**Title**

RESISTIVITY MODELLING FOR ARBITRARILY SHAPED TWO DIMENSIONAL STRUCTURES. PART II. USER'S GUIDE TO THE FORTRAN ALGORITHM RESIS2D



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# Resistivity Modelling for Arbitrarily Shaped Two Dimensional Structures Part II: User's Guide to the FORTRAN Algorithm RESIS2D

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## DISCLAIMER

# RESISTIVITY MODELLING FOR ARBITRARILY SHAPED TWO DIMENSIONAL STRUCTURES

## PART II. User's Guide to the FORTRAN Algorithm RESIS2D

by

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## INTRODUCTION

In Part I of this report, the development of a numerical solution technique is described to obtain the potential distribution in three-dimensional space due to a point source of charge injection in or on the surface of a half space containing any arbitrary two-dimensional conductivity distribution. Finite difference approximations are made to discretize the governing Poisson's equation with appropriate boundary conditions. It is shown that the discretization of Poisson's equation by elemental area brought about a numerical formulation for a more effective matrix technique to be utilized to solve for the potential distribution at each node of a discretized half-space. A FORTRAN algorithm named RESIS2D has been written to implement such a generalized solution method.

In this paper, a brief description of the FORTRAN program in terms of its construction is given. The formal input and output parameters for the relevant subroutines are discussed. The program is designed to be implemented on a CDC 7600 machine. The language of the algorithm is FORTRAN IV and certain programming norms for the CDC 7600 machine and the RUN76 compiler (developed at Lawrence Berkeley Laboratory, Computing Center) are routinely used. Some variables are stored in the LCM (Large Core Memory) of this machine and their calling sequence and usage apply to the CDC7600 alone.

The resulting solution of the potential distribution can be obtained for a current source or sink located on the surface or at any arbitrary surface location. Any arbitrary configuration of transmitter or receiver electrode arrays, therefore, could be simulated to obtain the resistivity response over arbitrarily shaped two-dimensional geologic bodies. For brevity, in the source deck provided in this report, only two electrode arrays commonly used in geothermal reservoir delineation are illustrated. These are: i) the collinear Dipole-Dipole or collinear Pole-Dipole configuration, and ii) Fixed Bipole transmitter and roving dipole receiver configuration.

## GENERAL DESCRIPTION OF THE ALGORITHM

The source-deck consists of a main program RESIS2D and the following subroutines:

i) SOLVENT
ii) BANDSYM
iii) LUDCOMP
iv) SOLVE
v) YTRAN
vi) ARRAYS
vii) CLINDIP
viii) RECON2D

A brief outline of each of these subprograms is given in the following sections.

## RESIS2D

In this part of the program, all of the input data for the model simulation are read in. These are:

i) Description of the rectangular, irregularly spaced discretization grid in x-z section.

ii) Selection of the discretized $K_y$ values.

iii) Selection of the electrode configuration.

iv) Selection of the transmitter and receiver electrode locations.

v) Description of the two-dimensional conductivity distribution in the lower half space.

vi) Description of the intrinsic percent frequency effect or chargeability distribution of the lower half space.

## SOLVENT

This subprogram is called by the main program RESIS2D and it sets up and solves the Capacitance Matrix equations described in the previous section in $(x, K_y, z)$ space for all specified transmitting nodes, simultaneously. The solution provides the potential distribution $\phi(x, K_y, z)$ at every node in the grid and their values at relevant receiver nodes are selected and stored.

## BANDSYM

This subroutine is called by SOLVENT and solves the equation $C\phi = S$. The C matrix is symmetric, banded, and positive definite. The equation is solved by Cholesky's LU-decomposition technique. The cholesky decomposition is performed by the subroutine LUDCOMP and the relevant backsubstitution steps are done by the subroutine SOLVE to yield the solution set $\phi(x, K_y, z)$ at each node, simultaneously, for all transmitting point sources.

## YTRAN

Once the solution sets of $\phi(x, K_y, z)$ at all the selected receiver nodes are obtained for several optimally chosen $K_y$ values, the subroutine YTRAN performs the inverse Fourier transformation to yield the solution of the potential in (x, y, z) space. The integration for the transformation is performed either by subsectional exponential fit of the envelope which yields an analytic solution for each subintegral, or by trapezoidal integration. For any configuration, with a finite displacement of the receiver location in the strike direction (y-axis), the envelope of $\phi(x, K_y, z)$ is sharply modulated by $\cos(k_y, y)$, and the use of subsectional exponential fit is recommended.

The choice of an optimal set of $K_y$ values is critical to the accuracy and execution time of this algorithm. For any grid chosen to represent the lower half-space, the behavior of $\phi(x, K_y, z)$ at several receiver nodes for several fixed transmitter nodes should be studied by comparison with available analytic model solutions (e.g. layered earth and outcropping vertical contacts) in $(x,K_y,z)$ space as a function of $K_y$ in the range $10^{-3} < K_y < 10$. Based on this analysis, 5 to 7 optimal $K_y$ values should be chosen to discretize adequately the range $0 < K_y < \infty$, so that the inverse transformation is accurate to 1-3%.

ARRAYS

The three-dimensional potential distribution for all of the selected receiver nodes for the prescribed transmitter nodes are used, in combination, to evaluate the apparent resistivity response for any arbitrary electrode array. The subroutine ARRAYS selects the specific subroutine required to compute responses for any particular configuration.

CLINDIP

This subroutine evaluates the apparent resistivity, the apparent percent frequency effect and apparent metal factor, for Collinear Dipole-Dipole and/or Pole-Dipole arrays along a profile perpendicular to the strike of the two-dimensional geologic selection. Options are provided for displaying the data in standard pseudo-sectional form, for the standard input data, as illustrated later in the examples. It is possible to obtain the apparent resistivity response for Collinear DP-DP or P-DP along profile lines inclined to the strike of the inhomogeneity at angles other than 90°. This is done by a linear interpolation in one-dimension for the transmitter node and a linear interpolation in 2-dimensions (X-Y plane) for the receiver node. The details of such interpolations are to be obtained from the listing of the subroutine, and care should be taken to see that the density of the prescribed transmitter and receiver node locations is adequate to perform the interpolations required.

RECON2D

This subroutine produces a map of several apparent resistivity parameters on the X-Y plane of the ground surface. The length and orientation of the transmitting dipole with respect to the strike-direction can be made arbitrary, by a proper selection of the grid in X-Z and X-Y planes. The definitions of the various parameters used to evaluate apparent resistivity, apparent conductance etc. are described in the listing of the subroutine.

DESCRIPTION OF THE INPUT PARAMETERS

Mesh Description

NNODX - Number of nodes in the x-direction (perpendicular to strike)

NNODZ - Number of nodes in the z-direction (vertically downward)

DX(I), I = 1, (NNODX-1) - Array of separation distances between the columns in the x-direction

DZ(J), I = 1, (NNODZ-1) - Array of separation distances between the rows in the z-direction

XSCAL - Scale factor for the DX Array

ZSCAL - Scale factor for the DZ Array.

UNIT - Scale factor for the mesh distances (x- and z-direction) in terms of an arbitrary unit length. The dimensions of the electrode configuration and the size and location of the inhomogeneities in the section are defined in terms of this unit distance, e.g. for a Collinear Dipole-Dipole array, unit length = a = dipole length.

It is to be noted that the minimum size of any element in the DX(I) or DZ(I) array is to be kept at 1.0. Thus, if 1/4$^{th}$ dipole length (unit) resolution is sought in x-direction of the mesh and 1/6$^{th}$ unit resolution is sought in z-direction, the appropriate mesh parameter input should be XSCAL=1.0, ZSCAL=1.5, UNIT=4.0. For routine use with high accuracy, it is recommended that a mesh resolution of at least 1/3 unit be used in the x and z directions.

In the working example to be illustrated in the following, a grid of 113 x 16 nodes is employed. In the standard usage of this mesh the parameters XSCAL = ZSCAL = 1.0 and UNIT = 4.0 are used. For this grid, accurate results could also be obtained with XSCAL=1, ZSCAL=2 and UNIT=4.0, thus providing higher resolution in z-direction (e.g. near surface vertical distribution), for an identical scale of simulation in the lateral extent.

The discretization of the infinitely extended lower half-space in the x-z plane is made by a finite choice of M and N for the mesh. The infinitely distant edges are handled by appropriate coarsening of the node intervals in $\pm$X and + Z - direction and by applying the empirical mixed boundary condition at the nodes located on the bounding edge. An increased value of M or N results in sizeable increase in the number of elements in the mesh, and optimization studies in this direction indicate that very rapid coarsening of the mesh away from the finely divided zone, where inhomogeneities are described and potentials measured, can be utilized using only a few node points in conjunction with the mixed boundary condition described. This can be illustrated by a mesh of 113 x 16 nodes (in x and z direction respectively) used in later examples. In this mesh, 105 inner nodes in the x-direction are used to define the zone of simulation with equal node intervals of high resolution (say 1.0 distance unit). The first 4 nodes to left and the last 4 nodes to the right, are rapidly coarsened in steps of 4, 20, 100 and 1000 times the internodal distance used in the description of the 'fine' mesh area. Similarly, the nodal separations in z-direction are coarsened, in the mesh, as 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 4, 4, 8, 64, 512 (DZ array). The zone defined by $6 \leq$ XNODE $\leq 108$ and $1 \leq$ ZNODE $\leq 14$, is used to simulate subsurface inhomogeneities in conductivity.

TRANSFORM PARAMETERS

NKY = Number of discrete Ky values used in the solution

YKY(I), I=1,NKY - Array of Ky values used.

IOPT . Eq. 0 - Inverse Transformation is done by integration with subsectional exponential fit. (Recommended for general use.)

IOPT .NE.0 - Inverse Transformation is done by integration with trapezoidal rule. (Recommended only for Collinear arrays perpendicular to the strike direction.)

The number and choice of Ky values should be optimal for each mesh size to provide at least 1% accuracy in the numerical integration.

PHYSICAL PROPERTY DISTRIBUTIONS

ICODE(I.J), I=1, NNODZ, J=1, NNODX - Array of coded conductivity distribution in the lower X-Z plane in terms of symbols 0 through 9.

RESIS(I), I=1, 10 - Array of intrinsic resistivity values associated with the code symbols 0 through 9, respectively.

PFE(I), I=1, 10 - Array of intrinsic percent frequency effect values associated with the code symbols 0 through 9, respectively.

COND(IX,IZ) - The nodal conductivity $\sigma_{i,j}$ is determined from ICODE(IX,IZ) and it indicates the conductivity in the region bounded by X(IX) and X(IX+1) in the x-direction and Z(IZ) and Z(IZ+1) in the Z-direction.

NXBEG, NXEND - The nodal conductivity distribution is read row by row (increasing in z-direction) for the range NXBEG $\leq$ XNODE $\leq$ NXEND, i.e., COND(NXBEG, IZ), IZ=1, NNODZ, are assumed to extend identically horizontally up to COND(1,IZ), IZ=1, NNODZ, and COND(NXEND,IZ), IZ=1, NNODZ, are assumed to extend identically horizontally up to COND(NNODX,IZ), IZ=1, NNODZ.

ARRAY DESCRIPTION

NARRAY = Number of Resistivity Survey Configurations modelled.

ICONFIG(I), I=1, NARRAY - Array of code numbers for various electrode configurations.

These codes are as follows:

ICONFIG=1, for Collinear Dipole-Dipole and/or Pole-Dipole profiling configuration at an arbitrary angle to the strike-direction; =2, for Reconnaissance Bipole-Dipole Mapping Configuration.

SPECIAL INPUT DATA FOR THE COLLINEAR DIPOLE-DIPOLE AND POLE-DIPOLE CONFIGURATION

If OPTPUN $\neq$ 0 - output of the ICONFIG=1 array is punched out.

If IPRINT = 0, The Standardized Pseudo-Section plot of apparent resistivity and apparent P.F.E. only are deployed for the Collinear Dipole-Dipole Configuration. (This is a special plot requiring the input parameters illustrated in the working example given later.)

If IPRINT = 1, The output for the Collinear Dipole-Dipole and Pole-Dipole arrays are printed out. With this option, the standardized pseudo section display is suppressed.

If IPRINT.GT.1, The normal printed output for DP-DP and P-DP as well as the standardized pseudo-section display for DP-DP is deployed. (This requires the input parameters to be as shown for the standardized cases, illustrated later in this paper.) The relevant sections dealing with the output formats for the results of Collinear DP-DP and P-DP can be easily understood from the listing of the subprogram CLINDIP.

SPECIAL INPUT DATA FOR THE RECONNAISSANCE BIPOLE DIPOLE MAPPING CONFIGURATION

If, INCLINE = 0, The Transmitting Dipole is perpendicular to strike for ICONFIG=2 array.

If, INCLINE = 1, The Transmitting Dipole is inclined at an acute angle to the line perpendicular to the strike (+X direction).

If, INCLINE = 2, The Transmitting Dipole is inclined at an obtuse angle to the line perpendicular to the strike direction (+X direction).

ISHIFT = Number of shifts of one pole of the Bipole from y=0 line in terms of the specified YSHIFT array (described in the following). In the Bipole-Dipole Configuration, one of the transmitter poles is always required to be located on y=0 line.

NRLIM = Number of shifts in the y-direction required to define the y-extent of the map to be produced, in terms of the specified YSHIFT array. The detailed formulation of the transmitter and the receiver positions are outlined in the listing of the subprogram RECON2D.

TRANSMITTER AND RECEIVER ELECTRODE COORDINATES

NTX = Number of Transmitting electrode nodes (projected to the line y=0, z=0).

NRX - Number of receiving electrode nodes (projected to the line y=0, z=0).

ITXP(J),J=1, NTX - Array of node numbers of the transmitter electrode locations.

IRXP(I),I=1, NRX - Array of node numbers of the receiver electrode locations.

NZSFT - Total number of surface and subsurface layers of transmitter electrodes.

ZSHIFT(J),I=1,NZSFT - Array of the depths of the layers of transmitting electrodes (in terms of UNIT).

NYSFT - Number of lines shifted along the strike where receiver lines are located (including y=0 line).

YSHIFT(I), I=1,NYSFT - Array of values of Y-shifts for various receiver lines (in terms of UNIT).

The locations of the layers of transmitter or receiver poles in the half-space are required to coincide with a row of the discretized mesh.

MODEL NAME AND TERMINATION PARAMETERS

TITLE(I),I=1,4. - 12 space alphanumeric name of the model.

IPKEY, if equal to 0, only resistivity response is evaluated; if equal to 1, resistivity as well as percent frequency effect and metal factor responses are evaluated.

MORE - An end of data indicator with following characteristics:

i) If only one model is to be evaluated, at the end of the data model data set, MORE is read twice with value 0.

ii) If more than one model is to be evaluated, at the end of the first data set, MORE is read twice as 0 and 1, respectively.

At the end of each of the intermediate continuing model data sets, MORE is read twice as 1 and 1 (or any other non zero integer), respectively. At the end of the last model data set, MORE is read twice as 1 and 0, respectively.

DIMENSION STATEMENTS AND STORAGE

The dimension requirements of the key variables defined in the main program are as follows:

| VARIABLE NAME | DIMENSION REQUIRED |
|---|---|
| X | NNODX |
| Z | NNODZ |
| ZSHIFT | NZSFT |
| ZRSHIFT | NZRSFT |
| YSHIFT | NYSFT |
| RESIS | 10 |
| PFE | 10 |
| DX | (NNODX-1) |
| DZ | (NNODZ-1) |
| ICONFIG | NARRAY |
| IXS | NTX*NZSFT |
| IZS | NTX*NZSFT |
| ICODE | (NNODZ,NNODX) |
| COND | (NNODX,NNODZ) |
| ITXP | NTX |
| IRXP | NRX |
| XMAT | NNODX*NNODZ |
| KY | NKY |
| VKY | NKY*(NTX*NZSFT)*(NRX*NZRSFT) |
| V | (NTX*NZSFT)*(NRX*NZRSFT*NYSFT) |
| A | (NNODX*NNODZ,NNODZ+1) |
| RS | (NNODX*NNODZ,NTX*NZSFT) |

In the standardized form of the source-deck attached herewith, the variables A and RS are stored in the LCM (Large Core Memory) and are type declared as LARGE, wherever used.

Dimension requirements of the local variables defined in the subprograms are evident from their listing, and will not be outlined here.

For the standardized working model with the input parameters shown later, the program requires approximately $107{,}000_8$ words in SCM (Small Core Memory) and $215{,}000_8$ words in LCM (Large Core Memory) using the RUN76 Compiler on a CDC7600 machine.

GENERAL COMMENTS ON VKY AND V ARRAYS

The array VKY consists of the solutions of potentials in the (x,Ky,z) space at selected receiver nodes, from all point sources of current. VKY is a three-dimensional array described as (((VKY(I,J,K),I=1, NKY), J=1, NTX*NZSFT),K=1, NRX*NZRSFT). The data stored in VKY is analogous to a five-dimensional storage in the implied DO form of (((((VKY(I,J,K,L,M),IKY=1,NKY),J=1,NTX), K=1,NZSFT),L=1,NRX,M=1,NZRSFT).

The array V(I,J),I=1,NTX*NZSFT,J=1,NRX*NTSF* NZRSFT, contains the transformed potential in the (x,y,z) space. The storage in this array is illustrated in an analogous five-dimensional array in implied DO-form as (((((V(I,J,K,L,M), I=1,NTX),J=1,NZSFT),K=1,NRX),L=1,NYSFT),M=1, NZRSFT). The sequence of accumulation of data in VKY is indicated in the final section of the subprogram SOLVENT and that of V in the first section of the subprogram YTRAN.

The output of the program could be generalized for any arbitrary electrode configuration, by proper combination of the data in V array for arbitrary values in ITXP and IRXP arrays.

COORDINATE SYSTEM

In the process of discretization, the coordinates of all nodes are defined with the origin at the top, left corner node i.e., IX=1, IZ=1. In later processing for specific electrode configuration, all distances are expressed in terms of UNIT normalizing length and the coordinates of transmitter or receiver electrodes are defined with reference to an origin at the top, central node (i.e., node with IX = NNODX/2 +1; IZ=1).

