00000	.00000	.00000	1.12981
4	7.30000	7.30000	1.95687	.91284	-1.13218	-.90677	1.30678	.00000	.00000	.00000	1.14366
5	7.40000	7.40000	1.94586	.90697	-1.17682	-.94252	1.32039	.00000	.00000	.00000	1.15827
6	7.50000	7.50000	1.93500	.90133	-1.22210	-.97879	1.33405	.00000	.00000	.00000	1.17416
7	7.60000	7.60000	1.92379	.89577	-1.26830	-1.01579	1.34785	.00000	.00000	.00000	1.19181
8	7.70000	7.70000	1.91262	.89031	-1.31539	-1.05351	1.36177	.00000	.00000	.00000	1.20993
9	7.80000	7.80000	1.90303	.88526	-1.36287	-1.09153	1.37566	.00000	.00000	.00000	1.22533
10	7.90000	7.90000	1.89735	.88123	-1.40966	-1.12901	1.38921	.00000	.00000	.00000	1.23378
11	8.00000	8.00000	1.89791	.87886	-1.45438	-1.16482	1.40205	.00000	.00000	.00000	1.23180
12	8.10000	8.10000	1.90603	.87864	-1.49580	-1.19800	1.41383	.00000	.00000	.00000	1.21856
13	8.20000	8.20000	1.92146	.88065	-1.53330	-1.22803	1.42441	.00000	.00000	.00000	1.19639
14	8.30000	8.30000	1.94302	.88472	-1.56679	-1.25485	1.43379	.00000	.00000	.00000	1.16865
15	8.40000	8.40000	1.97011	.89067	-1.59627	-1.27847	1.44200	.00000	.00000	.00000	1.13658
16	8.50000	8.50000	2.00372	.89863	-1.62135	-1.29855	1.44895	.00000	.00000	.00000	1.09826
17	8.60000	8.60000	2.04631	.90905	-1.64113	-1.31439	1.45441	.00000	.00000	.00000	1.05018
18	8.70000	8.70000	2.10114	.92250	-1.65455	-1.32514	1.45810	.00000	.00000	.00000	.98935
19	8.80000	8.80000	2.17168	.93958	-1.66066	-1.33004	1.45978	.00000	.00000	.00000	.91442
20	8.90000	8.90000	2.26173	.96078	-1.65888	-1.32861	1.45929	.00000	.00000	.00000	.82543
21	9.00000	9.00000	2.37624	.98658	-1.64895	-1.32066	1.45656	.00000	.00000	.00000	.72275
22	9.10000	9.10000	2.52332	1.01756	-1.63087	-1.30617	1.45158	.00000	.00000	.00000	.60576
23	9.20000	9.20000	2.71683	1.05442	-1.60500	-1.28546	1.44442	.00000	.00000	.00000	.47323
24	9.30000	9.30000	2.97898	1.09767	-1.57272	-1.25960	1.43545	.00000	.00000	.00000	.32674
25	9.40000	9.40000	3.34048	1.14666	-1.53737	-1.23129	1.42555	.00000	.00000	.00000	.17685
26	9.50000	9.50000	3.83463	1.19857	-1.50421	-1.20473	1.41621	.00000	.00000	.00000	.04593
27	9.60000	9.60000	4.48289	1.24881	-1.47788	-1.18364	1.40874	.00000	.00000	.00000	-.04260
28	9.70000	9.70000	5.28297	1.29340	-1.45957	-1.16898	1.40353	.00000	.00000	.00000	-.08404
29	9.80000	9.80000	6.21508	1.33081	-1.44759	-1.15939	1.40010	.00000	.00000	.00000	-.09375
30	9.90000	9.90000	7.25455	1.36123	-1.43981	-1.15315	1.39788	.00000	.00000	.00000	-.08883
31	10.00000	10.00000	8.37655	1.38552	-1.43464	-1.14902	1.39640	.00000	.00000	.00000	-.07910
32	10.10000	10.10000	9.55636	1.40461	-1.43110	-1.14618	1.39538	.00000	.00000	.00000	-.06899
33	10.20000	10.20000	10.76956	1.41934	-1.42857	-1.14415	1.39465	.00000	.00000	.00000	-.06001
34	10.30000	10.30000	11.99084	1.43038	-1.42672	-1.14267	1.39412	.00000	.00000	.00000	-.05249
35	10.40000	10.40000	13.19500	1.43822	-1.42540	-1.14161	1.39374	.00000	.00000	.00000	-.04617
36	10.50000	10.50000	14.34734	1.44295	-1.42457	-1.14095	1.39351	.00000	.00000	.00000	-.04079
37	10.60000	10.60000	15.42031	1.44405	-1.42451	-1.14090	1.39349	.00000	.00000	.00000	-.03529
38	10.70000	10.70000	16.33297	1.43856	-1.42617	-1.14223	1.39397	.00000	.00000	.00000	-.02807
39	10.80000	10.80000	17.10876	1.41628	-1.43278	-1.14753	1.39586	.00000	.00000	.00000	-.01893
40	10.90000	10.90000	17.37967	1.35041	-1.45166	-1.16265	1.40127	.00000	.00000	.00000	-.05548
41	11.00000	11.00000	17.74242	1.21267	-1.48342	-1.18808	1.41031	.00000	.00000	.00000	-.35938
42	11.10000	11.10000	16.94429	3.57334	-1.11246	-.89098	1.30073	.00000	.00000	1.00000	-1.78398
43	11.20000	11.20000	16.28388	5.89543	-.81891	-.65587	1.20697	.00000	.00000	1.00000	-1.34292
44	11.30000	11.30000	15.60241	7.12998	-.68825	-.55122	1.16281	.00000	.00000	1.00000	-.57090
45	11.40000	11.40000	15.14214	7.73352	-.62788	-.50287	1.14183	.00000	.00000	1.00000	-.15768
46	11.50000	11.50000	14.90784	8.11403	-.59075	-.47313	1.12873	.00000	.00000	1.00000	.01909
47	11.60000	11.60000	14.86466	8.42815	-.56074	-.44910	1.11804	.00000	.00000	1.00000	.10483
48	11.70000	11.70000	14.96687	8.72464	-.53323	-.42707	1.10814	.00000	.00000	1.00000	.15192
49	11.80000	11.80000	15.17855	9.02224	-.50661	-.40575	1.09848	.00000	.00000	1.00000	.17811
50	11.90000	11.90000	15.47204	9.32792	-.48039	-.38475	1.08888	.00000	.00000	1.00000	.19255
51	12.00000	12.00000	15.82633	9.64334	-.45452	-.36403	1.07932	.00000	.00000	1.00000	.20037
52	12.10000	12.10000	16.22489	9.96780	-.42911	-.34368	1.06985	.00000	.00000	1.00000	.20467
53	12.20000	12.20000	16.65410	10.29944	-.40434	-.32384	1.06054	.00000	.00000	1.00000	.20747
54	12.30000	12.30000	17.10287	10.63582	-.38038	-.30465	1.05146	.00000	.00000	1.00000	.20989
55	12.40000	12.40000	17.56242	10.97457	-.35736	-.28622	1.04265	.00000	.00000	1.00000	.21250
56	12.50000	12.50000	18.02580	11.31354	-.33537	-.26860	1.03417	.00000	.00000	1.00000	.21562
57	12.60000	12.60000	18.48745	11.65074	-.31446	-.25185	1.02604	.00000	.00000	1.00000	.21935
58	12.70000	12.70000	18.94303	11.98445	-.29465	-.23598	1.01928	.00000	.00000	1.00000	.22368
59	12.80000	12.80000	19.38879	12.31317	-.27594	-.22100	1.01090	.00000	.00000	1.00000	.22864