RESULTS

In the following section, a listing of the FORTRAN Source Deck RESIS2D is given. In later sections, sample outputs of the program for the *Collinear Dipole-Dipole and Reconnaissance Bipole-Dipole* Configuration, over a few simple 2-dimensional conductivity distributions are presented.

```
      PROGRAM RESIS2D (INPUT,OUTPUT,PUNCH)
C
***********************************************************************
C........      AUTHOR ...  ABHIJIT DEY
C                          ENGINEERING GEOSCIENCE
C                          UNIVERSITY OF CALIFORNIA
C                          BERKELEY
C......        LATEST REVISION ... APRIL,1976
C
***********************************************************************
C
C              ALL RIGHTS OF USAGE AND MODIFICATIONS ARE RESERVED BY
C              THE AUTHOR.
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C........      PURPOSE......
C
C              PROGRAM RESIS2D SOLVES FOR THE POTENTIALS IN 3-DIMENSIONS
C       (X-Y-Z SPACE) DUE TO A POINT SOURCE OF CURRENT WITH ARBITRARY
C       2-DIMENSIONAL CONDUCTIVITY DISTRIBUTION IN THE X-Z PLANE OF THE
C       LOWER HALF SPACE. THE GENERALISED POISSON,S EQUATION IS
C       DISCRETISED IN THE X-Z SPACE USING 5-POINT FINITE DIFFERENCE
C       APPROXIMATION, IN THE TRANSFORMED (X,KY,Z) DOMAIN. THE
C       CAPACITANCE MATRIX EQUATIONS THUS OBTAINED FOR ARBITRARY
C       CONDUCTIVITY DISTRIBUTIONS ARE SOLVED SIMULTANEOUSLY FOR SINGLE
C       AND/OR MULTIPLE, SURFACE OR SUBSURFACE LOCATIONS OF THE INJECTING
C       SOURCE FUNCTIONS. THESE SOLUTIONS ARE THEN INVERSE FOURIER
C       TRANSFORMED BACK TO (X-Y-Z) SPACE. ANY ARBITRARY SURFACE,DOWNHOLE
C       CONFIGURATION OR COMBINATIONS THEREOF USED IN RESISTIVITY
C       SURVEYS, COULD BE SIMULATED FOR GENERAL 2-DIMENSIONAL SUBSURFACE
C       DISTRIBUTION OF CONDUCTIVITIES.
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C.......       THE INPUT PARAMETERS ARE AS FOLLOWS.....
C
C......        MESH DESCRIPTION....
C         NNODX      = NUMBER OF NODES IN X-DIRECTION (PERP. TO STRIKE)
C         NNODZ      = NUMBER OF NODES IN Z-DIRECTION (VERTICALLY DOWN)
C         DX(I),I=1,(NNODX-1)   SEPARATION BETWEEN NODES IN X-DIRECTION
C         DZ(I),I=1,(NNODZ-1)   SEPARATION BETWEEN NODES IN Z-DIRECTION
C         XSCAL      = SCALE FACTOR IN X-DIRECTION OF THE MESH
C         ZSCAL      = SCALE FACTOR IN Z-DIRECTION OF THE MESH
C         UNIT       = SCALING FACTOR OF THE MESH DISTANCES IN TERMS OF
C       THE UNIT LENGTH FOR THE ELECTRODE CONFIGURATIONS
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C......        TRANSFORM PARAMETERS....
C         NKY        = NUMBER OF DISCRETE KY VALUES USED IN THE SOLUTION
C         YKY(I),I=1,NKY     - ARRAY OF KY VALUES USED
C         IOPT - IF .EQ. 0 -- INVERSE TRANSFORMATION IS DONE BY
C       INTEGRATION WITH EXPONENTIAL SUBSECTION FIT.
C         IOPT - IF .NE. 0 -- INVERSE TRANSFORMATION IS DONE BY
C       INTEGRATION WITH TRAPEZOIDAL RULE
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C.......       PHYSICAL PROPERTY DISTRIBUTION......
C         ICODE(I,J),I=1,NNODZ,J=1,NNODX  - ARRAY OF CODED CONDUCTIVITY
C       DISTRIBUTION IN THE LOWER X-Z PLANE IN TERMS OF SYMBOLS 0 THROUGH
C       9
C         RESIS(I),I=1,10  -- ARRAY OF INTRINSIC RESISTIVITY VALUES
```

```
C      ASSOCIATED WITH THE SYMBOLS 0 THROUGH 9
C        PFE(I),I=1,10  -- ARRAY OF INTRINSIC PERCENT FREQUENCY EFFECT
C      VALUES ASSOCIATED WITH THE SYMBOLS 0 THROUGH 9
C        COND(IX,IZ)    --  IS DETERMINED FROM ICODE(IX,IZ) AND IT
C      INDICATES THE CONDUCTIVITY IN THE REGION BOUNDED BY X(IX+1) AND
C      X(IX) IN X-DIRECTION AND Z(IZ+1) AND Z(IZ) IN Z-DIRECTION
C        NXBEG , NXEND  -- THE PHYSICAL PROPERTIES ARE DESCRIBED IN THE
C      RANGE NXBEG .LE. XNODE .LE. NXEND
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C.......       ARRAY DESCRIPTION......
C        NARRAY    = NUMBER OF RESISTIVITY SURVEY CONFIGURATIONS
C        ICONFIG(I),I=1,NARRAY  -- ARRAY OF CODE NUMBERS FOR VARIOUS
C      ELECTRODE CONFIGURATIONS
C        THESE CODES ARE...
C        ICONFIG = 1, FOR COLLINEAR DIPOLE-DIPOLE AND POLE-DIPOLE
C                  2, FOR RECONNAISSANCE BIPOLE-DIPOLE
C        IF OPTPUN .NE. 0 -- OUTPUT OF ICONFIG=1 ARRAY IS PUNCHED
C        THETA     = ANGLE (IN DEGREES) OF THE DIPOLE-DIPOLE PROFILE
C      LINE TO THE STRIKE( Y DIRECTION) OF THE CONDUCTIVITY DISTRIBUTION
C        INCLINE .EQ. 0 -- FOR TRANSMITTING BIPOLE PERPENDICULAR TO
C      STRIKE FOR ICONFIG=2
C        INCLINE.EQ. 1 -- FOR TRANSMITTING BIPOLE INCLINED AT AN ACUTE
C      ANGLE TO THE X-AXIS (PERPENDICULAR TO STRIKE),FOR ICONFIG=2
C        INCLINE .EQ. 2  -- FOR TRANSMITTING BIPOLE INCLINED AT AN OBTUS
C      ANGLE TO THE X-AXIS (PERPENDICULAR TO STRIKE),FOR ICONFIG=2
C        ISHIFT    = NUMBER OF SHIFTS OF ONE POLE OF THE BIPOLE FROM
C      Y=0 LINE IN TERMS OF THE SPECIFIED YSHIFT ARRAY
C        NRLIM     = NUMBER OF SHIFTS IN Y-DIRECTION (IN TERMS OF THE
C      SPECIFIED YSHIFT ARRAY) REQUIRED TO DEFINE THE Y-EXTENT OF THE
C      SURFACE MAP DESIRED, FOR ICONFIG=2. FOR THIS ARRAY NYSFT MUST BE
C      GREATER THAN OR EQUAL TO (NRLIM+ISHIFT-1)
C        IPRINT .EQ. 0 -- THE STANDARDISED PSEUDO SECTION PLOTS OF
C      APPARENT RESISTIVITY AND P.F.E. ARE DEPLOYED FOR COLLINEAR DP-DP
C      ALONE. ( REQUIRES STANDARDISED INPUT DATA )
C        IPRINT .EQ. 1 -- OUTPUTS FOR THE COLLINEAR DP - DP AND P - DP
C      ARRAYS ARE PRINTED OUT. THE STANDARDISED PSEUDO SECTION PLOTS
C      ARE SUPPRESSED.
C        IPRINT .GT. 1 -- NORMAL OUTPUTS FOR DP - DP AND P- DP ARRAYS
C      ARE PRINTED OUT . THE STANDARDISED PSEUDO SECTION PLOTS ARE
C      DISPLAYED FOR DP - DP ARRAY ALONE .( REQUIRES STANDARD INPUT )
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C......        TRANSMITTER AND RECEIVER ELECTRODE COORDINATES....
C        NTX = NUMBER OF TRANSMITTING ELECTRODE NODES(PROJECTED AT Z=0)
C        NRX = NUMBER OF RECEIVER ELECTRODE NODES(PROJECTED AT Z=0)
C        ITXP(I),I=1,NTX  -- ARRAY OF NODE NUMBERS OF THE TRANSMITTER
C      ELECTRODES
C        IRXP(I),I=1,NRX -- ARRAY OF NODE NUMBERS OF THE RECEIVER
C      ELECTRODES
C        NZSFT  = NUMBER OF SURFACE AND SUBSURFACE LAYERS OF TRANSMITTER
C      ELECTRODES
C        ZSHIFT(I),I=1,NZSFT  -- ARRAY OF DEPTHS OF THE LAYERS OF
C      TRANSMITTING ELECTRODES ( IN TERMS OF UNIT)
C        NZRSFT  = NUMBER OF SURFACE AND SUBSURFACE LAYERS OF RECEIVER
C      ELECTRODES
C        ZRSHIFT(I),I=1,NZRSFT  -- ARRAY OF DEPTHS OF THE LAYERS OF
C      RECEIVER ELECTRODES ( IN TERMS OF UNIT )
C        NYSFT  = NUMBER OF LINES SHIFTED ALONG STRIKE WHERE RECEIVER
C      ELECTRODES ARE LOCATED (INCLUDING Y=0 LINE)
```

```
C         YSHIFT(I),I=1,NYSFT  -- ARRAY OF VALUES CF Y-SHIFTS FOR VARIOUS
C       RECEIVER LINES ( IN TERMS OF UNIT )
C
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C.......         MODEL NAME AND TERMINATION PARAMETERS.....
C         TITLE(I),I=1,4  -- 12 SPACE ALPHANUMERIC NAME OF THE MODEL
C         IPKEY .EQ. 0  -- IF ONLY RESISTIVITY RESPONSE IS SOUGHT
C         IPKEY .NE. 0  -- IF RESISTIVITY AS WELL AS PERCENT FREQUENCY
C       EFFECT RESPOSES ARE SOUGHT
C         MORE .EQ. 0 -- AT THE END OF THE FIRST DATA SET -- FOLLOWED
C       BY ANOTHER MORE=0 CARD, IF NO FURTHER MODELS ARE TO BE COMPUTED
C         MORE .NE. 0  -- IF MORE THAN ONE MODEL IS TO BE COMPUTED.
C       AT THE END OF THE LAST DATA SET MORE SHOULD BE READ .EQ. 0
C
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C
C
      INTEGER OPTPUN
      LARGE A(1808,17),RS(1808,23)
      DIMENSION VKY(5000),V(1500)
      DIMENSION X(120),Z(20),YKY(10),ITXP(60),IRXP(120),YSHIFT(40),
     1ZSHIFT(20),ZRSHIFT(20),ICODE(20,120),RESIS(10),PFE(10),IXS(60),
     2IZS(60),TITLE(3),COND(120,20),DX(120),DZ(20),ICONFIG(25)
      DIMENSION XMAT(1808)
      COMMON /PACK1/ INCLINE,ISHIFT,NRLIM
      COMMON /GANG1/ OPTPUN,THETA,IPRINT
      READ 1, NNODX,NNODZ,NKY,NXBEG,NXEND,NARRAY,XSCAL,ZSCAL,UNIT
      NELX=NNODX-1
      NELZ=NNODZ-1
      READ 2, (DX(I),I=1,NELX)
      READ 3, (DZ(J),J=1,NELZ)
      READ 4, (YKY(K),K=1,NKY)
      READ 5, (ICONFIG(I),I=1,NARRAY)
      READ 6, NTX,NZSFT,NRX,NYSFT,NZRSFT
      READ 7, (ITXP(I),I=1,NTX)
      READ 8, (IRXP(J),J=1,NRX)
      READ 9, (ZSHIFT(I),I=1,NZSFT)
      READ 10, (ZRSHIFT(J),J=1,NZRSFT)
      READ 11, (YSHIFT(K),K=1,NYSFT)
  888 READ 12, IPKEY, (TITLE(I),I=1,3)
      IF(IPKEY .NE. 0) GO TO 101
      READ 14, (RESIS(I),I=1,10)
      GO TO 102
  101 READ 14, (RESIS(I),I=1,10)
      READ 15, (PFE(I),I=1,10)
  102 CONTINUE
      DO 103 I=1,NNODZ
      READ 16, (ICODE(I,J),J=NXBEG,NXEND)
  103 CONTINUE
    1 FORMAT(6I5,3F10.5)
    2 FORMAT(20F4.0)
    3 FORMAT(20F4.0)
    4 FORMAT(8F10.5)
    5 FORMAT(20I5)
    6 FORMAT(5I6)
    7 FORMAT(24I3)
    8 FORMAT(24I3)
    9 FORMAT(10F8.3)
   10 FORMAT(10F8.3)
   11 FORMAT(10F8.3)
   12 FORMAT(I5,3A4)
```

```
   14 FORMAT(10F8.3)
   15 FORMAT(10F8.3)
   16 FORMAT(80I1)
   17 FORMAT(I1)
C.....     READ IN THE SPECIAL INPUT DATA FOR CERTAIN ARRAYS
      IF(NARRAY .EQ. 1 .AND. ICONFIG(1) .EQ. 1)READ 21, OPTPUN,IPRINT,
     1THETA
      IF(NARRAY .EQ. 1 .AND. ICONFIG(1) .EQ. 2) READ 22, INCLINE,ISHIFT,
     1NRLIM
   21 FORMAT(2I5,F10.5)
   22 FORMAT(3I5)
      READ 17, MORE
C......       PRINT CARD IMAGES OF THE INPUT DATA
      PRINT 99
   99 FORMAT(1H1, //,25X,*CARD IMAGES OF THE INPUT DATA *,//)
      IF( MORE .NE. 0) GO TO 998
      PRINT 1,NNODX,NNODZ,NKY,NXBEG,NXEND,NARRAY,XSCAL,ZSCAL,UNIT
      PRINT 2, (DX(I),I=1,NELX)
      PRINT 3, (DZ(J),J=1,NELZ)
      PRINT 4, (YKY(K),K=1,NKY)
      PRINT 5, (ICONFIG(I),I=1,NARRAY)
      PRINT 6, NTX,NZSFT,NRX,NYSFT,NZRSFT
      PRINT 7, (ITXP(I),I=1,NTX)
      PRINT 8, (IRXP(J),J=1,NRX)
      PRINT 9, (ZSHIFT(I),I=1,NZSFT)
      PRINT 10, (ZRSHIFT(J),J=1,NZRSFT)
      PRINT 11, (YSHIFT(K),K=1,NYSFT)
  998 PRINT 12, IPKEY, (TITLE(I),I=1,3)
      PRINT 14, (RESIS(I),I=1,10)
      PRINT 15, (PFE(I),I=1,10)
      DO 133 I=1,NNODZ
      PRINT 16, (ICODE(I,J),J=NXBEG,NXEND)
  133 CONTINUE
      PRINT 17, MORE
      PRINT 21, OPTPUN,IPRINT,THETA
      PRINT 22, INCLINE,ISHIFT,NRLIM
      NTXTOT=NTX*NZSFT
      NRXTIT=NRX*NZRSFT
      NRXTOT=NRX*NZRSFT*NYSFT
      IPCOUNT=0
C....     SETTING UP THE SCALED DISTANCES AND ASSIGNED CONDUCTIVITY
C          DISTRIBUTION AT EACH ELEMENT IN THE MESH .
      IF( MORE .NE. 0) GO TO 1303
      X(1)=0.00
      Z(1)=0.00
      DO 104 IX=2,NNODX
  104 X(IX)=X(IX-1)+(DX(IX-1)/XSCAL)
      DO 105 IZ=2,NNODZ
  105 Z(IZ)=Z(IZ-1)+(DZ(IZ-1)/ZSCAL)
 1303 CONTINUE
      IPCOUNT=1
  999 DO 106 IZ=1,NNODZ
      DO 106 IX=1,NNODX
      IF(IPCOUNT .NE. 1) GO TO 107
      IF(IX .LT. NXBEG) ICODE(IZ,IX)=ICODE(IZ,NXBEG)
      IF(IX .GT. NXEND) ICODE(IZ,IX)=ICODE(IZ,NXEND)
      IRESX=ICODE(IZ,IX)+1
      COND(IX,IZ)=1.0/RESIS(IRESX)
      GO TO 106
  107 IRESX=ICODE(IZ,IX)+1
       COND(IX,IZ)=(1.0+PFE(IRESX)/100.0)/RESIS(IRESX)
  106 CONTINUE
```

```
      IF( MORE .NE. 0 .OR. IPCCUNT .NE. 1) GO TO 1304
      DO 130 IX=1,NELX
  130 DX(IX)=DX(IX)/XSCAL
      DO 135 IZ=1,NELZ
  135 DZ(IZ)=DZ(IZ)/ZSCAL
      PRINT 1045
 1045 FORMAT(5X,*NODE DISTANCES IN MESH UNITS FROM THE ORIGIN LOCATED AT
     1 THE TOP, LEFT HAND CORNER OF THE MESH *,//)
      PRINT 1040, ((IX,X(IX),DX(IX)),IX=1,NNODX)
 1040 FORMAT(2X,*IX=*,I5,3X,*X(IX)=*,F10.3,3X,*DX(IX)=*,F10.3)
      PRINT 1050, ((IZ,Z(IZ),DZ(IZ)),IZ=1,NNODZ)
 1050 FORMAT(2X,*IZ=*,I5,3X,*Z(IZ)=*,F10.3,3X,*DZ(IZ)=*,F10.3)
 1304 CONTINUE
      DO 111 IZTX=1,NZSFT
      ZSFT=ZSHIFT(IZTX)*UNIT
      DO 112 INDXZ=1,NNODZ
      IF( ZSFT .EQ. Z(INDXZ)) IZSQ=INDXZ
  112 CONTINUE
      DO 114 IXTX=1,NTX
      NTXCNT=(IZTX-1)*NTX+IXTX
      IXS(NTXCNT)=ITXP(IXTX)
      IZS(NTXCNT)=IZSQ
  114 CONTINUE
  111 CONTINUE
      NNODE=NNODX*NNODZ
      NBAND=2*NNODZ+1
      NNODTOT=NNODE*NTXCNT
      NLNA=NNODE*(NNODZ+1)
      NBAND2=NNODZ+1
      PRINT 1171, NLNA,NNODTOT
 1171 FORMAT(1H1,25X,*DIMENSION OF A SHOULD BE AT LEAST =*,I20,5X,
     1/,24X,*DIMENSION OF RS SHOULD BE AT LEAST =*,I20)
      DO 110 IKY=1,NKY
      YLAMDA=YKY(IKY)
C.......        FINITE DIFFERENCE SOLUTION FOR EACH OF THE KY VALUES .
      CALL SOLVENT (X,Z,COND,IXS,IZS,YLAMDA,DX,DZ,NNODX,NNODZ,IKY,
     1NTXCNT,NTX,ITXP,NRX,IRXP,NZRSFT,ZRSHIFT,NKY,NTXTOT,NRXTIT,NNODTOT,
     2NBAND,NBAND2,NNODE,NLNA,VKY,UNIT,A,RS,XMAT)
  110 CONTINUE
C.....    INVERSE TRANSFORMATION OF THE POTENTIALS IN (X ,KY, Z) SPACE
C         WITH APPROPRIATE Y-SHIFTS.
C......        IOPT .EQ. 0 ...  INTEGRATION BY SUBSECTIONAL EXPONENTIAL FIT
C......        IOPT .NE. 0 ... INTEGRATION BY TRAPEZOIDAL RULE
      IOPT=0
      CALL YTRAN (NRX,NYSFT,NZRSFT,YSHIFT,NTX,NZSFT,NKY,NTXTOT,NRXTOT,
     1NRXTIT,YKY,VKY,V,IOPT,UNIT)
C.....    SORT OUT COMBINATIONS OF THE POINT SOURCE POTENTIALS FOR
C         VARIOUS ELECTRODE ARRAYS.
      IF(IPKEY .EQ. 0) IPINDEX=0
      IF(IPKEY .NE. 0 .AND. IPCOUNT .EQ. 1) IPINDEX=0
      IF(IPKEY .NE. 0 .AND. IPCOUNT .EQ. 2) IPINDEX=1
      CALL ARRAYS( X,Z,NARRAY,ICONFIG,TITLE,NTXTOT,NRXTOT,NTX,NRX,ITXP,
     1IRXP,NZSFT,NYSFT,NZRSFT,ZSHIFT,YSHIFT,ZRSHIFT,IPINDEX,V,NNODX,
     2NNODZ,UNIT)
      IPCOUNT=IPCOUNT+1
      IF( IPKEY .NE. 0 .AND. IPCOUNT .EQ. 2) GO TO 999
      READ 17, MORE
      IF ( MORE .NE. 0) GO TO 888
      STOP
      END
      SUBROUTINE SOLVENT (X,Z,COND,IXS,IZS,YLAMDA,DX,DZ,NNODX,NNODZ,IKY,
     1NTXCNT,NTX,ITXP,NRX,IRXP,NZRSFT,ZRSHIFT,NKY,NTXTOT,NRXTIT,NNODTOT,
```

```
     2NBAND,NBAND2,NNODE,NLNA,VKY,UNIT,A,RS,XMAT)
*************************************************************************
C
C.......        AUTHOR ....  ABHIJIT DEY
C               LATEST REVISION ...  APRIL,1976
C............
C       ALL RIGHTS OF USAGE AND MODIFICATIONS ARE RESERVED BY AUTHOR
C............
C.......     PURPOSE.....
C                 SUBROUTINE SOLVENT DISCRETISES THE GENERALISED POISSON,S
C       EQUATION  IN (X- KY - Z) DOMAIN FOR A SET OF PRESCRIBED SET
C       OF KY VALUES USING A 5-POINT FINITE DIFFERENCE SCHEME. THE
C       SYSTEM OF CAPACITANCE MATRIX EQUATIONS ARE THEN GENERATED WITH
C       NEUMANN CONDITION FOR THE TOP SURFACE AND MIXED BOUNDARY CONDITIO
C       FOR THE LEFT,RIGHT AND BOTTOM EDGES, TAKING INTO ACCOUNT THE
C       ARBITRARY CONDUCTIVITY DISTRIBUTION IN THE X-Z PLANE. THE
C       CAPACITANCE MATRIX IS POSITIVE DEFINITE AND SATISFIES YOUNG,S
C       PROPERTY A . THE SYSTEM OF EQUATIONS ARE SOLVED SIMULTANEOUSLY
C       FOR ALL DELTA FUNCTION CURRENT SOURCE TERMS.
C
*************************************************************************
      LARGE A(NNODE,NBAND2),RS(NNODE,NTXCNT)
      DIMENSION XMAT(NNODE)
      DIMENSION IXS(1),IZS(1),C(60)
      DIMENSION VKY(NKY,NTXTOT,NRXTIT)
      DIMENSION COND(120,1),DX(1),DZ(1),ITXP(1),IRXP(1),X(1),Z(1),
     1ZRSHIFT(1)
      DIMENSION NSOURCE(60)
      EXTERNAL AK0,AK1
      DATA PI/3.141592653/
      AMP=2.0*PI
      XCENTR=(X(1)+X(NNODX))/2.0
      NELX=NNODX-1
      NELZ=NNODZ-1
      CALL SECOND(TIME)
      PRINT 33, TIME
   33 FORMAT(25X,*CP TIME =*,F20.5)
      DO 100 ITX=1,NTXCNT
      IXSP=IXS(ITX)
      IZSP=IZS(ITX)
      NSOURCE(ITX)=(IXSP-1)*NNODZ+IZSP
      DO 100 IX=1,NNODX
      DO 100 IZ=1,NNODZ
      N=(IX-1)*NNODZ+IZ
      RS(N,ITX)=0.00
      IF( N .NE. NSOURCE(ITX)) GO TO 100
      RS(N,ITX)=AMP/2.00
  100 CONTINUE
C.......      SET UP THE COEFFICIENT MATRIX FOR THE MESH.
      N1=1
      NCENT=NBAND2
      NMIDL=NBAND2-1
      NMIDU=NBAND2+1
      NEND=NBAND
      DO 210 IX=1,NNODX
      DO 220 IZ=1,NNODZ
      N=(IX-1)*NNODZ+IZ
      IF( IX .EQ. 1 .OR. IX .EQ. NNODX) GO TO 310
      IF( IZ .EQ. NNODZ) GO TO 315
      IF( IZ .EQ. 1) GO TO 320
C.....     COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF AN INTERIOR
C          NODE
```

```
      AREACON=(COND(IX-1,IZ-1)*DX(IX-1)*DZ(IZ-1)/4.0)+(COND(IX,IZ-1)*
     1DX(IX)*DZ(IZ-1)/4.0)+(COND(IX,IZ)*DX(IX)*DZ(IZ)/4.0)+(COND(IX-1,IZ
     2)*DX(IX-1)*DZ(IZ)/4.0)
      DO 400 KC=1,NBANC
  400 C(KC)=0.00
      C(N1)=-((DZ(IZ-1)*COND(IX-1,IZ-1)+DZ(IZ)*COND(IX-1,IZ))/(2.0*DX
     1(IX-1)))
      C(NMIDL)=-((DX(IX-1)*COND(IX-1,IZ-1)+DX(IX)*COND(IX,IZ-1))/(2.0*DZ
     1(IZ-1)))
      C(NMIDU)=-((DX(IX-1)*COND(IX-1,IZ)+DX(IX)*COND(IX,IZ))/(2.0*DZ
     1(IZ)))
      C(NEND)=-((DZ(IZ-1)*COND(IX,IZ-1)+DZ(IZ)*COND(IX,IZ))/(2.0*DX
     1(IX)))
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NENC)-YLAMDA*YLAMDA*AREACON)
      DO 410 KC=1,NBANC2
  410 A(N,KC)=C(KC)
      GO TO 350
  320 CONTINUE
C......     COEFFICIENTS FOR THE SELF ADJOINT EQUATION CF A NODE
C         LOCATED CN THE TOP SURFACE
      AREACON=(COND(IX-1,IZ)*DX(IX-1)*DZ(IZ)/4.0)+(COND(IX,IZ)*DX(IX)*
     1DZ(IZ)/4.0)
      DO 420 KC=1,NBANC
  420 C(KC)=0.00
      C(N1)=-DZ(IZ)*COND(IX-1,IZ)/(2.0*DX(IX-1))
      C(NMIDL)=0.00
      C(NMIDU)=-((DX(IX)*COND(IX,IZ)+DX(IX-1)*COND(IX-1,IZ))/(2.0*DZ
     1(IZ)))
      C(NEND)=-DZ(IZ)*COND(IX,IZ)/(2.0*DX(IX))
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NENC)-YLAMDA*YLAMDA*AREACON)
      DO 430 KC=1,NBANC2
  430 A(N,KC)=C(KC)
      GO TO 350
  315 CONTINUE
C......     COEFFICIENTS FOR THE SELF ADJOINT EQUATION CF A NODE
C         LOCATED ON THE BOTTOM SURFACE
      AREACON=(COND(IX-1,IZ-1)*DX(IX-1)*DZ(IZ-1)/4.0)+(COND(IX,IZ-1)*
     1DX(IX)*DZ(IZ-1)/4.0)
      XTX=ABS(X(IX)-XCENTR)
      R=SQRT(XTX*XTX+Z(IZ)*Z(IZ))
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .ANC. ARG2 .LT. 1.0E-70) AR(3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      THETA=ATAN(XTX/Z(IZ))
      DO 440 KC=1,NBANC
  440 C(KC)=0.00
      C(N1)=-DZ(IZ-1)*COND(IX-1,IZ-1)/(2.0*DX(IX-1))
      C(NMIDL)=-((DX(IX)*COND(IX,IZ-1)+DX(IX-1)*COND(IX-1,IZ-1))/(2.0*
     1DZ(IZ-1)))
      C(NMIDU)=0.00
      C(NEND)=-DZ(IZ-1)*COND(IX,IZ-1)/(2.0*DX(IX))
      CADD=-C(NMIDL)*DZ(IZ-1)*YLAMDA*COS(THETA)*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NENC)-YLAMDA*YLAMDA*AREACON)+
     1 CADD
      DO 441 KC=1,NBANC2
  441 A(N,KC)=C(KC)
      GO TO 350
  310 CONTINUE
      IF(IX .EQ. NNODX) GO TO 330
      DO 450 KC=1,NBANC
```

```
  450 C(KC)=0.00
      IF(IZ .GT. 1 .AND. IZ .NE. NNODZ) GO TO 4501
      IF(IZ .EQ. NNODZ) GO TO 4502
C......    COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF A NODE
C          LOCATED AT THE TOP,LEFT CORNER
      AREACON=COND(I ),IZ)*DX(IX)*DZ(IZ)/4.00
      XTX=ABS(X(IX)-XCENTR)
      R=XTX
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .AND. ARG2 .LT. 1.0E-70) ARG3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      C(N1)=0.00
      C(NMIDL)=0.00
      C(NMIDU)=-DX(IX)*COND(IX,IZ)/(2.0*DZ(IZ))
      C(NEND)=-DZ(IZ)*COND(IX,IZ)/(2.0*DX(IX))
      CADD=-C(NEND)*DX(IX)*YLAMDA*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NEND)-YLAMDA*YLAMDA*AREACON )+
     1 CADD
      GO TO 4503
C......    COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF A NODE
C          LOCATED ON THE LEFT EDGE
 4501 AREACON=(COND(IX,IZ-1)*DX(IX)*DZ(IZ-1)/4.0)+(COND(IX,IZ)*DX(IX)*
     1DZ(IZ)/4.0)
      XTX=ABS(X(IX)-XCENTR)
      R=SQRT(XTX*XTX+Z(IZ)*Z(IZ))
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .AND. ARG2 .LT. 1.0E-70) ARG3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      THETA=ATAN(Z(IZ)/XTX)
      C(N1)=0.00
      C(NMIDL)=-DX(IX)*COND(IX,IZ-1)/(2.0*DZ(IZ-1))
      C(NMIDU)=-DX(IX)*COND(IX,IZ)/(2.0*DZ(IZ))
      C(NEND)=-((DZ(IZ)*COND(IX,IZ)+DZ(IZ-1)*COND(IX,IZ-1))/(2.0*DX(IX)
     1))
      CADD=-C(NEND)*DX(IX)*YLAMDA*COS(THETA)*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NEND)-YLAMDA*YLAMDA*AREACON )+
     1 CADD
      GO TO 4503
C......    COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF A NODE
C          LOCATED AT THE BOTTOM , LEFT CORNER
 4502 AREACON=COND(I ),IZ-1)*DX(IX)*DZ(IZ-1)/4.00
      XTX=ABS(X(IX)-XCENTR)
      R=SQRT(XTX*XTX+Z(IZ)*Z(IZ))
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .AND. ARG2 .LT. 1.0E-70) ARG3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      THETA1=ATAN(Z(IZ)/XTX)
      THETA2=ATAN(XTX/Z(IZ))
      C(N1)=0.00
      C(NMIDL)=-DX(IX)*COND(IX,IZ-1)/(2.0*DZ(IZ-1))
      C(NMIDU)=0.00
      C(NEND)=-DZ(IZ-1)*COND(IX,IZ-1)/(2.0*DX(IX))
      CADD=-(C(NMIDL)*DZ(IZ-1)*COS(THETA2)+C(NEND)*DX(IX)*COS(THETA1))*
     1YLAMDA*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NEND)-YLAMDA*YLAMDA*AREACON)+
     1  CADD
```

```
 4503 DO 4511 KC=1,NBAND2
 4511 A(N,KC)=C(KC)
      GO TO 350
  330 CONTINUE
      CO 460 KC=1,NBANC
  460 C(KC)=0.00
      IF(IZ .GT. 1 .ANC. IZ .NE. NNODZ) GO TO 4601
      IF(IZ .EQ. NNODZ) GO TO 4602
C......     COEFFICIENTS FOR THE SELF ADJOINT EQUATION CF A NODE
C         AT THE TOP,RIGHT CORNER
      AREACON=COND(IX-1,IZ)*DX(IX-1)*DZ(IZ)/4.00
      XTX=ABS(X(IX)-XCENTR)
      R=XTX
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .ANC. ARG2 .LT. 1.0E-70) ARG3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      C(N1)=-DZ(IZ)*COND(IX-1,IZ)/(2.0*DX(IX-1))
      C(NMIDL)=0.00
      C(NMIDU)=-DX(IX-1)*COND(IX-1,IZ)/(2.0*DZ(IZ))
      C(NEND)=0.00
      CADD=-C(N1)*DX(IX-1)*YLAMDA*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NENC)-YLAMDA*YLAMDA*AREACON)+
     1 CADD
      GO TO 4603
C......     COEFFICIENTS FOR THE SELF ADJOINT EQUATION CF A NODE
C         LOCATED ON THE RIGHT EDGE
 4601 AREACON=(COND(IX-1,IZ-1)*DX(IX-1)*DZ(IZ-1)/4.0)+(COND(IX-1,IZ)*
     1DX(IX-1)*DZ(IZ)/4.0)
      XTX=ABS(X(IX)-XCENTR)
      R=SQRT(XTX*XTX+Z(IZ)*Z(IZ))
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .ANC. ARG2 .LT. 1.0E-70) ARG3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      THETA=ATAN(Z(IZ)/XTX)
      C(N1)=-((DZ(IZ)*COND(IX-1,IZ)+DZ(IZ-1)*COND(IX-1,IZ-1))/(2.0*DX
     1(IX-1)))
      C(NMIDL)=-DX(IX-1)*COND(IX-1,IZ-1)/(2.0*DZ(IZ-1))
      C(NMIDU)=-DX(IX-1)*COND(IX-1,IZ)/(2.0*DZ(IZ))
      C(NEND)=0.00
      CADD=-C(N1)*DX(IX-1)*YLAMDA*COS(THETA)*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NENC)-YLAMDA*YLAMDA*AREACON)+
     1  CADD
      GO TO 4603
C......     COEFFICIENTS FOR THE SELF ADJOINT ECUATION CF A NODE
C         LOCATED AT THE BOTTOM,RIGHT CORNER
 4602 AREACON=COND(IX-1,IZ-1)*DX(IX-1)*DZ(IZ-1)/4.00
      XTX=ABS(X(IX)-XCENTR)
      R=SQRT(XTX*XTX+Z(IZ)*Z(IZ))
      ARG=YLAMDA*R
      ARG1=AK1(ARG)
      ARG2=AK0(ARG)
      IF(ARG1 .LT. 1.0E-70 .AND. ARG2 .LT. 1.0E-70) ARG3=1.00
      IF(ARG1 .GE. 1.0E-70 .OR. ARG2 .GE. 1.0E-70) ARG3=ARG1/ARG2
      THETA1=ATAN(Z(IZ)/XTX)
      THETA2=ATAN(XTX/Z(IZ))
      C(N1)=-DZ(IZ-1)*COND(IX-1,IZ-1)/(2.0*DX(IX-1))
      C(NMIDL)=-DX(IX-1)*COND(IX-1,IZ-1)/(2.0*DZ(IZ-1))
      C(NMIDU)=0.00
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```
      C(NEND)=0.00
      CADD=-(C(NMIDL)*DZ(IZ-1)*COS(THETA2)+C(N1)*DX(IX-1)*COS(THETA1))*
     1YLAMDA*ARG3
      C(NCENT)=-(C(N1)+C(NMIDL)+C(NMIDU)+C(NEND)-YLAMDA*YLAMDA*AREACON)+
     1 CADD
 4603 DO 4611 KC=1,NBAND2
 4611 A(N,KC)=C(KC)
  350 CONTINUE
  220 CONTINUE
  210 CONTINUE
      CALL SECOND(TIME)
      PRINT 33, TIME
      CALL BANDSYM (A,NNODE,NNODZ,NNODE,RS,NNODE,NTXCNT,14,D1,D2,NBANC2,
     1XMAT,IER)
      PRINT 910, IER
  910 FORMAT(20X,*MATRIX SOLUTION ERROR INDEX =*,I5)
      CALL SECOND(TIME)
      PRINT 33, TIME
      DO 1210 ITX=1,NTXCNT
      DO 1220 IDWN=1,NZRSFT
      ZRSFT=ZRSHIFT(IDWN)*UNIT
      DO 1230 INDXZ=1,NNODZ
 1230 IF( ZRSFT .EQ. Z(INDXZ)) IZRS=INDXZ
      DO 1240 IRX=1,NRX
      IRXX=IRXP(IRX)
      IROWNX=IRX+(IDWN-1)*NRX
      NRXCHK=(IRXX-1)*NNODZ+IZRS
      VKY(IKY,ITX,IROWNX)=RS(NRXCHK,ITX)
C     PRINT 1411, IKY,YLAMDA,ITX,IROWNX,VKY(IKY,ITX,IROWNX)
C1411 FORMAT(2X,*IKY=*,I3,2X,*LAMDA=*,F12.5,2X,*ITX=*,I5,2X,*IROWNX=*,I5
C    1,2X,*VKY=*,E15.4)
 1240 CONTINUE
 1220 CONTINUE
 1210 CONTINUE
      RETURN
      END
      FUNCTION AK0(X)
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C     ..        AUTHOR ....   ABHIJIT DEY
C             LATEST REVISION ...   APRIL,1976
C ........   PURPOSE.....
C             EVALUATES THE MODIFIED BESSEL FUNCTION OF ZEROETH ORDER FOR
C          AN ARGUMENT X
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      IF( X .GE. 2.0) GO TO 10
      T=X/3.75
      T=T*T
      B1=1.0+T*(3.5156229+T*(3.0899424+T*(1.2067492+T*(0.2659732+T*(
     10.0360768+T*0.0045813)))))
      T=0.5*X
      Y=T*T
      AK0=-ALOG(T)*B1-0.57721566+Y*(0.42278420+Y*(0.23069756+Y*
     2(0.03488590+Y*(0.00262698+Y*(0.00010750+Y*0.00000740)))))
      RETURN
   10 T=2.0/X
      F=EXP(-X)/SQRT(X)
      AK0=F*(1.25331414+T*(-0.07832358+T*(0.02189568+T*(-0.01062446+T*
     1(0.00587872+T*(-0.00251540+T*0.00053208))))))
      RETURN
      END
      FUNCTION AK1(X)
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
C               AUTHOR....     ABHIJIT DEY
C           LATEST REVISION ....    APRIL,1976
C ........   PURPOSE.....
C.....      EVALUATES THE MODIFIEC EESSEL FUNTICN CF CRCER 1 FOR AN
C       ARGUMENT X
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      IF(X .GE. 2.00) GO TO 100
      T=X/3.75
      T2=T*T
      T4=T2*T2
      T6=T4*T2
      T8=T6*T2
      T10=T8*T2
      T12=T10*T2
      B=0.50+0.87890594*T2+0.51498869*T4+0.15084934*T6+0.02658733*T8+
     10.00301532*T10+0.00032411*T12
      BI1=X*B
      T=X*0.5
      T2=T*T
      T4=T2*T2
      T6=T4*T2
      T8=T6*T2
      T10=T8*T2
      T12=T10*T2
      AA=X*ALOG(T)*BI1+1.00+0.15443144*T2-0.67278579*T4-0.18156897*T6-
     10.01919402*T8-0.00110404*T10-0.00004686*T12
      AK1=AA/X
      RETURN
  100 T=2.0/X
      T2=T*T
      T3=T2*T
      T4=T3*T
      T5=T4*T
      T6=T5*T
      BB=1.25331414+0.23498619*T-0.03655620*T2+0.01504268*T3-
     10.00780353*T4+0.00325614*T5-0.00068245*T6
      AK1=BB*EXP(-X)/SGRT(X)
      RETURN
      END
      SUBROUTINE BANCSYM (A,N,NC,IA,B,IB,M,IDGT,D1,D2,NBND,X,IER)
C
C
C   FUNCTION             - LINEAR EQUATION SOLVER - SYMMETRIC BAND
C                             STORAGE MODE - SPACE ECONOMIZER SOLUTION
C   PARAMETERS    A      - THE COEFFICIENT MATRIX OF THE EQUATION
C                             AX = B, WHERE A IS ASSUMED TO BE AN N X N
C                             POSITIVE DEFINITE SYMMETRIC BAND MATRIX. A
C                             IS STORED IN SYMMETRIC BAND STORAGE MODE
C                             ANC THEREFORE HAS CIMENSION N BY (NC+1).
C                             (INPUT)
C                          ON OUTPUT, A IS REPLACED BY L WHERE
C                             A = L*L-TRANSPOSE. L IS A LOWER BAND
C                             MATRIX STORED IN BAND FORM AND THEREFORE
C                             HAS DIMENSION N BY (NC+1). NOTE THAT THE
C                             DIAGONAL ELEMENTS OF L ARE STORED IN
C                             RECIPRCCAL FORM. (OUTPUT)
C                 N      - ORDER OF MATRIX A AND NUMBER OF ROWS IN B.
C                             (INPUT)
C                 NC     - NUMBER OF UPPER OR LCWER CO-CIAGONALS OF A.
C                             (INPUT)
C                  NBND= NC+1
C                 IA     - ROW CIMENSION OF A AS SPECIFIED IN THE MAIN
```

```
C                                   PRCGRAM.(INPUT)
C                     B       - INPUT MATRIX OF DIMENSICN N X M CONTAINING
C                                 THE M RIGHT-HAND SIDES OF THE EQUATION
C                                 AX = B.
C                               ON OUTPUT, THE N X M SOLUTICN MATRIX X
C                                 REPLACES B.
C                     IB      - ROW CIMENSION OF B AS SPECIFIED IN THE MAIN
C                                 PRCGRAM.(INPUT)
C                     M       - NUMBER OF RIGHT HANC SIDES (COLUMNS IN B)
C                                 (INPUT)
C                     IDGT    - THE ELEMENTS OF A ARE ASSUMEC TO BE CORRECT
C                                 TO ICGT DECIMAL CIGITS (INFUT - CURRENTLY
C                                 NOT USED)
C                     D1,D2   - COMPCNENTS OF THE DETERMINANT OF A.
C                                 DETERMINANT(A) = D1*2.**D2. (OUTPUT)
C                     IER     - ERROR PARAMETER.
C                               TERMINAL ERROR = N
C                                 N = 1 INDICATES THAT THE MATRIX A IS
C                                   ALGORTHMICALLY NCT POSITIVE DEFINITE.
C-----------------------------------------------------------------------
C
      LARGE A(IA,NBND) , B(IB,M)
      DIMENSICN X(N)
      IER = 0
C                                       DECOMPOSITICN OF MATRIX A INTO
C                                       L*L-TRANSFCSE
      CALL LUDCCMP(A,N,NC,IA,D1,D2,NBNC,IER)
      IF (IER .NE. 0) GO TO 9000
      DO 5 I = 1,M
C                                       SOLUTION CF AX = B
      DO 51 IX=1,N
   51 X(IX)=B(IX,I)
      CALL SOLVE(A,X,N,NC,IA,NBND)
      DO 52 IX=1,N
   52 B(IX,I)=X(IX)
    5 CONTINUE
 9000 CONTINUE
      RETURN
      END
      SUBROUTINE LUDCOMP(A,N,NC,IA,D1,D2,NBND,IER)
C
C
C   FUNCTION                  - LU DECOMPOSITION OF A PCSITIVE DEFINITE
C                                 SYMMETRIC BAND MATRIX - CHCLESKY
C                                 DECOMPCSITION
C   PARAMETERS      A         - N X N POSITIVE DEFINITE SYMMETRIC BAND MATRIX
C                                 STORED IN SYMMETRIC BAND STORAGE MODE.
C                                 A SHCULD BE AN ARRAY CF SIZE N BY NC+1, AT
C                                 LEAST. (INPUT)
C                     N       - ROW CIMENSION OF A FCR THE PRESENT CALL
C                                 (INPUT).
C                     NC      - NUMBER OF UPPER OR LOWER CO-CIAGONALS (INPUT)
C                     IA      - ROW CIMENSION OF A AS SPECIFIED IN THE MAIN
C                                 PRCGRAM. (INPUT)
C                     UL      - OUTPUT MATRIX L WHERE A = L*L-TRANSPOSE. L IS
C                                 STORED IN BAND STORAGE MODE. UL SHOULD BE
C                                 AN ARRAY OF SIZE N BY NC+1, AT LEAST.
C                                 NOTE - THE DIAGONAL OF UL CONTAINS THE
C                                 RECIPRCCALS OF THE ACTUAL CIAGONAL ELEMENTS.
C                     IU      - ROW CIMENSION OF UL AS SPECIFIED IN THE MAIN
C                                 PRCGRAM. (INPUT)
C                     D1,D2   - COMPONENTS OF THE DETERMINANT OF A.
```

```
C                               DETERMINANT(A) = D1*2.**D2. (OUTPUT)
C                   IER     - ERROR PARAMETER.
C                             TERMINAL ERROR = N
C                               N = 1 INDICATES THAT THE MATRIX A IS
C                                 ALGORITHMICALLY NOT POSITIVE DEFINITE.
C-----------------------------------------------------------------------
C   LATEST REVISION         - FEBRUARY 6,1974
C
      LARGE A(IA,NBND)
      DATA             ZERO,ONE,FOUR,SIXTN,SIXTH/0.,1.,4.,16.,.0625/
      IER = 0
      RN = ONE/(N*SIXTN)
      D1 = ONE
      D2 = ZERO
      NCP1 = NC+1
      IF (NC .EQ. 0) GO TO 15
C                                       INITIALIZE ZERO ELEMENTS
      DO 10 I = 1,NC
         DO 5 J = I,NC
            K = NCP1-J
      A(I,K)=ZERO
    5    CONTINUE
   10 CONTINUE
C                                       I IS ROW INDEX OF ELEMENT BEING
C                                       COMPUTED
   15 DO 60 I = 1,N
         IMNCP1 = I-NCP1
         I1 = MAX0(1,1-IMNCP1)
C                                       J IS COLUMN INDEX OF ELEMENT BEING
C                                       COMPUTED
         DO 60 J = I1,NCP1
C                                       L IS ROW INDEX OF PREVIOUSLY COMPUTED
C                                       VECTOR BEING USED TO COMPUTE INNER
C                                       PRODUCT
            L = IMNCP1+J
            I2 = NCP1-J
            SUM = A(I,J)
            JM1 = J-1
            IF (JM1) 30,30,20
   20       DO 25 K = 1,JM1
C                                       M IS COLUMN INDEX
               M = I2+K
               SUM=SUM-A(I,K)*A(L,M)
   25       CONTINUE
   30       IF (J .NE. NCP1) GO TO 55
            IF (A(I,J)+SUM*RN .LE. A(I,J)) GO TO 65
      A(I,J)=ONE/SQRT(SUM)
C                                       UPDATE THE DETERMINANT
            D1 = D1*SUM
   35       IF (ABS(D1)-ONE) 45,45,40
   40       D1 = D1*SIXTH
            D2 = D2+FOUR
            GO TO 35
   45       IF (ABS(D1)-SIXTH) 50,50,60
   50       D1 = D1*SIXTN
            D2 = D2-FOUR
            GO TO 45
   55 A(I,J)=SUM*A(L,NCP1)
   60 CONTINUE
      GO TO 9005
   65 IER=1
 9005 RETURN
```

```
      END
      SUBROUTINE SOLVE (UL,X,N,NC,IA,NBND)
C
C                                  '
C   FUNCTION              - ELIMINATION PORTION CF THE SCLUTION OF AX = B
C                             SYMMETRIC BAND STORAGE MODE
C   PARAMETERS    UL      - THE RESULT L COMPUTED IN THE ROUTINE LUDAPB
C                             WHERE A = L*L-TRANSPOSE. L IS A LOWER BAND
C                             MATRIX STORED IN BAND STCRAGE MODE AND
C                             THEREFCRE HAS DIMENSION N X (NC+1). THE MAIN
C                             DIAGONAL ELEMENTS CF L ARE STORED IN
C                             RECIPRCCAL FORM. (INPUT)
C                 B       - VECTOR OF LENGTH N CONTAINING THE RIGHT HAND
C                             SIDE OF THE EQUATICN AX = B. (INPUT)
C                 N       - ORDER OF A AND THE LENGTH OF B AND X. (INPUT)
C                 NC      - NUMBER OF LOWER CO-DIAGCNALS OF A. (INPUT)
C                 IA      - ROW CIMENSION OF UL AS SPECIFIED IN THE MAIN
C                             PRCGRAM. (INPUT)
C                 X       - VECTOR OF LENGTH N CCNTAINING THE SOLUTION TO
C                             THE EQUATION AX = B. (OUTPUT)
C   PRECISION             - SINGLE
C   LANGUAGE              - FORTRAN
C-----------------------------------------------------------------------
C   LATEST REVISICN       - SEPTEMBER 14,1973
C
C
      LARGE UL(IA,NBND)
      DIMENSION X(1)
C                                      SOLUTION LY = B
      NC1 = NC+1
      IW = 0
      L = 0
      DO 15 I = 1,N
      SUM=X(I)
         IF (NC .LE. 0) GO TO 10
         IF (IW .EQ. 0) GO TO 9
         L = L+1
         IF ( L .GT. NC) L = NC
         K = NC1-L
         KL = I-L
         DO 5 J = K,NC
            SUM = SUM-X(KL)*UL(I,J)
            KL = KL+1
    5    CONTINUE
         GC TO 10
    9    IF (SUM .NE. 0.) IW = 1
   10    X(I) = SUM*UL(I,NC1)
   15 CONTINUE
C                                      SOLUTION UX = Y
   20 X(N) = X(N)*UL(N,NC1)
      IF (N .LE. 1) GO TO 40
      N1 = N+1
      DO 35 I = 2,N
         K = N1-I
         SUM = X(K)
         IF (NC .LE. 0) GO TO 30
         KL = K+1
         K1 = MIN0(N,K+NC)
         L = 1
         DO 25 J = KL,K1
            SUM = SUM-X(J)*UL(J,NC1-L)
            L = L+1
```

```
   25     CONTINUE
   30     X(K) = SUM*UL(K,NC1)
   35 CONTINUE
   40 RETURN
      END
      SUBROUTINE YTRAN (NRX,NYSFT,NZRSFT,YSHIFT,NTX,NZSFT,NKY,NTXTOT,
     1NRXTOT,NRXTIT,YKY,VKY,V,INDEX,UNIT)
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C     ..          AUTHOR ....   ABHIJIT DEY
C           LATEST REVISION ...   APRIL,1976
C
C......          PURPOSE.......
C           SUBROUTINE YTRAN PERFORMS THE INVERSE FOURIER TRANSFORM
C       OF THE POTENTIALS IN (X-KY-Z) SPACE BACK TO (X-Y-Z) SPACE.
C       THE TRANSFORMATION INTEGRAL IS DETERMINED BY FITTING SUBSECTIONS
C       IN KY-SPACE BY EXPONENTIALS OR BY TRAPEZOIDAL RULE.
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      DIMENSION VKY(NKY,NTXTOT,NRXTIT),V(NTXTOT,NRXTOT)
      DIMENSION YSHIFT(1),YKY(1)
      DO 100 ID=1,NZSFT
      DO 100 IE=1,NTX
      ITX=(ID-1)*NTX+IE
      IRX=0
      DO 100 IA=1,NZRSFT
      DO 100 IC=1,NYSFT
      Y=YSHIFT(IC)*UNIT
      DO 100 IB=1,NRX
      IRXA=(IA-1)*NRX+IB
      IRX=IRX+1
      IF( INDEX .NE. 0 .AND. Y .EQ. 0.00) GO TO 300
C.....      INTEGRATION BY SUBSECTIONAL EXPONENTIAL FITS
      IF(Y .EQ. 0.00) VA=VKY(1,ITX,IRXA)*YKY(1)
      IF(Y .NE. 0.00) VA=VKY(1,ITX,IRXA)*SIN(YKY(1)*Y)/Y
      DO 200 IKY=2,NKY
      IK1=IKY-1
      XK1=YKY(IK1)
      XK2=YKY(IKY)
      Y1=VKY(IK1,ITX,IRXA)