60	12.90000	12.90000	19.82085	12.63519	-.25835	-.20691	1.00390	.00000	.00000	1.00000	.23432
61	13.00000	13.00000	20.23560	12.94893	-.24187	-.19372	.99731	.00000	.00000	1.00000	.24082
62	13.10000	13.10000	20.63069	13.25307	-.22649	-.18140	.99111	.00000	.00000	1.00000	.24795
63	13.20000	13.20000	21.00490	13.54675	-.21216	-.16992	.98531	.00000	.00000	1.00000	.25556
64	13.30000	13.30000	21.35703	13.82917	-.19886	-.15927	.97988	.00000	.00000	1.00000	.26357
65	13.40000	13.40000	21.68538	14.09937	-.18654	-.14940	.97484	.00000	.00000	1.00000	.27207
66	13.50000	13.50000	21.98890	14.35658	-.17519	-.14031	.97016	.00000	.00000	1.00000	.28099
67	13.60000	13.60000	22.26846	14.60075	-.16474	-.13194	.96584	.00000	.00000	1.00000	.29004
68	13.70000	13.70000	22.52688	14.83266	-.15510	-.12422	.96183	.00000	.00000	1.00000	.29884
69	13.80000	13.80000	22.76765	15.05358	-.14617	-.11707	.95811	.00000	.00000	1.00000	.30708
70	13.90000	13.90000	22.99387	15.26480	-.13785	-.11041	.95463	.00000	.00000	1.00000	.31470
71	14.00000	14.00000	23.20791	15.46741	-.13008	-.10418	.95136	.00000	.00000	1.00000	.32170
72	14.10000	14.10000	23.41141	15.66226	-.12278	-.09833	.94828	.00000	.00000	1.00000	.32816
73	14.20000	14.20000	23.60531	15.84993	-.11591	-.09284	.94538	.00000	.00000	1.00000	.33419
74	14.30000	14.30000	23.78995	16.03071	-.10945	-.08766	.94264	.00000	.00000	1.00000	.33990
75	14.40000	14.40000	23.96522	16.20468	-.10337	-.08279	.94005	.00000	.00000	1.00000	.34542
76	14.50000	14.50000	24.13062	16.37170	-.09766	-.07821	.93761	.00000	.00000	1.00000	.35086
77	14.60000	14.60000	24.28493	16.53129	-.09232	-.07394	.93533	.00000	.00000	1.00000	.35639
78	14.70000	14.70000	24.42609	16.68255	-.08739	-.06999	.93322	.00000	.00000	1.00000	.36221
79	14.80000	14.80000	24.55176	16.82435	-.08288	-.06638	.93128	.00000	.00000	1.00000	.36849
80	14.90000	14.90000	24.66043	16.95585	-.07882	-.06313	.92954	.00000	.00000	1.00000	.37522
81	15.00000	15.00000	24.75243	17.07696	-.07520	-.06023	.92797	.00000	.00000	1.00000	.38219
82	15.10000	15.10000	24.82967	17.18837	-.07198	-.05765	.92658	.00000	.00000	1.00000	.38913
83	15.20000	15.20000	24.89487	17.29125	-.06911	-.05535	.92534	.00000	.00000	1.00000	.39582
84	15.30000	15.30000	24.95075	17.38691	-.06653	-.05328	.92422	.00000	.00000	1.00000	.40212
85	15.40000	15.40000	24.99960	17.47650	-.06420	-.05142	.92321	.00000	.00000	1.00000	.40800
86	15.50000	15.50000	25.04266	17.56077	-.06208	-.04972	.92229	.00000	.00000	1.00000	.41354
87	15.60000	15.60000	25.08076	17.64026	-.06015	-.04818	.92146	.00000	.00000	1.00000	.41878
88	15.70000	15.70000	25.11227	17.71435	-.05844	-.04680	.92071	.00000	.00000	1.00000	.42410
89	15.80000	15.80000	25.14118	17.78490	-.05687	-.04554	.92003	.00000	.00000	1.00000	.42883
90	15.90000	15.90000	25.15088	17.84438	-.05570	-.04461	.91952	.00000	.00000	1.00000	.43563
91	16.00000	16.00000	25.19297	17.91642	-.05410	-.04333	.91882	.00000	.00000	1.00000	.43604