      Y2=VKY(IKY,ITX,IRXA)
      IF(Y1 .LT. 1.0E-30 .OR. Y2 .LT. 1.0E-30) GO TO 210
      A=-ALOG(Y2/Y1)/(XK2-XK1)
      GO TO 215
  210 A=0.00
  215 CONTINUE
      IF( A .EQ. 0.00 .AND. Y .EQ. 0.00) GO TO 220
      VA=VA+(Y1*(A*COS(XK1*Y)-Y*SIN(XK1*Y))-Y2*(A*COS(XK2*Y)-Y*SIN(XK2*Y
     1)))/(A*A+Y*Y)
      GO TO 225
  220 VA=VA+Y1*(XK2-XK1)
  225 CONTINUE
  200 CONTINUE
      GO TO 250
  300 CONTINUE
C......      INTEGRATION BY TRAPEZOIDAL RULE
      VA=VKY(1,ITX,IRXA)*YKY(1)
      DO 310 IKY=2,NKY
      IK1=IKY-1
      XK1=YKY(IK1)
      XK2=YKY(IKY)
      Y1=VKY(IK1,ITX,IRXA)
      Y2=VKY(IKY,ITX,IRXA)
```

```
      AA=(Y1+Y2)*0.50*(XK2-XK1)
  310 VA=VA+AA
  250 CONTINUE
      V(ITX,IR))=(VA*2.0/3.141592653)*UNIT
  100 CONTINUE
      RETURN
      END
      SUBROUTINE ARRAYS (X,Z,NARRAY,ICONFIG,TITLE,NTXTCT,NRXTOT,NTX,
     1NRX,ITXP,IRXP,NZSFT,NYSFT,NZRSFT,ZSHIFT,YSHIFT,ZRSHIFT,IPKEY,V,
     2NNODX,NNODZ,UNIT)
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
C......         AUTHOR ....    ABHIJIT DEY
C          LATEST REVISION ...    APRIL,1976
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      DIMENSION V(NTXTCT,NRXTOT)
      DIMENSION X(1),Z(1),ICONFIG(1),TITLE(1),ITXP(1),IRXP(1),ZSHIFT(1),
     1YSHIFT(1),ZRSHIFT(1)
      DO 10 IX=1,NNODX
   10 X(IX)=X(IX)/UNIT
      DO 15 IZ=1,NNODZ
   15 Z(IZ)=Z(IZ)/UNIT
      DO 100 I=1,NARRAY
      INDEX=ICONFIG(I)
      GO TO (1,2), INDEX
    1 CALL CLINDIP(X,Z,IPKEY,TITLE,NTXTOT,NRXTOT,NRX,IRXP,NTX,ITXP,
     1NYSFT,YSHIFT,V,NNODX,NNODZ)
      GO TO 99
    2 CALL RECON2D(X,Z,NTXTOT,NRXTOT,NTX,NRX,ITXP,IRXP,NYSFT,YSHIFT,
     1TITLE,V,NNODX,NNODZ)
   99 CONTINUE
  100 CONTINUE
      DO 11 IX=1,NNODX
   11 X(IX)=X(IX)*UNIT
      DO 16 IZ=1,NNODZ
   16 Z(IZ)=Z(IZ)*UNIT
      RETURN
      END
      SUBROUTINE CLINDIP (X,Z,IPKEY,TITLE,NTXTCT,NRXTOT,NRX,IRXP,
     1NTX,ITXP,NYSFT,YSHIFT,V,NNODX,NNODZ)
C.......    PURPOSE.......
C       TO OBTAIN PROFILES OF APPARENT RESISTIVITY OVER INHOMOGENEITIES
C      WITH DIPOLE-DIPOLE AND POLE-DIPOLE CONFIGURATION OF ELECTRODES.
C      THE PROFILE LINES ARE INCLINED TO THE STRIKE OF THE INHOMOGENEITY
C        AUTHOR..... ABHIJIT DEY
C        DATE..... APRIL,1974
      INTEGER OPTPUN
      COMMON /GANG1/ OPTPUN,THETA,IPRINT
      DIMENSION V(NTXTCT,NRXTOT)
      DIMENSION X(1),Z(1),IRXP(1),ITXP(1),TITLE(1),YSHIFT(1)
      DIMENSION NPTS(20),NRA(20),NRB(20),GEOMFD(20),GEOMFP(20),APRES1(25
     1),APRES2(25),APIP1(25,20),APIP2(25,20),APRDC1(25,20),APRDC2(25,
     120),APMCFD(25,20),APMCFP(25,20),TXA(50),TXB(50),RXP(50)
      DIMENSION TXPOS(50),RXPOS(50)
      DIMENSION CRFD(20),CRFP(20)
      DATA NTA/1/,NTB/2/
      DATA NRA/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18/
      DATA NRB/2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19/
      DATA NPTS/22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4/
      DATA TXPOS/-12.0,-11.0,-10.0,-9.0,-8.0,-7.0,-6.0,-5.0,-4.0,-3.0,
     1-2.0,-1.0,0.0,1.0,2.0,3.0,4.0,5.0,6.0,7.0,8.0,9.0,10.0/
      DATA RXPOS/-10.0,-9.0,-8.0,-7.0,-6.0,-5.0,-4.0,-3.0,-2.0,-1.0,0.0,
     11.0,2.0,3.0,4.0,5.0,6.0,7.0,8.0,9.0,10.0,11.0,12.0/
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```
      DATA GEOMFD/3.0,12.0,30.0,60.0,105.0,168.0,252.0,360.0,495.0,660.0
     1,858.0,1092.0,1365.0,1680.0,2040.0,2448.0,2907.0,3420.0/
      DATA GEOMFP/2.0,6.0,12.0,20.0,30.0,42.0,56.0,72.0,90.0,110.0,132.0
     1,156.0,182.0,210.0,240.0,272.0,306.0,342.0/
C....    THE ARRAYS CRFD AND CRFP CONSIST OF THE CORRECTION FACTORS
C      EMPLOYED TO THE DF-DP AND P-DP ARRAYS FOR DIFFERENT DIPOLE
C      SEPARATIONS. THESE FACTORS ARE BASED ON COMPARISONS WITH KNOWN
C      SOLUTIONS OVER TWO-DIMENSIONAL STRUCTURES ( FOR A PRESCRIBED
C      SET OF KY VALUES USED ).
      DATA CRFD/0.945,0.96,0.965,0.96,0.96,0.96,0.96,0.96,0.96,0.96,0.96
     1,0.966,0.97,0.97,0.97,0.97,0.97,0.97,0.97/
      DATA CRFP/0.99,1.00,1.00,1.01,1.01,1.02,1.03,1.03,1.04,1.06,1.07,
     11.08,1.08,1.09,1.09,1.09,1.09,1.09/
      XCENTR=(X(1)+X(NNODX))/2.0
      THETAX=THETA/57.296
      DO 16 NSEP=1,18
      N1=NPTS(NSEP)
      DO 15 I=1,N1
      IA=NTA+I-1
      IB=NTB+I-1
      JC=NRA(NSEP)+I-1
      JD=NRB(NSEP)+I-1
      IF(THETA .EQ. 90.00) GO TO 771
C.... COORDINATES OF THE TX AND RX ELECTRODES ON THE INCLINED PROFILE
      AX=TXPOS(IA)
      BX=TXPOS(IB)
      CX=RXPOS(JC)
      DX=RXPOS(JD)
C....   COORDINATES OF THE TX AND RX ELECTRODES ON THE X-Y PLANE
      CC=SIN(THETAX)
      SS=COS(THETAX)
      XATX=(AX*CC)+XCENTR
      XBTX=(BX*CC)+XCENTR
      XCRX=(CX*CC)+XCENTR
      XDRX=(DX*CC)+XCENTR
      YATX=AX*SS
      YBTX=BX*SS
      YCRX=CX*SS
      YDRX=DX*SS
      NTPOSX=NTX-1
      DO 12 IX1=1,NTPOSX
      NX1=ITXP(IX1)
      NX2=ITXP(IX1+1)
      X1=X(NX1)
      X2=X(NX2)
      AA=ABS(X1-X2)
      IF(XATX .LT. X2 .AND. XATX .GE. X1) ITAX=IX1
      IF(XBTX .LT. X2 .AND. XBTX .GE. X1) ITBX=IX1
   12 CONTINUE
      NRPOSX=NRX-1
      DO 13 IX2=1,NRPOSX
      NX1=IRXP(IX2)
      NX2=IRXP(IX2+1)
      X1=X(NX1)
      X2=X(NX2)
      IF(XCRX .LT. X2 .AND. XCRX .GE. X1) IRCX=IX2
      IF(XDRX .LT. X2 .AND. XDRX .GE. X1) IRDX=IX2
   13 CONTINUE
C....   DETERMINATION OF THE RELATIVE Y-SHIFT BETWEEN TX AND RX POLES
      NRLINY=NYSFT-1
      DO 14 IY1=1,NRLINY
      Y1=YSHIFT(IY1)
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      Y2=YSHIFT(IY1+1)
      IF(ABS(YATX-YCRX) .LT. Y2 .AND. ABS(YATX-YCRX) .GE. Y1)IACY=IY1
      IF(ABS(YATX-YDRX) .LT. Y2 .AND. ABS(YATX-YDRX) .GE. Y1)IADY=IY1
      IF(ABS(YBTX-YCRX) .LT. Y2 .AND. ABS(YBTX-YCRX) .GE. Y1)IBCY=IY1
      IF(ABS(YBTX-YDRX) .LT. Y2 .AND. ABS(YBTX-YDRX) .GE. Y1)IBDY=IY1
   14 CONTINUE
C...  TWO-DIMENSIONAL INTERPOLATION OF V(RECEIVER) ASSUMING LINEAR
C     VARIATION ALONG THE EDGES OF A SQUARE GRID OF KNOWN CORNER VALUES.
C     AA IS THE SIDE DIMENSION OF THE SQUARE GRID
      KNXA=ITXP(ITAX)
      DXA=ABS(X(KNXA)-XATX)
      KNXC=IRXP(IRCX)
      KRC1=(IACY-1)*NRX+IRCX
      KRC2=KRC1+1
      KRC3=KRC2+NRX
      KRC4=KRC1+NRX
      V1=V(ITAX,KRC1)-(DXA*(V(ITAX,KRC1)-V(ITAX+1,KRC1))/AA)
      V2=V(ITAX,KRC2)-(DXA*(V(ITAX,KRC2)-V(ITAX+1,KRC2))/AA)
      V3=V(ITAX,KRC3)-(DXA*(V(ITAX,KRC3)-V(ITAX+1,KRC3))/AA)
      V4=V(ITAX,KRC4)-(DXA*(V(ITAX,KRC4)-V(ITAX+1,KRC4))/AA)
      DXC=ABS(X(KNXC)-XCRX)
      DYC=ABS(ABS(YATX-YCRX)-YSHIFT(IACY))
      V(IA,JC)=V1+(DXC*(V2-V1)/AA)+(DYC*(V4-V1)/AA)+(DXC*DYC*(V1-V2+V3-V
     14)/(AA*AA))
      KNXD=IRXP(IRDX)
      KRD1=(IADY-1)*NRX+IRDX
      KRD2=KRD1+1
      KRD3=KRD2+NRX
      KRD4=KRD1+NRX
      V1=V(ITAX,KRD1)-(DXA*(V(ITAX,KRD1)-V(ITAX+1,KRD1))/AA)
      V2=V(ITAX,KRD2)-(DXA*(V(ITAX,KRD2)-V(ITAX+1,KRD2))/AA)
      V3=V(ITAX,KRD3)-(DXA*(V(ITAX,KRD3)-V(ITAX+1,KRD3))/AA)
      V4=V(ITAX,KRD4)-(DXA*(V(ITAX,KRD4)-V(ITAX+1,KRD4))/AA)
      DXD=ABS(X(KNXD)-XDRX)
      DYD=ABS(ABS(YATX-YDRX)-YSHIFT(IADY))
      V(IA,JD)=V1+(DXD*(V2-V1)/AA)+(DYD*(V4-V1)/AA)+(DXD*DYD*(V1-V2+V3-V
     14)/(AA*AA))
      KNXB=ITXP(ITBX)
      DXB=ABS(X(KNXB)-XBTX)
      KNXC=IRXP(IRCX)
      KRC1=(IBCY-1)*NRX+IRCX
      KRC2=KRC1+1
      KRC3=KRC2+NRX
      KRC4=KRC1+NRX
      V1=V(ITBX,KRC1)-(DXB*(V(ITBX,KRC1)-V(ITBX+1,KRC1))/AA)
      V2=V(ITBX,KRC2)-(DXB*(V(ITBX,KRC2)-V(ITBX+1,KRC2))/AA)
      V3=V(ITBX,KRC3)-(DXB*(V(ITBX,KRC3)-V(ITBX+1,KRC3))/AA)
      V4=V(ITBX,KRC4)-(DXB*(V(ITBX,KRC4)-V(ITBX+1,KRC4))/AA)
      DXC=ABS(X(KNXC)-XCRX)
      DYC=ABS(ABS(YBTX-YCRX)-YSHIFT(IBCY))
      V(IB,JC)=V1+(DXC*(V2-V1)/AA)+(DYC*(V4-V1)/AA)+(DXC*DYC*(V1-V2+V3-V
     14)/(AA*AA))
      KNXD=IRXP(IRDX)
      KRD1=(IBDY-1)*NRX+IRDX
      KRD2=KRD1+1
      KRD3=KRD2+NRX
      KRD4=KRD1+NRX
      V1=V(ITBX,KRD1)-(DXB*(V(ITBX,KRD1)-V(ITBX+1,KRD1))/AA)
      V2=V(ITBX,KRD2)-(DXB*(V(ITBX,KRD2)-V(ITBX+1,KRD2))/AA)
      V3=V(ITBX,KRD3)-(DXB*(V(ITBX,KRD3)-V(ITBX+1,KRD3))/AA)
      V4=V(ITBX,KRD4)-(DXB*(V(ITBX,KRD4)-V(ITBX+1,KRD4))/AA)
      DXD=ABS(X(KNXD)-XDRX)
```

```
      DYD=ABS(ABS(YBTX-YCRX)-YSHIFT(IBCY))
      V(IB,JD)=V1+(CXD*(V2-V1)/AA)+(DYD*(V4-V1)/AA)+(DXD*DYD*(V1-V2+V3-V
     14)/(AA*AA))
  771 CONTINUE
C     PRINT 2333, IA,IE,JC,JD,V(IA,JC),V(IA,JC),V(IB,JC),V(IB,JD)
C2333 FORMAT (1X,*IA =*,I2,*IB=*,I2,*JC=*,I2,*JD=*,I2,*V(IA,JC)=*,F12.4,
C    1*V(IA,JD)=*,F12.4,*V(IB,JC)=*,F12.4,*V(IB,JD)=*,F12.4)
      TXA(I)=TXPOS(IA)
      TXB(I)=TXPOS(IB)
      RXP(I)=(RXPOS(JC)+RXPOS(JD))/2.0
      APRES1(I)=ABS((V(IB,JC)+V(IA,JD)-V(IA,JC)-V(IB,JC))*GEOMFD(NSEP))*
     1CRFD(NSEP)
      APRES2(I)=ABS((V(IE,JC)-V(IB,JD))*GEOMFP(NSEP))*CRFP(NSEP)
      IF(IPKEY)11,10,11
   11 APIP1(I,NSEP)=((APRDC1(I,NSEP)-APRES1(I))/APRES1(I))*100.0
      APMCFD(I,NSEP)=APIP1(I,NSEP)*1000.0/APRDC1(I,NSEP)
      APIP2(I,NSEP)=((APRDC2(I,NSEP)-APRES2(I))/APRES2(I))*100.0
      APMCFP(I,NSEP)=APIP2(I,NSEP)*1000.0/APRDC2(I,NSEP)
      GO TO 15
   10 APRDC1(I,NSEP)=APRES1(I)
      APRDC2(I,NSEP)=APRES2(I)
   15 CONTINUE
      IF(IPRINT .EQ. 0) GO TO 991
      PRINT 170, (TITLE(I),I=1,3)
  170 FORMAT (1H1,//////,55X,*CASE*,1X,3A4,///,50X,*DIPOLE-DIPOLE CONFIG
     1URATION OF ELECTRODES*,//)
      PRINT 171, THETA,NSEP
  171 FORMAT (/20X,*THE PROFILE LINE IS INCLINED TO THE STRIKE (+Y DIR)
     1AT  *,F10.3,*DEGREES*,/,50X,*DIPOLE-SEPARATION=*,I5,//)
      PRINT 172, ((TXA(I),TXB(I),RXP(I),APRDC1(I,NSEP),APIP1(I,NSEP
     1),APMCFD(I,NSEP)),I=1,N1)
  172 FORMAT (1X,*CURRENT ELECTRODES AT*,1X, F7.2,1X,*AND*,1X,F7.2,
     12X,*CENTER OF RECEIVER=*,F7.2,1X,*APP. RES. =*,F8.2,2X,*APP. P.F.E
     1.=*,F7.3,2X,*APP. MCF =*,F8.2)
      PRINT 173, (TITLE(I),I=1,3)
  173 FORMAT (1H1,//////,55X,*CASE*,1X,3A4,///,50X,*POLE-DIPOLE CONFIGUR
     1ATION OF ELECTRODES*,//)
      PRINT 171, THETA,NSEP
      PRINT 174, ((TXB(I),RXP(I),APRDC2(I,NSEP),APIP2(I,NSEP),
     1APMCFP(I,NSEP)),I=1,N1)
  174 FORMAT (2X,*CURRENT ELECTRODE AT =*,1X,F7.2,3X,*CENTER OF RECEIVER
     1 =*,F7.2,3X,*APP. RES. =*,F9.2,2X,*APP. P.F.E.=*,F7.3,2X,*APP. MCF
     1=*,F9.3)
  991 CONTINUE
      IF (OPTPUN .EQ. 0) GO TO 998
      PUNCH 180, (RXP(I),I=1,N1)
      PUNCH 181, (APRDC1(I,NSEP),I=1,N1)
C     PUNCH 182, (APRDC2(I,NSEP),I=1,N1)
  180 FORMAT (8F10.4)
  181 FORMAT (8F10.4)
  182 FORMAT (8F10.4)
  998 CONTINUE
   16 CONTINUE
      IF(IPRINT .EQ. 1) GO TO 9915
      PRINT 200,(TITLE(I),I=1,3)
  200 FORMAT (1H1,55X,*CASE*,1X,3A4,  /,50X,*DIPOLE-DIPOLE CONFIGURATION
     1 OF ELECTRODES*)
      PRINT 221
  221 FORMAT(   50X,*PSEUDO-SECTION OF THE APPARENT RESISTIVITY*)
      PRINT 205, THETA
  205 FORMAT (   45X,*THE PROFILE LINE IS INCLINED TO THE STRIKE ( +Y DI
     1R ) AT *,F4.1,* DEGREES*)
```

```
      PRINT 210
210   FORMAT (//,4X,*-11         -10         -9         -8         -7         -
     16         -5         -4         -3         -2         -1         0*)
      PRINT 220
220   FORMAT (5X,*X....X....X....X....X....X....X....X....X....X....X...
     1.X....X....X....X....X....X....X....X....X....X....X....X*)
      PRINT 231, (APRDC1(I, 1),I=1,11)
      PRINT 232, (APRDC1(I, 2),I=1,11)
      PRINT 233, (APRDC1(I, 3),I=1,10)
      PRINT 234, (APRDC1(I, 4),I=1,10)
      PRINT 235, (APRDC1(I, 5),I=1, 9)
      PRINT 236, (APRDC1(I, 6),I=1, 9)
      PRINT 237, (APRDC1(I, 7),I=1, 8)
      PRINT 238, (APRDC1(I, 8),I=1, 8)
      PRINT 239, (APRDC1(I, 9),I=1, 7)
      PRINT 240, (APRDC1(I,10),I=1, 7)
      PRINT 241, (APRDC1(I,11),I=1,6)
      PRINT 242, (APRDC1(I,12),I=1,6)
      PRINT 243, (APRDC1(I,13),I=1,5)
      PRINT 244, (APRDC1(I,14),I=1,5)
      PRINT 245, (APRDC1(I,15),I=1,4)
231   FORMAT (/////,4X,*1*,11(F7.1,3X))
232   FORMAT ( //,3X,* 2*, 5X,11(F7.1,3X))
233   FORMAT ( //,3X,* 3*,10X,10(F7.1,3X))
234   FORMAT ( //,3X,* 4*,15X,10(F7.1,3X))
235   FORMAT ( //,3X,* 5*,20X, 9(F7.1,3X))
236   FORMAT ( //,3X,* 6*,25X, 9(F7.1,3X))
237   FORMAT ( //,3X,* 7*,30X, 8(F7.1,3X))
238   FORMAT ( //,3X,* 8*,35X, 8(F7.1,3X))
239   FORMAT ( //,3X,* 9*,40X, 7(F7.1,3X))
240   FORMAT ( //,3X,*10*,45X, 7(F7.1,3X))
241   FORMAT(//,3X,*11*,50X,6(F7.1,3X))
242   FORMAT(//,3X,*12*,55X,6(F7.1,3X))
243   FORMAT(//,3X,*13*,60X,5(F7.1,3X))
244   FORMAT(//,3X,*14*,65X,5(F7.1,3X))
245   FORMAT(//,3X,*15*,70X,4(F7.1,3X))
      PRINT 264
264   FORMAT(1H1)
      PRINT 260
260   FORMAT(         /////,9X,*(         1         2         3         4
     1         5         6         7         8         9         10
     1 11*)
      PRINT 270
270   FORMAT (5X,*X....X....X....X....X....X....X....X....X....X....X...
     1.X....X....X....X....X....X....X....X....X....X....X....X*)
      PRINT 281, (APRDC1(I, 1),I=12,22)
      PRINT 282, (APRDC1(I, 2),I=11,21)
      PRINT 283, (APRDC1(I, 3),I=11,20)
      PRINT 284, (APRDC1(I, 4),I=10,19)
      PRINT 285, (APRDC1(I, 5),I=10,18)
      PRINT 286, (APRDC1(I, 6),I= 9,17)
      PRINT 287, (APRDC1(I, 7),I= 9,16)
      PRINT 288, (APRDC1(I, 8),I= 8,15)
      PRINT 289, (APRDC1(I, 9),I= 8,14)
      PRINT 290, (APRDC1(I,10),I= 7,13)
      PRINT 291, (APRDC1(I,11),I=7,12)
      PRINT 292, (APRDC1(I,12),I=6,11)
      PRINT 293, (APRDC1(I,13),I=6,10)
      PRINT 294, (APRDC1(I,14),I=5,9)
      PRINT 295, (APRDC1(I,15),I=5,8)
281   FORMAT (/////,10X,11(F7.1,3X),*1*)
282   FORMAT ( //, 5X,11(F7.1,3X), 5X,*2*)
```

```
283 FORMAT ( //,10X,10(F7.1,3X),10X,*3*)
284 FORMAT ( //, 5X,10(F7.1,3X),15X,*4*)
285 FORMAT ( //,10X, 9(F7.1,3X),20X,*5*)
286 FORMAT ( //, 5X, 9(F7.1,3X),25X,*6*)
287 FORMAT ( //,10X, 8(F7.1,3X),30X,*7*)
288 FORMAT ( //, 5X, 8(F7.1,3X),35X,*8*)
289 FORMAT ( //,10X, 7(F7.1,3X),40X,*9*)
290 FORMAT ( //, 5X, 7(F7.1,3X),45X,*10*)
291 FORMAT(//,10X,6(F7.1,3X),50X,*11*)
292 FORMAT(//, 5X,6(F7.1,3X),55X,*12*)
293 FORMAT(//,10X,5(F7.1,3X),60X,*13*)
294 FORMAT(//, 5X,5(F7.1,3X),65X,*14*)
295 FORMAT(//,10X,4(F7.1,3X),70X,*15*)
    IF(IPKEY .EQ. 0) RETURN
    PRINT 200, (TITLE(I),I=1,3)
    PRINT 222
222 FORMAT(   50X,*PSEUDO-SECTION OF THE PERCENT FREQUENCY EFFECT*)
    PRINT 205, THETA
    PRINT 210
    PRINT 220
    PRINT 331, (APIP1(I,1),I=1,11)
    PRINT 332, (APIP1(I,2),I=1,11)
    PRINT 333, (APIP1(I,3),I=1,10)
    PRINT 334, (APIP1(I,4),I=1,10)
    PRINT 335, (APIP1(I,5),I=1,9)
    PRINT 336, (APIP1(I,6),I=1,9)
    PRINT 337, (APIP1(I,7),I=1,8)
    PRINT 338, (APIP1(I,8),I=1,8)
    PRINT 339, (APIP1(I,9),I=1,7)
    PRINT 340, (APIP1(I,10),I=1,7)
    PRINT 341, (APIP1(I,11),I=1,6)
    PRINT 342, (APIP1(I,12),I=1,6)
    PRINT 343, (APIP1(I,13),I=1,5)
    PRINT 344, (APIP1(I,14),I=1,5)
    PRINT 345, (APIP1(I,15),I=1,4)
331 FORMAT (/////,4X,*1*,11(F7.1,3X))
332 FORMAT ( //,3X,* 2*, 5X,11(F7.1,3X))
333 FORMAT ( //,3X,* 3*,10X,10(F7.1,3X))
334 FORMAT ( //,3X,* 4*,15X,10(F7.1,3X))
335 FORMAT ( //,3X,* 5*,20X, 9(F7.1,3X))
336 FORMAT ( //,3X,* 6*,25X, 9(F7.1,3X))
337 FORMAT ( //,3X,* 7*,30X, 8(F7.1,3X))
338 FORMAT ( //,3X,* 8*,35X, 8(F7.1,3X))
339 FORMAT ( //,3X,* 9*,40X, 7(F7.1,3X))
340 FORMAT ( //,3X,*10*,45X, 7(F7.1,3X))
341 FORMAT(//,3X,*11*,50X,6(F7.1,3X))
342 FORMAT(//,3X,*12*,55X,6(F7.1,3X))
343 FORMAT(//,3X,*13*,60X,5(F7.1,3X))
344 FORMAT(//,3X,*14*,65X,5(F7.1,3X))
345 FORMAT(//,3X,*15*,70X,4(F7.1,3X))
    PRINT 264
    PRINT 260
    PRINT 270
    PRINT 381,(APIP1(I,1),I=12,22)
    PRINT 382,(APIP1(I,2),I=11,21)
    PRINT 383,(APIP1(I,3),I=11,20)
    PRINT 384,(APIP1(I,4),I=10,19)
    PRINT 385,(APIP1(I,5),I=10,18)
    PRINT 386,(APIP1(I,6),I=9,17)
    PRINT 387,(APIP1(I,7),I=9,16)
    PRINT 388,(APIP1(I,8),I=8,15)
    PRINT 389,(APIP1(I,9),I=8,14)
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      PRINT 390,(APIP1(I,10),I=7,13)
      PRINT 391, (APIP1(I,11),I=7,12)
      PRINT 392, (APIP1(I,12),I=6,11)
      PRINT 393, (APIP1(I,13),I=6,10)
      PRINT 394, (APIP1(I,14),I=5,9)
      PRINT 395, (APIP1(I,15),I=5,8)
  381 FORMAT (/////,10X,11(F7.1,3X),*1*)
  382 FORMAT ( //, 5X,11(F7.1,3X), 5X,*2*)
  383 FORMAT ( //,10X,10(F7.1,3X),10X,*3*)
  384 FORMAT ( //, 5X,10(F7.1,3X),15X,*4*)
  385 FORMAT ( //,10X, 9(F7.1,3X),20X,*5*)
  386 FORMAT ( //, 5X, 9(F7.1,3X),25X,*6*)
  387 FORMAT ( //,10X, 8(F7.1,3X),30X,*7*)
  388 FORMAT ( //, 5X, 8(F7.1,3X),35X,*8*)
  389 FORMAT ( //,10X, 7(F7.1,3X),40X,*9*)
  390 FORMAT ( //, 5X, 7(F7.1,3X),45X,*10*)
  391 FORMAT(//,10X,6(F7.1,3X),50X,*11*)
  392 FORMAT(//, 5X,6(F7.1,3X),55X,*12*)
  393 FORMAT(//,10X,5(F7.1,3X),60X,*13*)
  394 FORMAT(//, 5X,5(F7.1,3X),65X,*14*)
  395 FORMAT(//,10X,4(F7.1,3X),70X,*15*)
 9915 CONTINUE
      RETURN
      END
      SUBROUTINE RECON2D(X,Z,NTXTOT,NRXTOT,NTX,NRX,ITXP,IRXP,
     1NYSFT,YSHIFT,TITLE,V,NNODX,NNODZ)
C      $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
C
C.......    AUTHOR....  ABHIJIT DEY
C.....    PURPOSE.......
C          TO PRODUCE A TWO-DIMENSIONAL RESISTIVITY MAP ON THE X-Y SURFACE
C      ABOVE AN ARBITRARY 2-D INHOMOGENEITY. AT EACH OBSERVATION POINT,
C      TWO SMALL ORTHOGONAL RECEIVER DIPOLES EACH ORIENTED AT 45 DEGREES
C      TO THE X-AXIS , OR IN THE X- AND Y-DIRECTION, RESPECTIVELY, ARE
C      USED. TOTAL APPARENT RESISTIVITY MAPS ARE PRODUCED USING MODIFIED
C      KELLERS*S PARAMETERS, AS WELL AS IN THE DIRECTION OF THE VECTOR
C      E-FIELD OBSERVED ON THE SURFACE.
C        PROGRAM PARAMETERS....
C      FOR INCLINED DIPCLE TX.. NRLIM= LIMIT IN +Y AND -Y DIRECTION
C                                NYSFT  .GT. NRLIM ALSO .GT. ISHIFT
C                                NYSFT =ISHIFT+NRLIM-1
C........
C          SPECIAL NOTE....
C          IN THIS SUBROUTINE THE APPARENT CONDUCTANCE PARAMETER (CONKEL)
C       IS SCALED BY THE NORMALISING DISTANCE UNIT . THUS, IF UNIT= 1 KM,
C     ACTUAL CONKEL IS EQUAL TO CONKEL*1000.0 ( IN MHOS ).
C.............
C      $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
C      LARGE TOTRES(50,30),TOTCON(50,30)
      DIMENSION X(1),Z(1),TITLE(1),YSHIFT(1),IRXP(1),ITXP(1)
      DIMENSION V(NTXTOT,NRXTOT)
      DIMENSION RESKEL(50),CONKEL(50),RXP(50),THETA(50),APREST(50),
     1APRESX(50),APRESY(50),APRESP(50),CRFX(50),YSHIFTX(50),APRES1(50),
     1APRES2(50),GMFX(50),GMFY(50),GMFP(50),GMF1(50),GMF2(50)
      DIMENSION CRF1(50),CRF2(50)
      COMMON /PACK1/ INCLINE,ISHIFT,NRLIM
      DO 1333 III=1,50