INTRAC=**DT(M),M=1,MMAX

.11997123E-01	.11904835E-01	.11823326E-01	.11752575E-01	.11686466E-01	.11621272E-01	.11553923E-01	.11486843E-01
.11429221E-01	.11395110E-01	.11398504E-01	.11447287E-01	.11539942E-01	.11669425E-01	.11832133E-01	.12033970E-01
.12289785E-01	.12619062E-01	.13042731E-01	.13563541E-01	.14271291E-01	.15154571E-01	.16316768E-01	.17891232E-01
.20062302E-01	.23030096E-01	.26923432E-01	.31728554E-01	.37326647E-01	.43569520E-01	.50308036E-01	.57393726E-01
.64680028E-01	.72014787E-01	.79246729E-01	.86167475E-01	.92611538E-01	.98092849E-01	.10275209E+00	.10437910E+00
.10655769E+00	.10176428E+00	.97797966E-01	.93705235E-01	.90940889E-01	.89533766E-01	.89274419E-01	.89888279E-01
.91159575E-01	.92922218E-01	.95050043E-01	.97443714E-01	.10002148E+00	.10271667E+00	.10547670E+00	.10825965E+00
.11103223E+00	.11376837E+00	.11644548E+00	.11904041E+00	.12153127E+00	.12390413E+00	.12615159E+00	.12826637E+00
.13023843E+00	.13206130E+00	.13374030E+00	.13529229E+00	.13673830E+00	.13809695E+00	.13938244E+00	.14060461E+00
.14176915E+00	.14287805E+00	.14393072E+00	.14492407E+00	.14585081E+00	.14669863E+00	.14745336E+00	.14810604E+00
.14865E56E+00	.14912246E+00	.14951400E+00	.14984964E+00	.15014301E+00	.15040161E+00	.15063042E+00	.15081968E+00
.15099332E+00	.15105160E+00	.15130433E+00					

OUTPUT QUANTITIES FROM SUBROUTINES INV1 & PPFNEW

VT DISTRIBUTION ON INVISCID MESH AT INTRAC=100

.35952428E-02	.22893868E+00	.42765888E+00	.58163858E+00	.68745256E+00	.75313072E+00	.79141613E+00	.81400734E+00
.82886865E+00	.83987679E+00	.84878484E+00	.85602368E+00	.86186490E+00	.86665864E+00	.87078713E+00	.87455646E+00
.87817497E+00	.88179777E+00	.88555472E+00	.88952594E+00	.89371041E+00	.89803761E+00	.90241068E+00	.90675128E+00
.91102450E+00	.91523545E+00	.91940895E+00	.92357076E+00	.92773966E+00	.93192947E+00	.93615418E+00	.94042881E+00
.94476417E+00	.94916245E+00	.95362150E+00	.95814348E+00	.96273775E+00	.96741913E+00	.97221132E+00	.97715553E+00
.98230368E+00	.98768801E+00	.99329C4E+00	.99907119E+00	.10049686E+01	.10109639E+01	.10170775E+01	.10233855E+01
.10300245E+01	.10371529E+01	.10448630E+01	.10531139E+01	.10617641E+01	.10706621E+01	.10797108E+01	.10888826E+01
.10982145E+01	.11077993E+01	.11177515E+01	.11281444E+01	.11389688E+01	.11501670E+01	.11616943E+01	.11735337E+01
.11856840E+01	.11991416E+01	.12109259E+01	.12240769E+01	.12376005E+01	.12514292E+01	.12654393E+01	.12794396E+01

.12931573E+01	.13067821E+01	.13203900E+01	.13340535E+01	.13478490E+01	.13617689E+01	.13756598E+01	.13892143E+01
.14020460E+01	.14138275E+01	.14244078E+01	.14337935E+01	.14420055E+01	.14489516E+01	.14544092E+01	.14581001E+01
.14597804E+01	.14592936E+01	.14565693E+01	.14515953E+01	.14444504E+01	.14354861E+01	.14256072E+01	.14162761E+01
.14088199E+01	.14036036E+01	.14001757E+01	.13979393E+01	.13964500E+01	.13954239E+01	.13946921E+01	.13941568E+01
.13937714E+01	.13935304E+01	.13935084E+01	.13939856E+01	.13958820E+01	.14012880E+01	.14103330E+01	.13007452E+01
.12069895E+01	.11628265E+01	.11418453E+01	.11287473E+01	.11180491E+01	.11081527E+01	.10984912E+01	.10888895E+01
.10793310E+01	.10698624E+01	.10605507E+01	.10514648E+01	.10426612E+01	.10341794E+01	.10260489E+01	.10182872E+01
.10109041E+01	.10039115E+01	.99731677E+00	.99112112E+00	.98531565E+00	.97989229E+00	.97484641E+00	.97017122E+00
.96584747E+00	.96184217E+00	.95811696E+00	.95463555E+00	.95136818E+00	.94829111E+00	.94538708E+00	.94264476E+00
.94005715E+00	.93762154E+00	.93534117E+00	.93322622E+00	.93129045E+00	.92954314E+00	.92798121E+00	.92659007E+00
.92534771E+00	.92423111E+00	.92321989E+00	.92230094E+00	.92146443E+00	.92071894E+00	.92003453E+00	.91952673E+00
.91883136E+00							

INTRAC=100 PPF(M),M=1,MMAX

.25283025E+01	.25361254E+01	.25457672E+01	.25571951E+01	.25692899E+01	.25813960E+01	.25929755E+01	.26045448E+01
.26179140E+01	.26358182E+01	.26609565E+01	.26948006E+01	.27369416E+01	.27858871E+01	.28409088E+01	.29032869E+01
.29761702E+01	.30636620E+01	.31701650E+01	.33005051E+01	.34611269E+01	.36627701E+01	.39242185E+01	.42761188E+01
.47619367E+01	.54304931E+01	.63150589E+01	.74145811E+01	.87015471E+01	.10140753E+02	.11696771E+02	.13334526E+02
.15019611E+02	.16716526E+02	.18390254E+02	.19992923E+02	.21487823E+02	.22767441E+02	.23881332E+02	.24353436E+02
.25022228E+02	.22039718E+02	.19654042E+02	.18142531E+02	.17289649E+02	.16826886E+02	.16619139E+02	.16585312E+02
.16673245E+02	.16847089E+02	.17081606E+02	.17358159E+02	.17662280E+02	.17982873E+02	.18311421E+02	.18641673E+02
.18968788E+02	.19289207E+02	.19599961E+02	.19898141E+02	.20181055E+02	.20447266E+02	.20696214E+02	.20927338E+02
.21139671E+02	.21332750E+02	.21507690E+02	.21667052E+02	.21813818E+02	.21950514E+02	.22079016E+02	.22200580E+02
.22315903E+02	.22425219E+02	.22528428E+02	.22625139E+02	.22714443E+02	.22794822E+02	.22864570E+02	.22922689E+02
.22969543E+02	.23006682E+02	.23036161E+02	.23060015E+02	.23079883E+02	.23096621E+02	.23110782E+02	.23121098E+02
.23130512E+02	.23126669E+02	.23147846E+02					