      CRF1(III)=0.96
      CRF2(III)=0.96
 1333 CRFX(III)=0.96
      PI=3.141592654
C     XCENTR=(X(1)+X(95))/2.0
```

```
      XCENTR=(X(1)+X(NNODX))/2.0
      NTXX=NTX-1
      DO 100 ITX=1,NTXX
      IA=ITX
      IB=ITX+1
      NIA=ITXP(IA)
      NIB=ITXP(IB)
      TXA=X(NIA)-XCENTR
      TXB=X(NIB)-XCENTR
      CRF=1.00
      IF ( INCLINE .NE. 0) GO TO 500
      NRL=NRLIM
      ILX=0
      DO 200 I=1,NRL,2
C     DO 200 I=1,NRL
      ILX=ILX+1
      RYY=YSHIFT(I)
      YSHIFTX(ILX)=RYY
      RYYD2=RYY+YSHIFT(2)
      NRP=NRX-2
      JRX=0
C     DO 300 J=1,NRP
      DO 300 J=2,NRP,2
      JC=J+1
      JD1=JC+1
      JD2=JC-1
      JE1=JD1
      JE2=JC
      JCC=JC+(I-1)*NRX
      JDD1=JCC+NRX+1
      JDD2=JCC+NRX-1
      JEE1=JCC+1
      JEE2=JDD1-1
      NJC=IRXP(JC)
      NJD1=IRXP(JD1)
      NJD2=IRXP(JD2)
C     RXL=ABS(X(NJC)-X(NJD1))*1.4142
      RXL=ABS(X(NJC)-X(NJD1))
      TXLONG=ABS(X(NIB)-X(NIA))
C.....        CALCULATE THE RELEVANT DISTANCES
      AC=X(NJC)-X(NIA)
      BC=X(NJC)-X(NIB)
      IF((AC+BC) .EQ. 0.0) GO TO 300
      IF( ABS(AC) .LT. 1.10 .OR. ABS(BC) .LT. 1.10) GO TO 300
      JRX=JRX+1
      RXP(JRX)=X(NJC)-XCENTR
      AE1=X(NJD1)-X(NIA)
      BE1=X(NJD1)-X(NIB)
      AD2=X(NJD2)-X(NIA)
      BD2=X(NJD2)-X(NIB)
      AE2=AC
      BE2=BC
      RAC=SQRT(AC*AC+RYY*RYY)
      RBC=SQRT(BC*BC+RYY*RYY)
      RAC3=1.0/RAC
      RBC3=1.0/RBC
      RAE1=1.0/SQRT(AE1*AE1+RYY*RYY)
      RBE1=1.0/SQRT(BE1*BE1+RYY*RYY)
      RAE2=1.0/SQRT(AE2*AE2+RYYD2*RYYD2)
      RBE2=1.0/SQRT(BE2*BE2+RYYD2*RYYD2)
      RAD1=1.0/SQRT(AE1*AE1+RYYD2*RYYD2)
      RBD1=1.0/SQRT(BE1*BE1+RYYD2*RYYD2)
```

```
      RAD2=1.0/SQRT(AD2*AD2+RYYD2*RYYD2)
      RBD2=1.0/SQRT(BD2*BD2+RYYD2*RYYD2)
C......      EVALUATE THE POTENTIAL DIFFERENCES OBSERVED AT THE TWO
C     ORTHOGONAL RECEIVER DIPOLES.
      DELV1=(V(IA,JCC)-V(IB,JCC)-V(IA,JDD1)+V(IB,JDD1))
      DELV2=(V(IA,JCC)-V(IB,JCC)-V(IA,JDD2)+V(IB,JDD2))
      DELVX=(V(IA,JCC)-V(IB,JCC)-V(IA,JEE1)+V(IB,JEE1))
      DELVY=(V(IA,JCC)-V(IB,JCC)-V(IA,JEE2)+V(IB,JEE2))
      DELVP=(V(IA,JCC)-V(IB,JCC))
C     PRINT 777, IA,IB,JCC,JDD1,JDD2,V(IA,JCC),V(IB,JDD1),DELV1,DELV2
C 777 FORMAT (2X,*IA=*,I3,*IB=*,I3,*JCC=*,I3,*JDD1=*,I3,*JDD2=*,I3,
C    1*V(IA,JCC)=*,F12.3,*V(IB,JDD1)=*,F12.3,1X,*DELV1=*,F12.5,2X,
C    1*DELV2=*,F12.5)
      DELVX=DELVX*CRF1(JRX)
      DELVY=DELVY*CRF2(JRX)
      E1=DELVX/RXL
      E2=DELVY/RXL
      ETOT=SQRT(E1*E1+E2*E2)
      COSDEL=(RBC*RBC+RAC*RAC-TXLONG*TXLONG)/(2.0*RAC*RBC)
      DELTA=ACOS(COSDEL)
C.......      EVALUATE RESISTIVITY PARAMETERS A LA KELLER
      DENOM1=RAC3-RBC3-RAD1+RBD1
      DENOM2=RAC3-RBC3-RAD2+RBD2
      DENOMX=RAC3-RBC3-RAE1+RBE1
      DENOMY=RAC3-RBC3-RAE2+RBE2
      DENOM=SQRT(1.0+((RAC*RAC*RAC*RAC)/(RBC*RBC*RBC*RBC))-2.0*(RAC*RAC/
     1(RBC*RBC))*COS(DELTA))
C     RESKEL(JRX)=ETOT*RAC*RAC*CRF/DENOM
      DNUM=SQRT(1.0+(RAC*RAC/(RBC*RBC))-2.0*(RAC/RBC)*COS(DELTA))
C     CONKEL(JRX)=DNUM/(ETOT*RAC)
      VTOT=SQRT(DELVX*DELVX+DELVY*DELVY)
      RESKEL(JRX)=VTOT/(SQRT(DENOMX*DENOMX+DENOMY*DENOMY))
      DNUMA=ALOG(RAC3)-ALOG(RBC3)-ALOG(RAE1)+ALOG(RBE1)
      DNUMB=ALOG(RAC3)-ALOG(RBC3)-ALOG(RAE2)+ALOG(RBE2)
      DNUMX=SQRT(DNUMA*DNUMA+DNUMB*DNUMB)
      CONKEL(JRX)=DNUMX/VTOT
C.....    EVALUATE THE TOTAL APPARENT RESISTIVITY IN THE VECTOR E-FIELD
C     DIRECTION AT EACH OBSERVATION POINT.
      IF( DENOM1  .EQ. 0.00) GMF1(JRX)=0.00
      IF( DENOM1 .NE. 0.0) GMF1(JRX)=1.0/DENOM1
      IF( DENOM2 .EQ. 0.00) GMF2(JRX)=0.00
      IF ( DENOM2 .NE. 0.00) GMF2(JRX)=1.0/DENOM2
      IF( DENOMX .EQ. 0.00) GMFX(JRX)=0.00
      IF( DENOMX .NE. 0.00) GMFX(JRX)=1.00/DENOMX
      IF( DENOMY .EQ. 0.00) GMFY(JRX)=0.00
      IF( DENOMY .NE. 0.00) GMFY(JRX)=1.0/DENOMY
      IF( RAC3 .EQ. RBC3) GMFP(JRX)=0.00
      IF( RAC3 .NE. RBC3) GMFP(JRX)=1.0/(RAC3-RBC3)
      APRES1(JRX)=ABS(DELV1*GMF1(JRX))
      APRES2(JRX)=ABS(DELV2*GMF2(JRX))
      APRESX(JRX)=ABS(DELVX*GMFX(JRX))
      APRESY(JRX)=ABS(DELVY*GMFY(JRX))
      APRESP(JRX)=ABS(DELVP*GMFP(JRX))*CRFX(JRX)
      RXTL=RXL
      DELVT=ETOT*RXTL
C   ..    ANGLE OF THE FIELD LINES ARE CALCULATED ON THE BASIS OF
C     THE MEASURED EX AND EY OVER THE LENGTH OF THE ORTHOGONAL RECEIVER
      IF (E1 .EQ. 0.0) BETA=PI*0.50
      IF( E1 .NE. 0.0) BETA=ATAN2(E2,E1)
      DELX=RXTL*COS(BETA)
      DELY=RXTL*SIN(BETA)
      THETA1=BETA*57.296
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      RAD3=1.0/SQRT((AC+DELX)*(AC+DELX)+(RYY+DELY)*(RYY+DELY))
      RBD3=1.0/SQRT((BC+DELX)*(BC+DELX)+(RYY+DELY)*(RYY+DELY))
      GMF=1.0/(RAC3-RBC3-RAD3+RBD3)
      APREST(JRX)=ABS(GMF*DELVT)*CRF
C......     CALCULATE THE DEVIATION IN THE CURRENT LINES FROM THE
C     HOMOGENEOUS HALF SPACE SITUATION.
      HDELV1=RAC3-RBC3-RAE1+RBE1
      HDELV2=RAC3-RBC3-RAE2+RBE2
      IF(HDELV1 .EQ. 0.0) BETA=PI*0.50
      IF(HDELV1 .NE. 0.0) BETA=ATAN2(HDELV2,HDELV1)
      THETA2=BETA*57.296
      THETA(JRX)=THETA2-THETA1
      NJRX=JRX
  300 CONTINUE
      PRINT 310, (TITLE(I),I=1,3)
  310 FORMAT (1H1,///,55X,*CASE*,1X,3A4,//,40X,*TRANSMITTING DIPOLE IS P
     1ERPENDICULAR TO THE STRIKE OF THE INHOMOGENEITY*,/)
      PRINT 311, TXA,TXB,RXL
  311 FORMAT (/,30X,*CURRENT ELECTRODES ARE LOCATED AT  *,F12.4,2X,*AND*
     1F12.4,/,35X,*LENGTH OF THE RECEIVER DIPOLES ARE *,2X,F12.4)
      PRINT 312, RYY
  312 FORMAT (/,20X,*POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTE
     1D ON Y-AXIS BY *,F12.4,/)
      PRINT 1110
 1110 FORMAT(/,10X,*OBS.PT. *,5X,*GMFX*,5X,*APRES(X)*,5X,*GMFY*,5X,
     1*APRES(Y)*,5X,*GMFP*,5X,*APRESP*,5X,*RESKEL*,5X,*CONKEL*,5X,
     1*APREST*,5X,*THETA*,//)
      PRINT 314, ((RXP(JRX),GMFX(JRX),APRESX(JRX),GMFY(JRX),APRESY(JRX),
     1GMFP(JRX),APRESP(JRX),RESKEL(JRX),CONKEL(JRX),APREST(JRX),THETA(JR
     1X)),JRX=1,NJRX)
  314 FORMAT(7X,F8.2,4X,E10.3,2X,F8.2,2X,E10.3,2X,F8.2,2X,E10.3,2X,
     1F8.2,2X,F8.2,2X,F8.2,2X,F8.2,2X,F8.2)
      NRLX=ILX
  200 CONTINUE
      GO TO 1500
  500 CONTINUE
C....     INCLINE=1 FOR THE CASE WITH TX AT AN ACUTE ANGLE TO X-AXIS
C....     INCLINE=2 FOR THE CASE WITH TX AT AN OBTUSE ANGLE TO X-AXIS
      AYA=0.00
      AYB=0.00
      NRL=2*NRLIM-1
      RYT=YSHIFT(ISHIFT)
      TXLONG=SQRT((X(NIA)-X(NIB))*(X(NIA)-X(NIB))+RYT*RYT)
      ILX=0
C     DO 600 I=1,NRL
      DO 600 I=1,NRL,2
      ILX=ILX+1
      IF(I .LE. NRLIM) RYY=YSHIFT(I)
      IF(I .GT. NRLIM) RYY=-YSHIFT(I-NRLIM+1)
      YSHIFTX(ILX)=RYY
      RYYD2=RYY+YSHIFT(2)
      NRP=NRX-2
      JRX=0
C     DO 700 J=1,NRP
      DO 700 J=2,NRP,2
      JC=J+1
      JD1=JC+1
      JD2=JC-1
      NJC=IRXP(JC)
      NJD1=IRXP(JD1)
      NJD2=IRXP(JD2)
      AC=X(NJC)-X(NIA)
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      BC=X(NJC)-X(NIB)
      IF( ABS(AC) .LT. 1.10 .OR. ABS(BC) .LT. 1.10) GO TO 700
      IF(RYT .EQ. 0.0 .AND. (AC+BC) .EQ. 0.0) GO TO 700
      JRX=JRX+1
      AE1=X(NJD1)-X(NIA)
      IF( AE1 .EQ. 0.0) GO TO 700
      BE1=X(NJD1)-X(NIB)
      AD1=AE1
      BD1=BE1
      AE2=AC
      BE2=BC
      RXL=ABS(X(NJC)-X(NJD1))
      AD2=X(NJD2)-X(NIA)
      BD2=X(NJD2)-X(NIB)
      RXP(JRX)=X(NJC)-XCENTR
      IF ( I .LE. NRLIM) GO TO 710
      IF ( I .GT. NRLIM) GO TO 720
  710 NRY=IABS(ISHIFT-I)*NRX
      JCC=JC+(I-1)*NRX
      JDD1=JCC+NRX+1
      JDD2=JCC+NRX-1
      JEE1=JCC+1
      JEE2=JCC+NRX
      JCCX=JC+NRY
      JEE1X=JCCX+1
      IF(ISHIFT .LE. I) JDD1X=JC+NRY+NRX+1
      IF(ISHIFT .GT. I) JDD1X=JC+NRY-NRX+1
      JDD2X=JDD1X-2
      JEE2X=JDD1X-1
      IF(INCLINE .EQ. 1) GO TO 715
      IF(INCLINE .EQ. 2) GO TO 716
  715 RAC=SQRT(AC*AC+RYY*RYY)
      RBC=SQRT(BC*BC+(RYY-RYT)*(RYY-RYT))
      AYB=RYT
      RAE1=1.0/SQRT(AE1*AE1+RYY*RYY)
      RAD1=1.0/SQRT(AD1*AD1+RYY*RYY)
      RBE1=1.0/SQRT(BE1*BE1+(RYY-RYT)*(RYY-RYT))
      RBD1=1.0/SQRT(BD1*BD1+(RYY-RYT)*(RYY-RYT))
      RAE2=1.0/SQRT(AE2*AE2+RYYD2*RYYD2)
      RAD2=1.0/SQRT(AD2*AD2+RYYD2*RYYD2)
      RBE2=1.0/SQRT(BE2*BE2+(RYYD2-RYT)*(RYYD2-RYT))
      RBD2=1.0/SQRT(BD2*BD2+(RYYD2-RYT)*(RYYD2-RYT))
      DELV1=(V(IA,JCC)-V(IA,JDD1)-V(IB,JCCX)+V(IB,JDD1X))
      DELV2=(V(IA,JCC)-V(IA,JDD2)-V(IB,JCCX)+V(IB,JDD2X))
      DELVX=(V(IA,JCC)-V(IA,JEE1)-V(IB,JCCX)+V(IB,JEE1X))
      DELVY=(V(IA,JCC)-V(IA,JEE2)-V(IB,JCCX)+V(IB,JEE2X))
      DELVP=(V(IA,JCC)-V(IB,JCCX))
      RYTC=RYY-RYT
      GO TO 745
  716 RAC=SQRT(AC*AC+(RYY-RYT)*(RYY-RYT))
      RBC=SQRT(BC*BC+RYY*RYY)
      AYA=RYT
      RAE1=1.0/SQRT(AE1*AE1+(RYY-RYT)*(RYY-RYT))
      RAD1=1.0/SQRT(AD1*AD1+(RYY-RYT)*(RYY-RYT))
      RBE1=1.0/SQRT(BE1*BE1+RYY*RYY)
      RBD1=1.0/SQRT(BD1*BD1+RYY*RYY)
      RAE2=1.0/SQRT(AE2*AE2+(RYYD2-RYT)*(RYYD2-RYT))
      RAD2=1.0/SQRT(AD2*AD2+(RYYD2-RYT)*(RYYD2-RYT))
      RBE2=1.0/SQRT(BE2*BE2+RYYD2*RYYD2)
      RBD2=1.0/SQRT(BD2*BD2+RYYD2*RYYD2)
      DELV1=(V(IA,JCCX)-V(IA,JDD1X)-V(IB,JCC)+V(IB,JDD1))
      DELV2=(V(IA,JCCX)-V(IA,JDD2X)-V(IB,JCC)+V(IB,JDD2))
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      DELVX=(V(IA,JCCX)-V(IA,JEE1X)-V(IB,JCC)+V(IB,JEE1))
      DELVY=(V(IA,JCCX)-V(IA,JEE2X)-V(IB,JCC)+V(IB,JEE2))
      DELVP=(V(IA,JCCX)-V(IB,JCC))
      RYTC=RYY-RYT
      GO TO 745
  720 NRY=IABS(ISHIFT+I-NRLIM-1)*NRX
      JCC=JC+(I-NRLIM)*NRX
      JDD1=JCC-NRX+1
      JDD2=JCC-NRX-1
      JEE1=JCC+1
      JEE2=JCC-NRX
      JCCX=JC+NRY
      JDD1X=JCCX-NRX+1
      JDD2X=JDD1X-2
      JEE1X=JCCX+1
      JEE2X=JDD1X-1
      IF(INCLINE .EQ. 1) GO TO 725
      IF(INCLINE .EQ. 2) GO TO 726
  725 RAC=SQRT(AC*AC+RYY*RYY)
      RBC=SQRT(BC*BC+(RYY-RYT)*(RYY-RYT))
      RAE1=1.0/SQRT(AE1*AE1+RYY*RYY)
      RAD1=1.0/SQRT(AD1*AD1+RYY*RYY)
      RBE1=1.0/SQRT(BE1*BE1+(RYY-RYT)*(RYY-RYT))
      RBD1=1.0/SQRT(BD1*BD1+(RYY-RYT)*(RYY-RYT))
      RAE2=1.0/SQRT(AE2*AE2+RYYD2*RYYD2)
      RAD2=1.0/SQRT(AD2*AD2+RYYD2*RYYD2)
      RBE2=1.0/SQRT(BE2*BE2+(RYYD2-RYT)*(RYYD2-RYT))
      RBD2=1.0/SQRT(BD2*BD2+(RYYD2-RYT)*(RYYD2-RYT))
      DELV1=(V(IA,JCC)-V(IA,JDD1)-V(IB,JCCX)+V(IB,JDD1X))
      DELV2=(V(IA,JCC)-V(IA,JDD2)-V(IB,JCCX)+V(IB,JDD2X))
      DELVX=(V(IA,JCC)-V(IA,JEE1)-V(IB,JCCX)+V(IB,JEE1X))
      DELVY=(V(IA,JCC)-V(IA,JEE2)-V(IB,JCCX)+V(IB,JEE2X))
      DELVP=(V(IA,JCC)-V(IB,JCCX))
      GO TO 745
  726 RAC=SQRT(AC*AC+(RYY-RYT)*(RYY-RYT))
      RBC=SQRT(BC*BC+RYY*RYY)
      RAE1=1.0/SQRT(AE1*AE1+(RYY-RYT)*(RYY-RYT))
      RAD1=1.0/SQRT(AD1*AD1+(RYY-RYT)*(RYY-RYT))
      RBE1=1.0/SQRT(BE1*BE1+RYY*RYY)
      RBD1=1.0/SQRT(BD1*BD1+RYY*RYY)
      RAE2=1.0/SQRT(AE2*AE2+(RYYD2-RYT)*(RYYD2-RYT))
      RAD2=1.0/SQRT(AD2*AD2+(RYYD2-RYT)*(RYYD2-RYT))
      RBE2=1.0/SQRT(BE2*BE2+RYYD2*RYYD2)
      RBD2=1.0/SQRT(BD2*BD2+RYYD2*RYYD2)
      DELV1=(V(IA,JCCX)-V(IA,JDD1X)-V(IB,JCC)+V(IB,JDD1))
      DELV2=(V(IA,JCCX)-V(IA,JDD2X)-V(IB,JCC)+V(IB,JDD2))
      DELVX=(V(IA,JCCX)-V(IA,JEE1X)-V(IB,JCC)+V(IB,JEE1))
      DELVY=(V(IA,JCCX)-V(IA,JEE2X)-V(IB,JCC)+V(IB,JEE2))
      DELVP=(V(IA,JCCX)-V(IB,JCC))
  745 CONTINUE
      DELVX=DELVX*CRF1(JRX)
      DELVY=DELVY*CRF2(JRX)
      E1=DELVX/RXL
      E2=DELVY/RXL
      ETOT=SQRT(E1*E1+E2*E2)
C     PRINT 1440, IA,IB,JCC,JDD1,JDD2,JCCX,JDD1X,JDD2X,I,V(IA,JCC),
C    1V(IB,JDD2X),DELV1,DELV2
C1440 FORMAT (2X,*IA=*,I2,*IB=*,I2,*JCC=*,I3,*JDD1=*,I3,*JDD2=*,I3,*JCCX
C    1=*,I3,*JDD1X=*,I3,*JDD2X=*,I3,*I=*,I2,*V(IA,JCC)=*,F8.4,*V(IB,JD(2
C    1X)=*,F8.4,*DV1=*,F8.4,*DV2=*,F8.4)
C......      EVALUATE THE RESISTIVITY PARAMETERS A LA KELLER
      RAC3=1.0/RAC
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      RBC3=1.0/RBC
      DENOMX=RAC3-RBC3-RAE1+RBE1
      DENOM1=RAC3-RBC3-RAD1+RBD1
      DENOMY=RAC3-RBC3-RAE2+RBE2
      DENOM2=RAC3-RBC3-RAD2+RBD2
      COSDEL=(RBC*RBC+RAC*RAC-TXLONG*TXLONG)/(2.0*RAC*RBC)
      DELTA=ACOS(COSDEL)
      DENOM=SQRT(1.0+((RAC*RAC*RAC*RAC)/(RBC*RBC*RBC*RBC))-2.0*(RAC*RAC/
     1(RBC*RBC))*COS(DELTA))
C     RESKEL(JRX)=ETOT*RAC*RAC*CRF/DENOM
      DNUM=SQRT(1.0+(RAC/RBC)*(RAC/RBC)-2.0*(RAC/RBC)*COS(DELTA))
C     CONKEL(JRX)=DNUM/(ETOT*RAC)
      VTOT=SQRT(DELVX*DELVX+DELVY*DELVY)
      RESKEL(JRX)=VTOT/(SQRT(DENOMX*DENOMX+DENOMY*DENOMY))
      DNUMA=ALOG(RAC3)-ALOG(RBC3)-ALOG(RAE1)+ALOG(RBE1)
      DNUMB=ALOG(RAC3)-ALOG(RBC3)-ALOG(RAE2)+ALOG(RBE2)
      DNUMX=SQRT(DNUMA*DNUMA+DNUMB*DNUMB)
      CONKEL(JRX)=DNUMX/VTOT
      IF( DENOM1  .EQ. 0.00) GMF1(JRX)=0.00
      IF( DENOM1 .NE. 0.0) GMF1(JRX)=1.0/DENOM1
      IF( DENOM2 .EQ. 0.00) GMF2(JRX)=0.00
      IF ( DENOM2 .NE. 0.00) GMF2(JRX)=1.0/DENOM2
      IF( DENOMX .EQ. 0.00) GMFX(JRX)=0.00
      IF( DENOMX .NE. 0.00) GMFX(JRX)=1.0/DENOMX
      IF( DENOMY .EQ. 0.00) GMFY(JRX)=0.00
      IF( DENOMY .NE. 0.00) GMFY(JRX)=1.0/DENOMY
      IF( RAC3 .EQ. RBC3) GMFP(JRX)=0.00
      IF( RAC3 .NE. RBC3) GMFP(JRX)=1.0/(RAC3-RBC3)
C     PRINT 3139, RXP(JRX),YSHIFTX(I),GMFP,DELVP
C3139 FORMAT (10X,*RXP=*,F10.3,*YSHIFT=*,F10.3,*GMF=*,E12.4,*DELV=*,
C    1E14.5)
      APRES1(JRX)=ABS(DELV1*GMF1(JRX))
      APRES2(JRX)=ABS(DELV2*GMF2(JRX))
      APRESX(JRX)=ABS(DELVX*GMFX(JRX))
      APRESY(JRX)=ABS(DELVY*GMFY(JRX))
      APRESP(JRX)=ABS(DELVP*GMFP(JRX))*CRFX(JRX)
C....    EVALUATE THE TOTAL APPARENT RESISTIVITY IN THE VECTOR E-FIELD
C     DIRECTION
      RXTL=RXL
      DELVT=ETOT*RXTL
C.....   ANGLE OF THE FIELD LINES ARE CALCULATED ON THE BASIS OF
C     THE MEASURED EX AND EY OVER THE LENGTH OF THE ORTHOGONAL RECEIVER
C     DIPOLES .
      IF (E1 .EQ. 0.0) BETA=PI*0.50
      IF( E1 .NE. 0.0) BETA=ATAN2(E2,E1)
      DELX=RXTL*COS(BETA)
      DELY=RXTL*SIN(BETA)
      THETA1=BETA*57.296
      IF(INCLINE .EQ. 1) GO TO 810
      IF(INCLINE .EQ. 2) GO TO 820
  810 RAD3=1.0/SQRT((AC+DELX)*(AC+DELX)+(RYY+DELY)*(RYY+DELY))
      RBD3=1.0/SQRT((BC+DELX)*(BC+DELX)+(RYY-RYT+DELY)*(RYY-RYT+DELY))
      GO TO 845
  820 RAD3=1.0/SQRT((AC+DELX)*(AC+DELX)+(RYY-RYT+DELY)*(RYY-RYT+DELY))
      RBD3=1.0/SQRT((BC+DELX)*(BC+DELX)+(RYY+DELY)*(RYY+DELY))
  845 GMF=1.0/(RAC3-RBC3-RAD3+RBD3)
      APREST(JRX)=ABS(GMF*DELVT)*CRF
C..    CALCULATE THE DEVIATION OF THE CURRENT LINES FROM THE HOMOGENEOUS
C     HALF SPACE SITUATION .
      HDELV1=RAC3-RBC3-RAE1+RBE1
      HDELV2=RAC3-RBC3-RAE2+RBE2
      IF(HDELV1 .EQ. 0.0) BETA=PI*0.50
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      IF(HDELV1 .NE. 0.0) BETA=ATAN2(HDELV2,HDELV1)
      THETA2=BETA*57.296
      THETA(JRX)=THETA2-THETA1
      NJRX=JRX
C     TOTCON(JRX,ILX)=CONKEL(JRX)
C     TOTRES(JRX,ILX)=RESKEL(JRX)
  700 CONTINUE
      PRINT 910, (TITLE(I),I=1,3)
  910 FORMAT (1H1,///,50X,*CASE*,1X,3A4,//,35X,*TRANSMITTING DIPOLE IS I
     1NCLINED TO THE STRIKE OF THE INHOMOGENEITY*,/)
      PRINT 911, TXA,AYA,TXB,AYB,RXL
  911 FORMAT (//,25X,*CURRENT ELECTRODE POSITI(NS ARE AT X1=*,F10.2,2X,
     1*Y1=*,F10.2,2X,*AND AT X2=*,F10.2,2X,*Y2=*,F10.2,/,25X,*LENGTH CF
     1THE RECEIVER DIPOLES ARE *,F10.3,/)
      PRINT 912, RYY
  912 FORMAT (/,20X,*POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTE
     1D ON Y-AXIS BY *,F12.4,/)
      PRINT 1110
      PRINT 914, ((RXP(JRX),GMFX(JRX),APRESX(JRX),GMFY(JRX),APRESY(JRX),
     1GMFP(JRX),APRESP(JRX),RESKEL(JRX),CONKEL(JRX),APREST(JRX),THETA(JR
     1X)),JRX=1,NJRX)
  914 FORMAT(7X,F8.2,4X,E10.3,2X,F8.2,2X,E10.3,2X,F8.2,2X,E10.3,2X,
     1F8.2,2X,F8.2,2X,F8.2,2X,F8.2,2X,F8.2)
      NRLX=ILX
  600 CONTINUE
 1500 CONTINUE
      NJRXX=NJRX-1
C     DO 1444 J=2,NJRXX
C     DO 1444 I=1,NRL
C     IF(APRESP(J) .NE. 0.00) GO TO 1444
C     APRESP(J)=(APRESP(J-1)+APRESP(J+1))*0.50
C1444 CONTINUE
C     PUNCH 325, (TITLE(I),I=1,3)
  325 FORMAT(3A5)
C     PUNCH 321, (RXP(JRX),JRX=1,NJRX)
  321 FORMAT(8F10.3)
C     PUNCH 322, (YSHIFTX(ILX),ILX=1,NRLX)
  322 FORMAT(10F8.3)
C     PUNCH 323, ((TOTRES(JRX,ILX),JRX=1,NJRX),ILX=1,NRLX)
  323 FORMAT(8E10.3)
C     PUNCH 324, ((TOTCON(JRX,ILX),JRX=1,NJRX),ILX=1,NRLX)
  324 FORMAT(10F8.3)
  100 CONTINUE
      RETURN
      END
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C       ***********************************************************************
C
C         SMAPLE INPUT DATA CARDS FOR THE MODELS SIMULATED USING THE
C       COLLINEAR DIPOLE - DIPOLE CONFIGURATION .
C         THE SEQUENCE AND FORMAT OF THE INPUT PARAMETERS ARE AS INDICATED
C       IN THE LISTING OF THE MAIN PROGRAM RESIS2D. THE CHOICE OF YKY
C       ARRAY IS OPTIMISED FOR THE STANDARD 113 X 16 GRID USED.
C
C       ***********************************************************************
 113   16    5   28   85    1 1.00      1.00       4.00
1000 100  20    4    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    '    1    1    1    1    1    1    4   20 1001000
   1    1    1    1    2    2    2    2    2    2    4    4    8   64  512
 0.006     0.050     0.150     0.300     1.250
   1
   23     1    23     1     1
  9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97
 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97101105
 0.00
 0.00
 0.00
    1 MODEL A
 100.0    10.00
 1.00     25.00
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000011111111000000000000000000000000
00000000000000000000000011111111000000000000000000000000
00000000000000000000000011111111000000000000000000000000
00000000000000000000000011111111000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
    0     0 90.00
0
1
    0 MODEL B
 100.0    30.00    10.00
11111111111111111111111111111111111111111111111111111111
11111111111111111111111111111111111111111111111111111111
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000022222222000000000000000000000000
00000000000000000000000022222222000000000000000000000000
00000000000000000000000022222222000000000000000000000000
00000000000000000000000022222222000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000


00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
    0     0 90.00


    0 MODEL C
 10.00    200.0    50.0
00000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
11111111111111111111111111111111111111111111111111111111
11111111111111111111111111111111111111111111111111111111
11111111111111111111111111111111111111111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
22222222222222222222222222222222222211111111111111111111
    0     0 90.00
1
0
```