INTRAC=100 RHOUE(M),M=1,MMAX

-1	.12794388E+01	.12931567E+01	.13067815E+01	.13203894E+01	.13340530E+01	.13478485E+01	.13617684E+01
.13756593E+01	.13892138E+01	.14020453E+01	.14138268E+01	.14244070E+01	.14337924E+01	.14420042E+01	.14489498E+01
.14544068E+01	.14580967E+01	.14597756E+01	.14592864E+01	.14565585E+01	.14515786E+01	.14444248E+01	.14354477E+01
.14255526E+01	.14162058E+01	.14087411E+01	.14035259E+01	.14001048E+01	.13978775E+01	.13963971E+01	.13953790E+01
.13946540E+01	.13941242E+01	.13937434E+01	.13935059E+01	.13934865E+01	.13939656E+01	.13958632E+01	.14012693E+01
.14103147E+01	.13007263E+01	.12069721E+01	.11628107E+01	.11418309E+01	.11287338E+01	.11180365E+01	.11081408E+01
.10984799E+01	.10888787E+01	.10793207E+01	.10698525E+01	.10605411E+01	.10514555E+01	.10426522E+01	.10341706E+01
.10260403E+01	.10182788E+01	.10108958E+01	.10039033E+01	.99730875E+00	.99111323E+00	.98530787E+00	.97988461E+00
.97483881E+00	.97016371E+00	.96584003E+00	.96183480E+00	.95810967E+00	.95462831E+00	.95136101E+00	.94828400E+00
.94538002E+00	.94263777E+00	.94005021E+00	.93761464E+00	.93533433E+00	.93321942E+00	.93128370E+00	.92953643E+00
.92797454E+00	.92658343E+00	.92534111E+00	.92422454E+00	.92321335E+00	.92229433E+00	.92145795E+00	.92071248E+00
.92002810E+00	.91952032E+00	.91882495E+00					

VT DISTRIBUTION ON INVISCID MESH AT INTRAC=100

.35952428E-02	.22893877E+00	.42765896E+00	.58163865E+00	.68745262E+00	.75313078E+00	.79141619E+00	.81400739E+00
.82880810E+00	.83987685E+00	.84878489E+00	.85602373E+00	.86186495E+00	.86665869E+00	.87078718E+00	.87455650E+00
.87817502E+00	.88179781E+00	.88555476E+00	.88952599E+00	.89371045E+00	.89803765E+00	.90241072E+00	.90675132E+00
.91102454E+00	.91523548E+00	.91940899E+00	.92357080E+00	.92773970E+00	.93192951E+00	.93615422E+00	.94042884E+00
.94476421E+00	.94916249E+00	.95362154E+00	.95814351E+00	.96273779E+00	.96741917E+00	.97221136E+00	.97715556E+00
.98230372E+00	.98768805E+00	.99329407E+00	.99907123E+00	.10049687E+01	.10109640E+01	.10170776E+01	.10233855E+01
.10300245E+01	.10371529E+01	.10448630E+01	.10531140E+01	.10617642E+01	.10706622E+01	.10797108E+01	.10888827E+01
.10982146E+01	.11077993E+01	.11177516E+01	.11281445E+01	.11389689E+01	.11501670E+01	.11616933E+01	.11735337E+01
.11856840E+01	.11981417E+01	.12109259E+01	.12240760E+01	.12376008E+01	.12514292E+01	.12654393E+01	.12794396E+01
.12931574E+01	.13067822E+01	.13203900E+01	.13340536E+01	.13478491E+01	.13617691E+01	.13756600E+01	.13892145E+01
.14020461E+01	.14138278E+01	.14244081E+01	.14337938E+01	.14420059E+01	.14489520E+01	.14544096E+01	.14581006E+01
.14597810E+01	.14592943E+01	.14565702E+01	.14515963E+01	.14444514E+01	.14354870E+01	.14256075E+01	.14162756E+01
.14088185E+01	.14036018E+01	.14001738E+01	.13979376E+01	.13964485E+01	.13954227E+01	.13946912E+01	.13941561E+01
.13937709E+01	.13935301E+01	.13935082E+01	.13939854E+01	.13958817E+01	.14012875E+01	.14103323E+01	.13007443E+01
.12069891E+01	.11628265E+01	.11418455E+01	.11287475E+01	.11180493E+01	.11081530E+01	.10984914E+01	.10888897E+01
.10793312E+01	.10698626E+01	.10605508E+01	.10514649E+01	.10426613E+01	.10341795E+01	.10260490E+01	.10182873E+01
.10109041E+01	.10039115E+01	.99731678E+00	.99112113E+00	.98531565E+00	.97989228E+00	.97484639E+00	.97017120E+00
.96584745E+00	.96184214E+00	.95811694E+00	.95463552E+00	.95136816E+00	.94829108E+00	.94538705E+00	.94264474E+00
.94005712E+00	.93762151E+00	.93534115E+00	.93322619E+00	.93129042E+00	.92954312E+00	.92798118E+00	.92659004E+00

ORIGINAL PAGE IS
OF POOR QUALITY

.92534768E+00 .92423109E+00 .92321987E+00 .92230082E+00 .92146441E+00 .92071892E+00 .92003452E+00 .91952672E+00
.91883136E+00

INTRAC=100 PMF(M),M=1,MMAX
.25283025E+01 .25361246E+01 .25457665E+01 .25571945E+01 .25692893E+01 .25813954E+01 .25929749E+01 .26045442E+01
.26179134E+01 .26358175E+01 .26609557E+01 .26947997E+01 .27369405E+01 .27858858E+01 .28409071E+01 .29032848E+01
.29761673E+01 .30636579E+01 .31701591E+01 .33004962E+01 .34611130E+01 .36627479E+01 .39241824E+01 .42760602E+01
.47618448E+01 .54303593E+01 .63148854E+01 .74143807E+01 .87013328E+01 .10140535E+02 .11696556E+02 .13334317E+02
.15019411E+02 .16716335E+02 .18390072E+02 .19992749E+02 .21487656E+02 .22767279E+02 .23881174E+02 .24353278E+02
.25022072E+02 .22039565E+02 .19653904E+02 .18142407E+02 .17289538E+02 .16826784E+02 .16619043E+02 .16585221E+02
.16673158E+02 .16847004E+02 .17081523E+02 .17358077E+02 .17662199E+02 .17982742E+02 .18311340E+02 .18641592E+02
.18968708E+02 .19289127E+02 .19599880E+02 .19898060E+02 .20180974E+02 .20447185E+02 .20696132E+02 .20927256E+02
.21139589E+02 .21332668E+02 .21507607E+02 .21666969E+02 .21813735E+02 .21950431E+02 .22078933E+02 .22200497E+02
.22315820E+02 .22425136E+02 .22528345E+02 .22625056E+02 .22714360E+02 .22794739E+02 .22864488E+02 .22922607E+02
.22969461E+02 .23006600E+02 .23036079E+02 .23059934E+02 .23079801E+02 .23096539E+02 .23110701E+02 .23121017E+02
.23130432E+02 .23126588E+02 .23147766E+02

INTRAC=100 RHOUE(M),M=1,MMAX
-1 .12794388E+01 .12931567E+01 .13067815E+01 .13203894E+01 .13340530E+01 .13478485E+01 .13617684E+01
.13756593E+01 .13892138E+01 .14020453E+01 .14138268E+01 .14244070E+01 .14337924E+01 .14420042E+01 .14489498E+01
.14544068E+01 .14580567E+01 .14597756E+01 .14592864E+01 .14565585E+01 .14515786E+01 .14444248E+01 .14354477E+01
.14255526E+01 .14162058E+01 .14087411E+01 .14035259E+01 .14001048E+01 .13978775E+01 .13963971E+01 .13953790E+01
.13946540E+01 .13941242E+01 .13937434E+01 .13935059E+01 .13934865E+01 .13939656E+01 .13958632E+01 .14012693E+01
.14103147E+01 .13007263E+01 .12069721E+01 .11628107E+01 .11418309E+01 .11287338E+01 .11180365E+01 .11081408E+01
.10984799E+01 .10888787E+01 .10793207E+01 .10698525E+01 .10605411E+01 .10514555E+01 .10426522E+01 .10341706E+01
.10260403E+01 .10182788E+01 .10108958E+01 .10039033E+01 .99730875E+00 .99111323E+00 .98530787E+00 .97988461E+00
.97483881E+00 .97016371E+00 .96584003E+00 .96183480E+00 .95810967E+00 .95462831E+00 .95136101E+00 .94828400E+00
.94538002E+00 .94263777E+00 .94005021E+00 .93761464E+00 .93533433E+00 .93321942E+00 .93128370E+00 .92953643E+00
.92797454E+00 .92658343E+00 .92534111E+00 .92422454E+00 .92321335E+00 .92229433E+00 .92145795E+00 .92071248E+00
.92002810E+00 .91952032E+00 .91882499E+00
VT DISTRIBUTION ON INVISCID MESH AT INTRAC=100

.35952428E-02 .22893887E+00 .42765904E+00 .58163872E+00 .68745269E+00 .75313085E+00 .79141625E+00 .81400745E+00
.82880816E+00 .83987690E+00 .84878494E+00 .85602378E+00 .86186500E+00 .86665874E+00 .87078722E+00 .87455655E+00
.87817506E+00 .88179786E+00 .88555481E+00 .88952603E+00 .89371049E+00 .89803769E+00 .90241076E+00 .90675136E+00
.91102458E+00 .91523552E+00 .91940903E+00 .92357084E+00 .92773974E+00 .93192955E+00 .93615425E+00 .94042888E+00
.94476425E+00 .94916252E+00 .95362158E+00 .95814355E+00 .96273783E+00 .96741920E+00 .97221139E+00 .97715560E+00
.98230376E+00 .98768808E+00 .99329411E+00 .99907126E+00 .10049687E+01 .10109640E+01 .10170776E+01 .10233856E+01
.10300246E+01 .10371530E+01 .10448631E+01 .10531140E+01 .10617642E+01 .10706622E+01 .10797109E+01 .10888827E+01
.10982146E+01 .11077993E+01 .11177516E+01 .11281445E+01 .11389689E+01 .11501671E+01 .11616934E+01 .11735338E+01
.11856841E+01 .11981417E+01 .12109260E+01 .12240761E+01 .12376008E+01 .12514293E+01 .12654394E+01 .12794397E+01
.12931574E+01 .13067823E+01 .13203901E+01 .13340537E+01 .13478492E+01 .13617692E+01 .13756601E+01 .13892146E+01
.14020463E+01 .14138280E+01 .14244083E+01 .14337940E+01 .14420062E+01 .14489524E+01 .14544100E+01 .14581010E+01
.14597816E+01 .14592950E+01 .14565710E+01 .14515972E+01 .14444524E+01 .14354878E+01 .14256078E+01 .14162750E+01
.14088172E+01 .14036000E+01 .14001719E+01 .13979360E+01 .13964471E+01 .13954216E+01 .13946903E+01 .13941554E+01
.13937704E+01 .13935297E+01 .13935079E+01 .13939851E+01 .13958814E+01 .14012871E+01 .14103317E+01 .13007436E+01
.12069887E+01 .11628265E+01 .11418457E+01 .11287477E+01 .11180496E+01 .11081532E+01 .10984916E+01 .10888898E+01
.10793313E+01 .10698627E+01 .10605509E+01 .10514650E+01 .10426614E+01 .10341796E+01 .10260490E+01 .10182873E+01
.10109042E+01 .10039115E+01 .99731679E+00 .99112113E+00 .98531565E+00 .97989228E+00 .97484638E+00 .97017119E+00
.96584743E+00 .96184212E+00 .95811692E+00 .95463550E+00 .95136813E+00 .94829106E+00 .94538702E+00 .94264471E+00
.94005710E+00 .93761488E+00 .93534112E+00 .93322616E+00 .93129039E+00 .92954309E+00 .92798115E+00 .92659002E+00
.92534766E+00 .92423107E+00 .92321985E+00 .92230080E+00 .92146439E+00 .92071890E+00 .92003450E+00 .91952671E+00
.91883135E+00