2-D MODEL SECTION MODEL A -- RESISTIVITY

```
     -7     -6     -5     -4     -3     -2     -1      0      1      2      3      4      5      6      7
Z=0 **************************************************************************************************************************************
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=1 00000000000000000000000000000000000000000000000000000000000*****************0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
Z=2 00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000*111111111111111*0000000000000000000000000000000000000000000000000000000000
Z=3 00000000000000000000000000000000000000000000000000000000000*****************0000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=4 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=5 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=6 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=7 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=8 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

INDEX FOR RESISTIVITY (OHM. M)

```
0 =   100.00     1 =   10.00     2 =   -0.00     3 =   -0.00     4 =   -0.00
5 =    -0.00     6 =   -0.00     7 =   -0.00     8 =   -0.00     9 =   -0.00
UNIT IN X SCALING =     1.00     UNIT IN Z SCALING =     1.00
```

CONFIGURATION DISTANCE UNIT = 4.000

CASE MODEL A
DIPOLE-DIPOLE CONFIGURATION OF ELECTRODES
PSEUDO-SECTION OF THE APPARENT RESISTIVITY
THE PROFILE LINE IS INCLINED TO THE STRIKE ( +Y DIR ) AT 90.0 DEGREES

| | -11 | | -10 | | -9 | | -8 | | -7 | | -6 | | -5 | | -4 | | -3 | | -2 | | -1 | | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 100.5 | | 100.2 | | 100.1 | | 100.1 | | 100.2 | | 100.3 | | 100.6 | | 101.6 | | 102.8 | | 94.5 | | 85.9 | | 65.9 | | 54.5 | | 102.8 | | 101.6 | | 100.6 | | 100.3 | | 100.2 | | 100.1 | | 100.1 | | 100.2 | | 100.5 | | 1 |
| 2 | | | 100.8 | | 100.2 | | 100.1 | | 100.2 | | 100.5 | | 101.3 | | 103.3 | | 105.3 | | 88.8 | | 67.0 | | 61.1 | | 67.0 | | 88.8 | | 105.3 | | 103.3 | | 101.3 | | 100.5 | | 100.2 | | 100.1 | | 100.2 | | 100.8 | | | 2 |
| 3 | | | | 101.6 | | 100.9 | | 100.9 | | 101.4 | | 102.7 | | 105.6 | | 107.5 | | 85.3 | | 58.7 | | 52.1 | | 52.1 | | 58.7 | | 83.3 | | 107.5 | | 105.6 | | 102.7 | | 101.4 | | 100.9 | | 100.9 | | 101.6 | | | | 3 |
| 4 | | | | | 102.1 | | 101.5 | | 102.0 | | 103.6 | | 107.1 | | 108.5 | | 82.4 | | 54.9 | | 52.0 | | 54.1 | | 52.0 | | 54.9 | | 82.4 | | 108.5 | | 107.1 | | 103.6 | | 102.0 | | 101.5 | | 102.1 | | | | | 4 |
| 5 | | | | | | 103.5 | | 103.5 | | 105.2 | | 109.1 | | 109.8 | | 80.7 | | 53.4 | | 54.5 | | 59.8 | | 59.8 | | 54.5 | | 53.4 | | 80.7 | | 109.8 | | 109.1 | | 105.2 | | 103.5 | | 103.5 | | | | | | 5 |
| 6 | | | | | | | 105.7 | | 107.1 | | 111.0 | | 110.9 | | 79.5 | | 52.7 | | 57.2 | | 64.9 | | 67.0 | | 64.9 | | 57.2 | | 52.7 | | 79.5 | | 110.9 | | 111.0 | | 107.1 | | 105.7 | | | | | | | 6 |
| 7 | | | | | | | | 109.5 | | 113.0 | | 111.9 | | 78.5 | | 52.4 | | 59.6 | | 69.1 | | 72.4 | | 72.4 | | 69.1 | | 55.6 | | 52.4 | | 78.5 | | 111.9 | | 113.0 | | 109.5 | | | | | | | | 7 |
| 8 | | | | | | | | | 115.5 | | 113.1 | | 77.8 | | 52.3 | | 61.7 | | 72.3 | | 76.4 | | 77.5 | | 76.4 | | 72.3 | | 61.7 | | 52.3 | | 77.8 | | 113.1 | | 115.5 | | | | | | | | | 8 |
| 9 | | | | | | | | | | 114.8 | | 77.4 | | 52.3 | | 63.5 | | 74.9 | | 79.3 | | 80.8 | | 80.8 | | 79.3 | | 74.9 | | 63.5 | | 52.3 | | 77.4 | | 114.8 | | | | | | | | | | 9 |
| 10 | | | | | | | | | | | 77.7 | | 52.6 | | 65.1 | | 77.0 | | 81.5 | | 83.2 | | 83.7 | | 83.2 | | 81.5 | | 77.0 | | 65.1 | | 52.6 | | 77.7 | | | | | | | | | | | 10 |
| 11 | | | | | | | | | | | | 53.2 | | 66.8 | | 78.8 | | 83.2 | | 85.0 | | 85.6 | | 85.6 | | 85.0 | | 83.2 | | 78.8 | | 66.8 | | 53.2 | | | | | | | | | | | | 11 |
| 12 | | | | | | | | | | | | | 69.0 | | 81.1 | | 85.3 | | 86.9 | | 87.6 | | 87.7 | | 87.6 | | 86.9 | | 85.3 | | 81.1 | | 69.0 | | | | | | | | | | | | | 12 |
| 13 | | | | | | | | | | | | | | 83.5 | | 87.2 | | 88.5 | | 89.0 | | 89.2 | | 89.2 | | 89.0 | | 88.5 | | 87.2 | | 83.5 | | | | | | | | | | | | | | 13 |
| 14 | | | | | | | | | | | | | | | 89.1 | | 89.9 | | 90.1 | | 90.1 | | 90.1 | | 90.1 | | 90.1 | | 89.9 | | 89.1 | | | | | | | | | | | | | | | 14 |
| 15 | | | | | | | | | | | | | | | | 91.6 | | 91.3 | | 91.0 | | 90.9 | | 90.9 | | 91.0 | | 91.3 | | 91.6 | | | | | | | | | | | | | | | | 15 |

2-D MODEL SECTION  MODEL A  -- P.F.E.

```
     -7        -6        -5        -4        -3        -2        -1         0         1         2         3         4         5         6         7
Z=0  ***************************************************************************************************************************************
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=1  00000000000000000000000000000000000000000000000000000000000*****************00000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
Z=2  00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000*111111111111111*00000000000000000000000000000000000000000000000000000000000
Z=3  00000000000000000000000000000000000000000000000000000000000*****************00000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=4  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=5  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=6  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=7  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=8  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

INDEX FOR PERCENT FREQUENCY EFFECT

```
0 =    1.00     1 =    25.00     2 =    -0.00     3 =    -0.00     4 =    -0.00
5 =   -0.00     6 =    -0.00     7 =    -0.00     8 =    -0.00     9 =    -0.00
UNIT IN X SCALING =    1.00     UNIT IN Z SCALING =    1.00
```

CONFIGURATION DISTANCE UNIT =    4.000

CASE MODEL A
DIPOLE-DIPOLE CONFIGURATION OF ELECTRODES
PSEUDO-SECTION OF THE PERCENT FREQUENCY EFFECT
THE PROFILE LINE IS INCLINED TO THE STRIKE ( +Y DIP ) AT 90.0 DEGREES

| | -11 | | -10 | | -9 | | -8 | | -7 | | -6 | | -5 | | -4 | | -3 | | -2 | | -1 | | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | .9 | | .8 | | 1.4 | | 1.8 | | 1.8 | | 1.4 | | .8 | | .9 | | 1.0 | | 1.C | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1 |
| 2 | | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | .9 | | .9 | | .7 | | .6 | | 1.7 | | 3.7 | | 4.4 | | 3.7 | | 1.7 | | .6 | | .7 | | .9 | | .9 | | 1.C | | 1.0 | | 1.0 | | 1.0 | | | 2 |
| 3 | | | | 1.0 | | 1.0 | | .9 | | .9 | | .8 | | .5 | | .4 | | 1.8 | | 5.0 | | 7.2 | | 7.2 | | 5.0 | | 1.8 | | .4 | | .5 | | .8 | | .9 | | .9 | | 1.0 | | 1.0 | | | | 3 |
| 4 | | | | | .9 | | .9 | | .8 | | .7 | | .4 | | .2 | | 1.9 | | 5.6 | | 8.0 | | 8.6 | | 8.C | | 5.6 | | 1.9 | | .2 | | .4 | | .7 | | .8 | | .9 | | .9 | | | | | 4 |
| 5 | | | | | | .9 | | .8 | | .6 | | .2 | | .0 | | 1.9 | | 6.0 | | 8.0 | | 8.3 | | 8.3 | | 8.0 | | 6.0 | | 1.9 | | .0 | | .2 | | .6 | | .8 | | .9 | | | | | | 5 |
| 6 | | | | | | | .7 | | .5 | | .1 | | -.1 | | 1.8 | | 6.1 | | 7.7 | | 7.7 | | 7.7 | | 7.7 | | 7.7 | | 6.1 | | 1.8 | | -.1 | | .1 | | .5 | | .7 | | | | | | | 6 |
| 7 | | | | | | | | .4 | | -.0 | | -.3 | | 1.8 | | 6.2 | | 7.4 | | 7.2 | | 7.1 | | 7.1 | | 7.2 | | 7.4 | | 6.2 | | 1.8 | | -.3 | | -.0 | | .4 | | | | | | | | 7 |
| 8 | | | | | | | | | -.1 | | -.4 | | 1.7 | | 6.2 | | 7.1 | | 6.8 | | 6.6 | | 6.5 | | 6.6 | | 6.8 | | 7.1 | | 6.2 | | 1.7 | | -.4 | | -.1 | | | | | | | | | 8 |
| 9 | | | | | | | | | | -.6 | | 1.6 | | 6.2 | | 6.8 | | 6.4 | | 6.2 | | 6.1 | | 6.1 | | 6.2 | | 6.4 | | 6.8 | | 6.2 | | 1.6 | | -.6 | | | | | | | | | | 9 |
| 10 | | | | | | | | | | | 1.5 | | 6.1 | | 6.5 | | 6.1 | | 5.9 | | 5.7 | | 5.7 | | 5.7 | | 5.9 | | 6.1 | | 6.5 | | 6.1 | | 1.5 | | | | | | | | | | | 10 |
| 11 | | | | | | | | | | | | 6.1 | | 6.3 | | 5.8 | | 5.6 | | 5.4 | | 5.4 | | 5.4 | | 5.4 | | 5.6 | | 5.8 | | 6.3 | | 6.1 | | | | | | | | | | | | 11 |
| 12 | | | | | | | | | | | | | 6.1 | | 5.6 | | 5.3 | | 5.2 | | 5.1 | | 5.1 | | 5.1 | | 5.2 | | 5.3 | | 5.6 | | 6.1 | | | | | | | | | | | | | 12 |
| 13 | | | | | | | | | | | | | | 5.4 | | 5.1 | | 5.0 | | 4.8 | | 4.8 | | 4.8 | | 4.8 | | 5.0 | | 5.1 | | 5.4 | | | | | | | | | | | | | | 13 |
| 14 | | | | | | | | | | | | | | | 4.9 | | 4.8 | | 4.6 | | 4.6 | | 4.6 | | 4.6 | | 4.6 | | 4.6 | | 4.9 | | | | | | | | | | | | | | | 14 |
| 15 | | | | | | | | | | | | | | | | 4.6 | | 4.5 | | 4.4 | | 4.3 | | 4.3 | | 4.4 | | 4.5 | | 4.6 | | | | | | | | | | | | | | | | 15 |

```
                        2-D MODEL SECTICN  MCDEL B    -- RESISTIVITY
     -7        -6        -5        -4        -3        -2        -1         0         1         2         3         4         5         6         7
Z=0  *************************************************************************************************************************************************
     111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
     *************************************************************************************************************************************************
     00000000000000000000000CCC0000000000000000000CCCCCCC0C0C000000000000000000000000000000000000000000000000000000000000000000000000000000000000C
Z=1  00C00000000000000000000000000000000000000000000000000CC000C0*********************000000000000000000000000000000000000000000000000000000000000
     000000000000000C00000CCCCCCCCC0000000C0000000000000000000000*2222222222222222222*00000000000000000000000000000000000000000000000C000000CC0C00
     0000000000000000000000C000CCCCC0000000C000000CCC0C0000000000*2222222222222222222*000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000*2222222222222222222*000000000000000000000000000000000000000000000000000000000000
Z=2  000CCCC0000000CCCC000C00CCCCCC000000000000000000000000000000*2222222222222222222*0000000000000000000000000000000000000000000000000000C0C0CCCC
     000000000000000000000000CCCCC00000000000000000000CCC00000000*2222222222222222222*00000000000000000000000000000000000000000000000000000000000C
     000000000000000000000000000000000000000000000000000000000000*2222222222222222222*0CCCCC00000000000000000C00C000000000000000000000000000000000
     0000000C0000CCCCCCCC0CCCCC0CCC000000000000000000000000000000*2222222222222222222*000000000000000000000000000000000000000000000C00CCCCCC000000
Z=3  0000000000000000000000CC0CC000000000000000000000000000C00000*********************000000000000000000000000000000000000000000000000000000000000
     C00CC00CC0C0000CCCC00C000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000C0000C00000
     0000000C00000C000CCCCCCCC0000C00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000C0CCCCCCCC
     0000000000000000000000000000000000000000000000000000000CCC0CCC0C000000C000000000000000000000000000000000000000000000000000000000000000000000
Z=4  000CCC0C00CCCCCCCC0000000CCCCC0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000C000000
     00000000000000000000000CCCCC0000000000000000000000CCCCCC00000000000000000000000000000000000000000000000000000000000000000000000000000C0000000
     00000000000000000000000000000000000000000000000000000C00000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     C00CCCCCC00000CCCCCCCCCCCCCC00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000CCCCCCCCC
Z=5  000000000000000000000000CCCCC0000000000CCCCCCCC0C0C0000000000000000000000000000000000000000000000000000000000000000000000000000000000000C
     C00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     0000000000C0C0C0CCC0CCC00000000C000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000C
     00000000000000000000000000000000000000000000CCCCC0000000000000000000000000000000000000000000000000000000000000000000000000000000CCCCCCC0CC
Z=6  C00CC000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     0000C0000000000C0CCCCCCCCCCCC00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000C0C000
     0000000000000000CCCCCCCCCC000000000000000000000CCC0C000000000000000000000000000000000000000000000000000000000000000000000000000000000000000C
     0000C0000000CC0C00CC0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=7  000C000000C0CCCCCC0CCCC0CCCC00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000CC0C00000
     00000000000000000000000000000000000000000000000000000CCCCCC0C0C0C0CC000000000000000000000000000000000000000000000000000000000000000000000000
     C0C0CCCCC00000C00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00CC000000000000000000000000000000000000000000000000000CCCCCCCC0C0C0CCCCCCCCCCCCCCC000000000000000000000000000000000000000000000000000000000
Z=8  000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     000C0C0C0C0C0CCCC000CCCCCC00000C0000CCCCCCCC0C0C0C000CC000000000000000000000000000000000000000000000000000000000000000000000000CC0CC0000C
```

INDEX FOR RESISTIVITY (OHM. M)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C = | 100.00 | 1 = | 30.00 | 2 = | 10.00 | 3 = | -0.00 | 4 = | -0.00 |
| 5 = | -0.00 | 6 = | -0.00 | 7 = | -0.00 | 8 = | -0.00 | 9 = | -0.00 |

UNIT IN X SCALING = 1.CC    UNIT IN Z SCALING = 1.CO

CONFIGURATICN DISTANCE UNIT = 4.000

CASE MODEL 8
DIPOLE-DIPOLE CONFIGURATION OF ELECTRODES
PSEUDO-SECTION OF THE APPARENT RESISTIVITY
THE PROFILE LINE IS INCLINED TO THE STRIKE ( +Y DIR ) AT 90.0 DEGREES

-11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 44.3 | 44.1 | 44.0 | 44.0 | 44.1 | 44.1 | 44.3 | 44.7 | 45.2 | 42.6 | 39.7 | 39.7 | 42.6 | 45.2 | 44.7 | 44.3 | 44.1 | 44.1 | 44.0 | 44.0 | 44.1 | 44.3 1 |
| 2 | 58.5 | 58.1 | 58.0 | 58.1 | 58.2 | 58.7 | 59.7 | 60.5 | 54.4 | 45.5 | 42.3 | 45.5 | 54.4 | 60.5 | 59.7 | 58.7 | 58.2 | 58.1 | 58.0 | 58.1 | 58.5 | 2 |
| 3 | 68.7 | 68.2 | 68.2 | 68.5 | 69.2 | 70.7 | 71.5 | 62.1 | 49.6 | 44.3 | 44.3 | 49.6 | 62.1 | 71.5 | 70.7 | 69.2 | 68.5 | 68.2 | 68.2 | 68.7 | 3 | |
| 4 | 76.0 | 75.5 | 75.7 | 76.6 | 78.5 | 79.1 | 67.0 | 52.4 | 47.8 | 47.4 | 47.8 | 52.4 | 67.0 | 79.1 | 78.5 | 76.6 | 75.7 | 75.5 | 76.0 | 4 | | |
| 5 | 82.1 | 81.9 | 82.9 | 84.9 | 85.2 | 70.7 | 55.0 | 51.6 | 52.5 | 52.5 | 51.6 | 55.0 | 70.7 | 85.2 | 84.9 | 82.9 | 81.9 | 82.1 | 5 | | | |
| 6 | 87.6 | 88.2 | 90.2 | 89.9 | 73.5 | 57.0 | 55.1 | 57.3 | 58.1 | 57.3 | 55.1 | 57.0 | 73.5 | 89.9 | 90.2 | 88.2 | 87.6 | 6 | | | | |
| 7 | 93.2 | 94.8 | 93.8 | 75.6 | 58.7 | 58.2 | 61.6 | 63.1 | 63.1 | 61.6 | 58.2 | 58.7 | 75.6 | 93.8 | 94.8 | 93.2 | 7 | | | | | |
| 8 | 99.3 | 97.3 | 77.4 | 60.2 | 61.0 | 65.2 | 67.3 | 67.0 | 67.3 | 65.2 | 61.0 | 60.2 | 77.4 | 97.3 | 99.3 | 8 | | | | | | |
| 9 | 100.8 | 79.0 | 61.5 | 63.3 | 68.3 | 70.8 | 71.8 | 71.8 | 70.8 | 68.3 | 63.3 | 61.5 | 79.0 | 100.8 | 9 | | | | | | | |
| 10 | 80.9 | 62.8 | 65.5 | 71.0 | 73.7 | 75.0 | 75.4 | 75.0 | 73.7 | 71.0 | 65.5 | 62.8 | 80.9 | 10 | | | | | | | | |
| 11 | 64.3 | 67.7 | 73.5 | 76.3 | 77.6 | 78.2 | 78.2 | 77.6 | 76.3 | 73.5 | 67.7 | 64.3 | 11 | | | | | | | | | |
| 12 | 70.4 | 76.3 | 79.0 | 80.4 | 81.0 | 81.2 | 81.0 | 80.4 | 79.0 | 76.3 | 70.4 | 12 | | | | | | | | | | |
| 13 | 79.2 | 81.6 | 82.8 | 83.3 | 83.5 | 83.5 | 83.3 | 82.8 | 81.6 | 79.2 | 13 | | | | | | | | | | | |
| 14 | 84.1 | 84.8 | 85.1 | 85.3 | 85.3 | 85.3 | 85.1 | 84.8 | 84.1 | 14 | | | | | | | | | | | | |
| 15 | 87.1 | 87.0 | 86.9 | 86.9 | 86.9 | 86.9 | 87.0 | 87.1 | 15 | | | | | | | | | | | | | |

```
                                     2-D MODEL SECTION  MODEL C     -- RESISTIVITY
     -7        -6        -5        -4        -3        -2        -1         0         1         2         3         4         5         6         7
Z=0 ************************************************************************************************************************************************
    000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    ************************************************************************************************************************************************
    111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
Z=1 111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
    111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
    ********************************************************************************************1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
Z=2 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
Z=3 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
Z=4 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
Z=5 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
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Z=6 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
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Z=7 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
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    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
Z=8 2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111
    2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*1111111111111111111111111111111111111111111111111111

                                      INDEX FOR RESISTIVITY (OHM. M)
   0 =     10.00      1 =   200.00      2 =    50.00      3 =    -0.00      4 =    -0.00
   5 =     -0.00      6 =    -0.00      7 =    -0.00      8 =    -0.00      9 =    -0.00
   UNIT IN X SCALING =       1.00      UNIT IN Z SCALING =     1.00

                                      CONFIGURATION DISTANCE UNIT =        4.000
```

CASE MODEL C
DIPOLE-DIPOLE CONFIGURATION OF ELECTRODES
PSEUDO-SECTION OF THE APPARENT RESISTIVITY
THE PROFILE LINE IS INCLINED TO THE STRIKE ( +Y DIR ) AT 90.0 DEGREES