INTRAC=100 PMF(M),M=1,MMAX
.25283025E+01 .25361237E+01 .25457658E+01 .25571937E+01 .25692886E+01 .25813947E+01 .25929742E+01 .26045434E+01
.26179126E+01 .26358167E+01 .26609547E+01 .26947986E+01 .27369392E+01 .27858842E+01 .28409052E+01 .29032822E+01
.29761640E+01 .30636534E+01 .31701526E+01 .33004865E+01 .34610982E+01 .36627244E+01 .39241449E+01 .42760005E+01
.47617525E+01 .54302266E+01 .63147155E+01 .74141849E+01 .87011241E+01 .10140323E+02 .11696346E+02 .13334113E+02
.15019216E+02 .16716148E+02 .18389894E+02 .19992578E+02 .21487492E+02 .22767119E+02 .23881018E+02 .24353124E+02
.25021522E+02 .22039415E+02 .19653770E+02 .18142284E+02 .17289422E+02 .16826680E+02 .16619046E+02 .16585129E+02

.16673069E+02	.16846918E+02	.17081438E+02	.17357994E+02	.17662117E+02	.17982661E+02	.18311259E+02	.18641512E+02
.18968627E+02	.19289046E+02	.19599799E+02	.19897979E+02	.20180893E+02	.20447103E+02	.20696050E+02	.20927174E+02
.21139506E+02	.21332585E+02	.21507525E+02	.21666886E+02	.21813653E+02	.21950348E+02	.22078851E+02	.22200414E+02
.22315738E+02	.22425054E+02	.22528263E+02	.22624974E+02	.22714278E+02	.22794657E+02	.22864405E+02	.22922525E+02
.22969379E+02	.23006519E+02	.23035998E+02	.23059852E+02	.23079720E+02	.23096458E+02	.23110620E+02	.23120937E+02
.23130351E+02	.23126508E+02	.23147686E+02					

INTRAC=100 RHOUE(M),M=1,MMAX

-1	.12794388E+01	.12931567E+01	.13067815E+01	.13203894E+01	.13340530E+01	.13478485E+01	.13617684E+01
.13756593E+01	.13892138E+01	.14020453E+01	.14138268E+01	.14244070E+01	.14337924E+01	.14420042E+01	.14489498E+01
.14544068E+01	.14580967E+01	.14597756E+01	.14552864E+01	.14565585E+01	.14515786E+01	.14444248E+01	.14354477E+01
.14255526E+01	.14162058E+01	.14087411E+01	.14035259E+01	.14001048E+01	.13978775E+01	.13963971E+01	.13953790E+01
.13946540E+01	.13941242E+01	.13937434E+01	.13935059E+01	.13934865E+01	.13939656E+01	.13958632E+01	.14012693E+01
.14103147E+01	.13007263E+01	.12069721E+01	.11628107E+01	.11418309E+01	.11287338E+01	.11180365E+01	.11081408E+01
.10984759E+01	.10888787E+01	.10793207E+01	.10698525E+01	.10605411E+01	.10514555E+01	.10426522E+01	.10341706E+01
.10260403E+01	.10182788E+01	.10108958E+01	.10039033E+01	.99730875E+00	.99111323E+00	.98530787E+00	.97988461E+00
.97483881E+00	.97016371E+00	.96584003E+00	.96183480E+00	.95810967E+00	.95462831E+00	.95136101E+00	.94828400E+00
.94538002E+00	.94263777E+00	.94005021E+00	.93761464E+00	.93533433E+00	.93321942E+00	.93128370E+00	.92953643E+00
.92797454E+00	.92658343E+00	.92534111E+00	.92422454E+00	.92321335E+00	.92229433E+00	.92145795E+00	.92071248E+00
.92002281E+00	.91952032E+00	.91882499E+00					

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
**	-.21223E-03	.10636E-04	.99000E+01	-.76023E-04	.23292E-05	.96000E+01	-1	-1	-1

*** SUMMARY OF CONVERGENCE HISTORY ***

INTRAC	DDTMAX	RMSDT	SMDT	DUEMAX	RMSUE	SMUE	DSFMAX	DFMAX	DGMAX
1	-.36126E+01	.22150E+00	.16000E+02	-.50202E+00	.36911E-01	.10300E+02			
2	-.11354E+01	.58411E-01	.16000E+02	-.31643E+00	.17793E-01	.92000E+01	-1	-1	-1
3	.10069E+01	.34470E-01	.12700E+02	-.20846E+00	.11374E-01	.91000E+01	-1	-1	-1
4	.16100E+01	.69307E-01	.12400E+02	.21601E+00	.11371E-01	.12200E+02	-1	-1	-1
5	.19658E+01	.95563E-01	.12000E+02	.24301E+00	.13023E-01	.11800E+02	-1	-1	-1
6	.18070E+01	.88620E-01	.11700E+02	.21789E+00	.11005E-01	.11400E+02	-1	-1	-1
7	.15874E+01	.79962E-01	.11500E+02	.18372E+00	.90156E-02	.11200E+02	-1	-1	-1
8	.13308E+01	.70375E-01	.11300E+02	.15465E+00	.73440E-02	.11000E+02	-1	-1	-1
9	.10997E+01	.58266E-01	.11200E+02	.13241E+00	.58984E-02	.10800E+02	-1	-1	-1
10	.90230E+00	.45410E-01	.11000E+02	.11449E+00	.47018E-02	.10600E+02	-1	-1	-1
11	.73054E+00	.32995E-01	.10900E+02	.10031E+00	.37329E-02	.10500E+02	-1	-1	-1
12	.58671E+00	.22876E-01	.10700E+02	.87466E-01	.30061E-02	.10400E+02	-1	-1	-1
13	.48057E+00	.15302E-01	.10600E+02	.76735E-01	.24622E-02	.10300E+02	-1	-1	-1
14	-.44127E+00	.15641E-01	.11400E+02	.66979E-01	.22387E-02	.10200E+02	-1	-1	-1
15	.31880E+00	.12700E-01	.10400E+02	.58102E-01	.18762E-02	.10200E+02	-1	-1	-1
16	.26230E+00	.10966E-01	.10300E+02	.51308E-01	.16153E-02	.10100E+02	-1	-1	-1
17	-.52098E+00	.14819E-01	.11300E+02	-.45396E-01	.17231E-02	.11300E+02	-1	-1	-1
18	-.30991E+00	.16008E-01	.11300E+02	.37837E-01	.15749E-02	.10000E+02	-1	-1	-1
19	-.21626E+00	.15484E-01	.11300E+02	.32356E-01	.14193E-02	.99000E+01	-1	-1	-1
20	-.17523E+00	.13671E-01	.15000E+02	.27679E-01	.12368E-02	.99000E+01	-1	-1	-1
21	-.14963E+00	.11588E-01	.14800E+02	.23623E-01	.10566E-02	.98000E+01	-1	-1	-1
22	-.12557E+00	.97244E-02	.14600E+02	.20392E-01	.89776E-03	.98000E+01	-1	-1	-1
23	-.10573E+00	.82043E-02	.14500E+02	.17335E-01	.76475E-03	.98000E+01	-1	-1	-1
24	-.89702E-01	.69773E-02	.14400E+02	.14635E-01	.65401E-03	.97000E+01	-1	-1	-1
25	-.77026E-01	.60055E-02	.14400E+02	.12559E-01	.56311E-03	.97000E+01	-1	-1	-1
26	-.67009E-01	.52354E-02	.14400E+02	.10638E-01	.48871E-03	.97000E+01	-1	-1	-1

27	-.58938E-01	.46141E-02	.14400E+02	.88934E-02	.42727E-03	.97000E+01	-I	-I	-I
28	-.52403E-01	.41115E-02	.14400E+02	.73521E-02	.37673E-03	.96000E+01	-I	-I	-I
29	-.47068E-01	.36998E-02	.14500E+02	.61840E-02	.33501E-03	.96000E+01	-I	-I	-I
30	-.42637E-01	.33583E-02	.14500E+02	.51243E-02	.30053E-03	.96000E+01	-I	-I	-I
31	-.39074E-01	.30620E-02	.11200E+02	.41737E-02	.27139E-03	.96000E+01	-I	-I	-I
32	-.36268E-01	.28173E-02	.11200E+02	-.37253E-02	.24763E-03	.11400E+02	-I	-I	-I
33	-.33779E-01	.26010E-02	.11200E+02	-.34647E-02	.22743E-03	.11400E+02	-I	-I	-I
34	-.31528E-01	.24049E-02	.11200E+02	-.32280E-02	.20990E-03	.11400E+02	-I	-I	-I
35	-.29481E-01	.22353E-02	.11200E+02	-.30171E-02	.19521E-03	.11400E+02	-I	-I	-I
36	-.27596E-01	.20807E-02	.11200E+02	-.28251E-02	.18232E-03	.11200E+02	-I	-I	-I
37	-.25843E-01	.19388E-02	.11200E+02	-.26536E-02	.17083E-03	.11200E+02	-I	-I	-I
38	-.24196E-01	.18046E-02	.11200E+02	-.24915E-02	.16024E-03	.11200E+02	-I	-I	-I
39	-.22647E-01	.16835E-02	.11200E+02	-.23382E-02	.15079E-03	.11200E+02	-I	-I	-I
40	-.21156E-01	.15684E-02	.11200E+02	-.21897E-02	.14187E-03	.11200E+02	-I	-I	-I
41	-.19750E-01	.14665E-02	.11200E+02	-.20490E-02	.13390E-03	.11200E+02	-I	-I	-I
42	-.18404E-01	.13637E-02	.11200E+02	-.19135E-02	.12589E-03	.11200E+02	-I	-I	-I
43	-.17129E-01	.12641E-02	.11200E+02	-.17845E-02	.11807E-03	.11200E+02	-I	-I	-I
44	-.15918E-01	.11738E-02	.11200E+02	-.16616E-02	.11081E-03	.11200E+02	-I	-I	-I
45	-.14771E-01	.10865E-02	.11200E+02	-.15446E-02	.10374E-03	.11200E+02	-I	-I	-I
46	-.13684E-01	.10047E-02	.11200E+02	-.14332E-02	.96981E-04	.11200E+02	-I	-I	-I
47	-.12653E-01	.92754E-03	.11200E+02	-.13273E-02	.90494E-04	.11200E+02	-I	-I	-I
48	-.11677E-01	.85455E-03	.11200E+02	-.12267E-02	.84255E-04	.11200E+02	-I	-I	-I
49	-.10755E-01	.78583E-03	.11200E+02	-.11668E-02	.78283E-04	.99000E+01	-I	-I	-I
50	-.20242E+00	.13830E-01	.11200E+02	-.21601E-01	.11857E-02	.11200E+02	-I	-I	-I
51	-.15735E+00	.11660E-01	.11100E+02	-.17412E-01	.10376E-02	.11400E+02	-I	-I	-I
52	-.21030E+00	.13842E-01	.11100E+02	-.22578E-01	.12619E-02	.11100E+02	-I	-I	-I
53	-.10895E+00	.82007E-02	.11300E+02	-.13011E-01	.77251E-03	.11500E+02	-I	-I	-I
54	-.74466E-01	.51194E-02	.11300E+02	-.88064E-02	.50584E-03	.11500E+02	-I	-I	-I
55	-.61171E-01	.39756E-02	.11100E+02	-.69799E-02	.40343E-03	.11300E+02	-I	-I	-I
56	-.53338E-01	.34931E-02	.11100E+02	-.59694E-02	.35869E-03	.11300E+02	-I	-I	-I
57	-.47228E-01	.31806E-02	.11100E+02	-.52941E-02	.32968E-03	.11100E+02	-I	-I	-I
58	-.42207E-01	.28937E-02	.11100E+02	-.47565E-02	.30342E-03	.11100E+02	-I	-I	-I
59	-.37871E-01	.26123E-02	.11100E+02	-.42884E-02	.27768E-03	.11100E+02	-I	-I	-I
60	-.34034E-01	.23554E-02	.11100E+02	-.38721E-02	.25384E-03	.11200E+02	-I	-I	-I
61	-.30636E-01	.21245E-02	.11100E+02	-.34979E-02	.23203E-03	.11100E+02	-I	-I	-I
62	-.27479E-01	.18974E-02	.11100E+02	-.31486E-02	.21048E-03	.11100E+02	-I	-I	-I
63	-.24657E-01	.16964E-02	.11100E+02	-.28342E-02	.19107E-03	.11100E+02	-I	-I	-I
64	-.22117E-01	.15167E-02	.11100E+02	-.26204E-02	.17342E-03	.99000E+01	-I	-I	-I
65	-.19876E-01	.13626E-02	.11100E+02	-.24774E-02	.15789E-03	.99000E+01	-I	-I	-I
66	-.17890E-01	.12267E-02	.11100E+02	-.23330E-02	.14392E-03	.98000E+01	-I	-I	-I
67	-.16039E-01	.10966E-02	.11100E+02	-.21984E-02	.13050E-03	.98000E+01	-I	-I	-I
68	-.14373E-01	.97970E-03	.11100E+02	-.20628E-02	.11826E-03	.98000E+01	-I	-I	-I
69	-.12868E-01	.87489E-03	.11100E+02	-.19281E-02	.10708E-03	.98000E+01	-I	-I	-I
70	-.11512E-01	.78269E-03	.11100E+02	-.17959E-02	.97005E-04	.98000E+01	-I	-I	-I
71	-.10290E-01	.69959E-03	.11100E+02	-.16672E-02	.87784E-04	.98000E+01	-I	-I	-I
72	-.91863E-02	.62259E-03	.11100E+02	-.15427E-02	.79200E-04	.98000E+01	-I	-I	-I
73	-.81921E-02	.55581E-03	.11100E+02	-.14234E-02	.71531E-04	.98000E+01	-I	-I	-I
74	-.72290E-02	.48734E-03	.11100E+02	-.13111E-02	.63904E-04	.97000E+01	-I	-I	-I
75	-.64357E-02	.43591E-03	.11100E+02	-.12074E-02	.57689E-04	.97000E+01	-I	-I	-I
76	-.57192E-02	.38817E-03	.11100E+02	-.11092E-02	.51930E-04	.97000E+01	-I	-I	-I
77	-.50764E-02	.34469E-03	.11100E+02	-.10163E-02	.46643E-04	.97000E+01	-I	-I	-I
78	-.44979E-02	.30534E-03	.11100E+02	-.92890E-03	.41812E-04	.97000E+01	-I	-I	-I
79	-.39777E-02	.26995E-03	.11100E+02	-.84700E-03	.37416E-04	.97000E+01	-I	-I	-I
80	-.35107E-02	.23823E-03	.11100E+02	-.77054E-03	.33427E-04	.97000E+01	-I	-I	-I
81	-.30924E-02	.20991E-03	.11100E+02	-.69944E-03	.29818E-04	.97000E+01	-I	-I	-I
82	-.27183E-02	.18445E-03	.11100E+02	-.63352E-03	.26547E-04	.97000E+01	-I	-I	-I
83	-.23845E-02	.16186E-03	.11100E+02	-.57259E-03	.23600E-04	.97000E+01	-I	-I	-I
84	-.20870E-02	.14170E-03	.11100E+02	-.51644E-03	.20943E-04	.97000E+01	-I	-I	-I
85	-.18222E-02	.12378E-03	.11100E+02	-.46484E-03	.18552E-04	.97000E+01	-I	-I	-I
86	-.15870E-02	.10786E-03	.11100E+02	-.41753E-03	.16404E-04	.97000E+01	-I	-I	-I
87	-.13784E-02	.93728E-04	.11100E+02	-.37428E-03	.14476E-04	.97000E+01	-I	-I	-I

88	-.11938E-02	.81247E-04	.11100E+02	-.33482E-03	.12751E-04	.97000E+01	-I	-I	-I
89	-.103C9E-02	.70222E-04	.11000E+02	-.29891E-03	.11209E-04	.97000E+01	-I	-I	-I
90	-.888C0E-03	.60502E-04	.11000E+02	-.2663CE-03	.98338E-05	.97000E+01	-I	-I	-I
91	-.766C5E-03	.51952E-04	.10200E+02	-.23675E-03	.86086E-05	.97000E+01	-I	-I	-I
92	-.66869E-03	.44448E-04	.10100E+02	-.21003E-03	.75195E-05	.97000E+01	-I	-I	-I
93	-.58295E-03	.37877E-04	.10100E+02	-.18593E-03	.65532E-05	.97000E+01	-I	-I	-I
94	-.50675E-03	.32138E-04	.10100E+02	-.16444E-03	.56976E-05	.96000E+01	-I	-I	-I
95	-.44089E-03	.27139E-04	.10000E+02	-.14544E-03	.49415E-05	.96000E+01	-I	-I	-I
96	-.38257E-03	.22797E-04	.10000E+02	-.12835E-03	.42747E-05	.96000E+01	-I	-I	-I
97	-.33091E-03	.19038E-04	.10000E+02	-.11301E-03	.36880E-05	.96000F+01	-I	-I	-I
98	-.28553E-03	.15800E-04	.99000E+01	-.99271E-04	.31735E-05	.96000E+01	-I	-I	-I
99	-.24660E-03	.13016E-04	.99000E+01	-.86985E-04	.27228E-05	.96000E+01	-I	-I	-I
**	-.21223E-03	.10636E-04	.99000E+01	-.76023E-04	.23292E-05	.96000E+01	-I	-I	-I

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16 Abstract

A program called ALESEP is presented for the analysis of the inviscid-viscous interaction which occurs due to the presence of a closed laminar-transitional separation bubble on an airfoil or infinite swept wing. The ALESEP code provides an iterative solution of the boundary layer equations expressed in an inverse formulation coupled to a Cauchy integral representation of the inviscid flow. This interaction analysis is treated as a local perturbation to a known solution obtained from a global airfoil analysis; hence, part of the required input to the ALESEP code are the reference displacement thickness and tangential velocity distributions. Special windward differencing may be used in the reversed flow regions of the separation bubble to accurately account for the flow direction in the discretization of the streamwise convection of momentum. The ALESEP code contains a forced transition model based on a streamwise intermittency function, a natural transition model based on a solution of the integral form of the turbulent kinetic energy equation, and an empirical natural transition model. In addition, wall suction may be applied to the boundary layer to either control its growth or alleviate the separation bubble. Complete documentation of the two-dimensional code was originally given in NASA Contract Report 172310. An updated set of instructions for the input, output, and program usage for both two-dimensional airfoils and infinite swept wings is given herein along with a sample case.

17 Key Words (Suggested by Author(s)):
Interaction, separation bubble, viscous, transitional, airfoil and infinite swept wing separation

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