-11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11

X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X....X

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.4 | 18.3 | 18.2 | 18.2 | 18.2 | 18.2 | 18.2 | 18.2 | 18.2 | 18.1 | 18.1 | 18.0 | 18.0 | 18.0 | 18.1 | 18.1 | 18.1 | 18.0 | 18.0 | 18.0 | 18.1 | 18.2 | 1 |
| 2 | 28.6 | 28.3 | 28.2 | 28.2 | 28.2 | 28.1 | 28.1 | 28.0 | 28.0 | 27.9 | 27.7 | 27.6 | 27.8 | 28.2 | 28.5 | 28.4 | 28.4 | 28.3 | 28.3 | 28.4 | 28.6 | | 2 |
| 3 | 37.3 | 36.9 | 36.8 | 36.7 | 36.6 | 36.5 | 36.4 | 36.3 | 36.1 | 35.9 | 35.8 | 36.2 | 36.9 | 37.8 | 38.3 | 38.4 | 38.3 | 38.2 | 38.3 | 38.6 | | | 3 |
| 4 | 44.2 | 43.6 | 43.4 | 43.2 | 43.1 | 42.9 | 42.7 | 42.4 | 42.2 | 42.2 | 42.8 | 43.8 | 45.2 | 46.6 | 47.5 | 47.6 | 47.5 | 47.5 | 47.9 | | | | 4 |
| 5 | 49.7 | 49.1 | 48.7 | 48.4 | 48.2 | 47.9 | 47.6 | 47.3 | 47.4 | 48.2 | 49.5 | 51.1 | 53.1 | 55.1 | 56.4 | 56.7 | 56.8 | 57.2 | | | | | 5 |
| 6 | 53.9 | 53.1 | 52.7 | 52.3 | 51.9 | 51.5 | 51.2 | 51.4 | 52.4 | 53.9 | 55.8 | 58.0 | 60.6 | 63.2 | 65.1 | 65.7 | 66.2 | | | | | | 6 |
| 7 | 56.9 | 56.0 | 55.4 | 54.9 | 54.4 | 54.1 | 54.4 | 55.6 | 57.3 | 59.4 | 61.8 | 64.5 | 67.7 | 71.0 | 73.6 | 74.8 | | | | | | | 7 |
| 8 | 58.9 | 57.9 | 57.2 | 56.6 | 56.3 | 56.7 | 58.0 | 59.8 | 62.0 | 64.5 | 67.4 | 70.7 | 74.5 | 78.7 | 82.2 | | | | | | | | 8 |
| 9 | 60.1 | 59.0 | 58.2 | 57.8 | 58.3 | 59.7 | 61.7 | 64.0 | 66.5 | 69.4 | 72.7 | 76.6 | 81.2 | 86.5 | | | | | | | | | 9 |
| 10 | 60.6 | 59.5 | 59.0 | 59.5 | 61.0 | 63.0 | 65.3 | 67.9 | 70.8 | 74.1 | 77.9 | 82.4 | 88.0 | | | | | | | | | | 10 |
| 11 | 60.7 | 60.0 | 60.5 | 62.0 | 64.0 | 66.3 | 68.8 | 71.7 | 74.9 | 78.6 | 83.0 | 88.4 | | | | | | | | | | | 11 |
| 12 | 61.4 | 61.7 | 63.1 | 65.1 | 67.3 | 69.8 | 72.6 | 75.7 | 79.3 | 83.6 | 88.9 | | | | | | | | | | | | 12 |
| 13 | 63.0 | 64.2 | 66.0 | 68.1 | 70.5 | 73.2 | 76.2 | 79.7 | 83.7 | 88.7 | | | | | | | | | | | | | 13 |
| 14 | 65.1 | 66.6 | 68.5 | 70.7 | 73.2 | 76.1 | 79.4 | 83.5 | 88.0 | | | | | | | | | | | | | | 14 |
| 15 | 67.4 | 69.0 | 71.0 | 73.3 | 76.0 | 79.1 | 82.7 | 87.2 | | | | | | | | | | | | | | | 15 |

```
C        ******************************************************************
C
C        SMAPLE INPUT CATA CARDS FOR THE MODELS SIMULATED USING THE
C       RECONNAISSANCE BIPOLE - DIPOLE CONFIGURATION
C         THE SEQUENCE AND FORMAT OF THE INPUT PARAMETERS ARE AS INDICATED
C       IN THE LISTING OF THE MAIN PROGRAM RESIS2D. THE CHOICE OF YKY
C       ARRAY IS OPTIMISED FOR THE STANDARD 113 X 16 GRID USED.
C
C        ******************************************************************
  113   16    5   28   85    1 1.00      1.00      4.00
1000 100   20    4    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1    1
   1    1    1    1    1    1    1    1    4   20 1001000
   1    1    1    1    2    2    2    2    2    2    4    4    8   64  512
 0.006     0.050     0.150     0.300     1.250
    2
    2         1    81    37         1
 41 49
 17 18 19 20 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 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88
 89 90 91 92 93 94 95 96 97
0.00
0.00
0.00      0.25      0.50      0.75      1.00      1.25      1.50      1.75      2.00      2.25
2.50      2.75      3.00      3.25      3.50      3.75      4.00      4.25      4.50      4.75
5.00      5.25      5.50      5.75      6.00      6.25      6.50      6.75      7.00      7.25
7.50      7.75      8.00      8.25      8.50      8.75      9.00      9.25
     0 MODEL A
 100.0    10.00
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000001111111100000000000000000000000000
000000000000000000000000001111111100000000000000000000000000
000000000000000000000000001111111100000000000000000000000000
000000000000000000000000001111111100000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
    1    5   29
0
1
     0 MODEL B
 100.0    30.00    10.00
111111111111111111111111111111111111111111111111111111111111
111111111111111111111111111111111111111111111111111111111111
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000002222222200000000000000000000000000
000000000000000000000000002222222200000000000000000000000000
000000000000000000000000002222222200000000000000000000000000


000000000000000000000000002222222200000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
    1    5   29
1
1
     0 MODEL C
 10.00    200.0    50.0
000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000
111111111111111111111111111111111111111111111111111111111111
111111111111111111111111111111111111111111111111111111111111
111111111111111111111111111111111111111111111111111111111111
222222222222222222222222222222222222222111111111111111111111
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222222222222222222222222222222222222222111111111111111111111
222222222222222222222222222222222222222111111111111111111111
222222222222222222222222222222222222222111111111111111111111
    2    7   29
1
0
```

## 2-D MODEL SECTION MODEL A -- RESISTIVITY

```
       -7          -6          -5          -4          -3          -2          -1          0          1          2          3          4          5          6          7
Z=0  *****************************************************************************************************************************************************
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=1  000000000000000000000000000000000000000000000000000000000000000000*****************000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
Z=2  000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
     000000000000000000000000000000000000000000000000000000000000000000*111111111111111*000000000000000000000000000000000000000000000000000000000000000000
Z=3  000000000000000000000000000000000000000000000000000000000000000000*****************000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=4  00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=5  00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=6  00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=7  00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=8  00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
     00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
```

INDEX FOR RESISTIVITY (OHM. M)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 = | 100.00 | 1 = | 10.00 | 2 = | -0.00 | 3 = | -0.00 | 4 = | -0.00 |
| 5 = | -0.00 | 6 = | -0.00 | 7 = | -0.00 | 8 = | -0.00 | 9 = | -0.00 |

UNIT IN X SCALING = 1.00 UNIT IN Z SCALING = 1.00

CONFIGURATION DISTANCE UNIT = 4.000

CASE MODEL A

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 0.00 AND AT X2= -2.00 Y2= 1.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY 0.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -2.390E+02 | 106.58 | 1.438E+03 | 83.34 | 2.014E+01 | 105.10 | 106.03 | .03 | 119.84 | -2.03 |
| -9.00 | -1.852E+02 | 105.70 | 1.146E+03 | 84.41 | 1.707E+01 | 105.29 | 105.21 | .03 | 120.19 | -1.83 |
| -8.50 | -1.401E+02 | 104.82 | 8.952E+02 | 85.57 | 1.425E+01 | 105.32 | 104.40 | .03 | 120.82 | -1.61 |
| -8.00 | -1.028E+02 | 103.96 | 6.814E+02 | 86.88 | 1.168E+01 | 105.19 | 103.61 | .02 | 121.81 | -1.39 |
| -7.50 | -7.272E+01 | 103.14 | 5.021E+02 | 88.42 | 9.361E+00 | 104.90 | 102.86 | .02 | 123.37 | -1.16 |
| -7.00 | -4.900E+01 | 102.41 | 3.543E+02 | 90.34 | 7.288E+00 | 104.46 | 102.20 | .02 | 125.82 | -.92 |
| -6.50 | -3.093E+01 | 101.90 | 2.351E+02 | 92.85 | 5.462E+00 | 103.91 | 101.76 | .02 | 129.83 | -.66 |
| -6.00 | -1.776E+01 | 101.82 | 1.420E+02 | 96.25 | 3.884E+00 | 103.31 | 101.73 | .01 | 136.81 | -.39 |
| -5.50 | -8.774E+00 | 102.30 | 7.288E+01 | 100.39 | 2.551E+00 | 102.83 | 102.27 | .01 | 149.93 | -.13 |
| -.50 | -2.531E+01 | 82.28 | 2.363E+01 | 76.97 | -3.718E+00 | 66.33 | 79.49 | .02 | 63.73 | -1.91 |
| 0.00 | -3.792E+01 | 68.10 | 4.665E+01 | 64.53 | -5.071E+00 | 61.68 | 66.70 | .03 | 53.76 | -1.50 |
| .50 | -5.571E+01 | 56.27 | 8.277E+01 | 56.51 | -6.704E+00 | 60.56 | 56.35 | .04 | 46.25 | .11 |
| 1.00 | -7.925E+01 | 51.09 | 1.351E+02 | 53.36 | -8.604E+00 | 62.24 | 51.68 | .04 | 43.22 | 1.10 |
| 1.50 | -1.092E+02 | 51.79 | 2.067E+02 | 53.41 | -1.076E+01 | 65.05 | 52.15 | .05 | 44.31 | .73 |
| 2.00 | -1.464E+02 | 54.75 | 3.006E+02 | 54.85 | -1.318E+01 | 67.88 | 54.77 | .05 | 47.19 | .04 |
| 2.50 | -1.915E+02 | 58.23 | 4.198E+02 | 56.75 | -1.585E+01 | 70.38 | 57.97 | .05 | 50.56 | -.55 |
| 3.00 | -2.452E+02 | 61.59 | 5.675E+02 | 58.72 | -1.878E+01 | 72.48 | 61.15 | .06 | 53.91 | -.98 |
| 3.50 | -3.083E+02 | 64.65 | 7.465E+02 | 60.59 | -2.195E+01 | 74.19 | 64.07 | .06 | 57.02 | -1.28 |
| 4.00 | -3.816E+02 | 67.35 | 9.600E+02 | 62.30 | -2.538E+01 | 75.58 | 66.68 | .06 | 59.82 | -1.49 |
| 4.50 | -4.657E+02 | 69.70 | 1.211E+03 | 63.84 | -2.906E+01 | 76.69 | 68.97 | .06 | 62.32 | -1.63 |
| 5.00 | -5.615E+02 | 71.75 | 1.502E+03 | 65.19 | -3.299E+01 | 77.57 | 70.98 | .06 | 64.53 | -1.74 |
| 5.50 | -6.696E+02 | 73.53 | 1.837E+03 | 66.37 | -3.717E+01 | 78.25 | 72.72 | .07 | 66.49 | -1.81 |
| 6.00 | -7.909E+02 | 75.08 | 2.218E+03 | 67.41 | -4.161E+01 | 78.77 | 74.25 | .07 | 68.23 | -1.87 |
| 6.50 | -9.261E+02 | 76.44 | 2.649E+03 | 68.30 | -4.629E+01 | 79.15 | 75.59 | .07 | 69.77 | -1.92 |
| 7.00 | -1.076E+03 | 77.64 | 3.132E+03 | 69.06 | -5.122E+01 | 79.40 | 76.78 | .07 | 71.15 | -1.97 |
| 7.50 | -1.241E+03 | 78.71 | 3.671E+03 | 69.71 | -5.641E+01 | 79.56 | 77.83 | .07 | 72.39 | -2.01 |
| 8.00 | -1.422E+03 | 79.67 | 4.268E+03 | 70.25 | -6.184E+01 | 79.62 | 78.78 | .08 | 73.51 | -2.06 |
| 8.50 | -1.620E+03 | 80.55 | 4.927E+03 | 70.68 | -6.753E+01 | 79.59 | 79.65 | .08 | 74.55 | -2.11 |
| 9.00 | -1.836E+03 | 81.40 | 5.650E+03 | 71.02 | -7.346E+01 | 79.49 | 80.46 | .08 | 75.53 | -2.17 |
| 9.50 | -2.070E+03 | 82.21 | 6.441E+03 | 71.27 | -7.965E+01 | 79.31 | 81.25 | .09 | 76.46 | -2.25 |

CASE MODEL A

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 0.00 AND AT X2= -2.00 Y2= 1.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY 2.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -3.770E+02 | 112.30 | 5.139E+02 | 97.11 | 2.583E+01 | 108.45 | 107.23 | .04 | 118.00 | -3.87 |
| -9.00 | -3.119E+02 | 111.60 | 3.965E+02 | 97.55 | 2.259E+01 | 108.91 | 106.45 | .03 | 117.49 | -3.68 |
| -8.50 | -2.567E+02 | 110.93 | 3.004E+02 | 97.86 | 1.960E+01 | 109.24 | 105.61 | .03 | 116.81 | -3.50 |
| -8.00 | -2.107E+02 | 110.27 | 2.233E+02 | 98.01 | 1.689E+01 | 109.45 | 104.67 | .03 | 115.86 | -3.35 |
| -7.50 | -1.738E+02 | 109.64 | 1.628E+02 | 97.96 | 1.445E+01 | 109.55 | 103.58 | .03 | 114.44 | -3.23 |
| -7.00 | -1.462E+02 | 109.14 | 1.163E+02 | 97.65 | 1.231E+01 | 109.54 | 102.26 | .03 | 112.25 | -3.14 |
| -6.50 | -1.294E+02 | 109.10 | 8.187E+01 | 96.97 | 1.048E+01 | 109.47 | 100.59 | .03 | 108.90 | -3.12 |
| -6.00 | -1.314E+02 | 110.97 | 5.729E+01 | 95.79 | 9.008E+00 | 109.45 | 98.37 | .02 | 103.97 | -3.24 |
| -5.50 | -2.158E+02 | 126.29 | 4.074E+01 | 94.08 | 7.982E+00 | 109.82 | 95.37 | .02 | 97.56 | -3.53 |
| -.50 | -2.184E+01 | 81.89 | -2.872E+01 | 75.26 | -3.261E+00 | 65.85 | 79.52 | .02 | 62.70 | 2.30 |
| 0.00 | -3.293E+01 | 67.41 | -5.714E+01 | 64.05 | -4.472E+00 | 61.10 | 66.59 | .02 | 54.26 | -1.25 |
| .50 | -4.853E+01 | 55.68 | -1.074E+02 | 54.98 | -5.941E+00 | 59.99 | 55.56 | .03 | 46.33 | .27 |
| 1.00 | -6.923E+01 | 50.74 | -1.914E+02 | 49.35 | -7.661E+00 | 61.69 | 50.58 | .04 | 42.90 | .50 |
| 1.50 | -9.572E+01 | 51.62 | -3.266E+02 | 46.47 | -9.629E+00 | 64.51 | 51.23 | .05 | 44.04 | 1.55 |
| 2.00 | -1.287E+02 | 54.60 | -5.386E+02 | 44.95 | -1.185E+01 | 67.33 | 54.12 | .05 | 47.09 | 2.31 |
| 2.50 | -1.689E+02 | 58.02 | -8.659E+02 | 43.88 | -1.431E+01 | 69.81 | 57.56 | .05 | 50.61 | 2.64 |
| 3.00 | -2.170E+02 | 61.30 | -1.368E+03 | 42.73 | -1.702E+01 | 71.90 | 60.91 | .05 | 54.05 | 2.70 |
| 3.50 | -2.738E+02 | 64.27 | -2.139E+03 | 41.12 | -1.998E+01 | 73.61 | 63.97 | .05 | 57.22 | 2.61 |
| 4.00 | -3.401E+02 | 66.90 | -3.343E+03 | 38.67 | -2.319E+01 | 75.01 | 66.67 | .05 | 60.06 | 2.44 |
| 4.50 | -4.164E+02 | 69.19 | -5.273E+03 | 34.81 | -2.664E+01 | 76.14 | 69.03 | .06 | 62.57 | 2.24 |
| 5.00 | -5.037E+02 | 71.19 | -8.530E+03 | 28.45 | -3.034E+01 | 77.03 | 71.09 | .06 | 64.79 | 2.03 |
| 5.50 | -6.027E+02 | 72.93 | -1.454E+04 | 17.10 | -3.430E+01 | 77.74 | 72.87 | .06 | 66.75 | 1.82 |
| 6.00 | -7.140E+02 | 74.46 | -2.767E+04 | 6.92 | -3.850E+01 | 78.28 | 74.43 | .06 | 68.49 | -358.39 |
| 6.50 | -8.385E+02 | 75.80 | -7.122E+04 | 84.38 | -4.295E+01 | 78.68 | 75.80 | .07 | 70.03 | -358.58 |
| 7.00 | -9.769E+02 | 76.99 | 1.116E+06 | 1991.71 | -4.764E+01 | 78.97 | 77.01 | .07 | 71.41 | 1.25 |
| 7.50 | -1.130E+03 | 78.05 | 9.157E+04 | 197.42 | -5.259E+01 | 79.14 | 78.08 | .07 | 72.65 | 1.08 |
| 8.00 | -1.298E+03 | 79.02 | 5.699E+04 | 135.04 | -5.779E+01 | 79.23 | 79.06 | .07 | 73.78 | .92 |
| 8.50 | -1.483E+03 | 79.91 | 4.586E+04 | 113.47 | -6.324E+01 | 79.23 | 79.95 | .08 | 74.83 | .78 |
| 9.00 | -1.684E+03 | 80.75 | 4.098E+04 | 102.60 | -6.893E+01 | 79.15 | 80.79 | .08 | 75.82 | .64 |
| 9.50 | -1.903E+03 | 81.56 | 3.870E+04 | 96.05 | -7.488E+01 | 78.99 | 81.60 | .08 | 76.77 | .50 |

# CASE MODEL A

## TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= [illegible] Y1= 0.00 AND AT X2= -2.00 Y2= 1.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY -6.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| 9.50 | -1.224E+03 | 106.60 | -8.432E+02 | 106.30 | 3.939E+01 | 99.60 | 106.40 | .04 | 112.57 | .08 |
| -9.00 | -1.223E+03 | 106.10 | -7.250E+02 | 106.35 | 3.701E+01 | 100.02 | 106.29 | .04 | 112.91 | -.06 |
| -8.50 | -1.261E+03 | 105.54 | -6.271E+02 | 106.39 | 3.491E+01 | 100.36 | 106.22 | .04 | 113.39 | -.18 |
| -8.00 | -1.363E+03 | 104.71 | -5.467E+02 | 106.43 | 3.310E+01 | 100.61 | 106.19 | .04 | 114.05 | -.32 |
| -7.50 | -1.585E+03 | 103.13 | -4.820E+02 | 106.46 | 3.161E+01 | 100.78 | 106.18 | .04 | 114.87 | -.50 |
| -7.00 | -2.099E+03 | 99.14 | -4.311E+02 | 106.44 | 3.047E+01 | 100.84 | 106.16 | .04 | 115.79 | -.78 |
| -6.50 | -3.780E+03 | 83.87 | -3.928E+02 | 106.25 | 2.969E+01 | 100.75 | 106.04 | .04 | 116.70 | -1.24 |
| -6.00 | 2.058E+05 | 2348.60 | -3.662E+02 | 105.62 | 2.934E+01 | 100.41 | 105.71 | .04 | 117.40 | -2.16 |
| -5.50 | 3.083E+03 | 188.76 | -3.513E+02 | 104.48 | 2.949E+01 | 99.59 | 105.99 | .04 | 118.92 | -5.13 |
| -.50 | 6.511E+02 | 71.94 | 2.931E+03 | 194.50 | 2.338E+02 | 87.34 | 81.92 | .09 | 83.37 | -18.46 |
| 0.00 | 7.608E+02 | 61.55 | 1.688E+03 | 134.43 | 7.608E+02 | 440.24 | 78.74 | .09 | 81.06 | -20.29 |
| .50 | 9.183E+02 | 51.97 | 1.304E+03 | 111.84 | -8.325E+02 | 605.94 | 77.16 | .10 | 80.63 | -21.43 |
| 1.00 | 1.145E+03 | 42.74 | 1.144E+03 | 99.60 | -3.059E+02 | 254.06 | 76.65 | .10 | 81.08 | -21.77 |
| 1.50 | 1.475E+03 | 33.84 | 1.080E+03 | 92.29 | -2.034E+02 | 182.59 | 77.10 | .10 | 81.91 | -21.18 |
| 2.00 | 1.973E+03 | 23.05 | 1.069E+03 | 87.55 | -1.617E+02 | 151.63 | 77.76 | .10 | 82.62 | -20.33 |
| 2.50 | 2.764E+03 | 8.04 | 1.093E+03 | 84.28 | -1.404E+02 | 134.28 | 78.43 | .10 | 83.11 | -19.42 |
| 3.00 | 4.132E+03 | 15.56 | 1.145E+03 | 81.92 | -1.285E+02 | 123.17 | 79.05 | .10 | 83.39 | -18.50 |
| 3.50 | 6.885E+03 | 59.96 | 1.219E+03 | 80.16 | -1.217E+02 | 115.44 | 79.63 | .10 | 83.51 | -17.59 |
| 4.00 | 1.456E+04 | 178.42 | 1.316E+03 | 78.84 | -1.181E+02 | 109.74 | 80.14 | .10 | 83.53 | -16.72 |
| 4.50 | 1.080E+05 | 1587.58 | 1.433E+03 | 77.82 | -1.167E+02 | 105.37 | 80.61 | .10 | 83.48 | -15.89 |
| 5.00 | -2.782E+04 | 452.72 | 1.570E+03 | 77.02 | -1.168E+02 | 101.91 | 81.03 | .10 | 83.40 | -15.13 |
| 5.50 | -1.437E+04 | 247.18 | 1.730E+03 | 76.40 | -1.180E+02 | 99.09 | 81.40 | .10 | 83.31 | -14.42 |
| 6.00 | -1.064E+04 | 187.64 | 1.912E+03 | 75.90 | -1.202E+02 | 96.74 | 81.74 | .11 | 83.21 | -13.77 |
| 6.50 | -9.006E+03 | 159.40 | 2.118E+03 | 75.49 | -1.231E+02 | 94.74 | 82.04 | .11 | 83.13 | -13.17 |
| 7.00 | -8.171E+03 | 142.98 | 2.348E+03 | 75.14 | -1.266E+02 | 93.00 | 82.31 | .11 | 83.05 | -12.64 |
| 7.50 | -7.733E+03 | 132.31 | 2.606E+03 | 74.85 | -1.307E+02 | 91.47 | 82.56 | .11 | 82.98 | -12.16 |
| 8.00 | -7.525E+03 | 124.88 | 2.891E+03 | 74.58 | -1.354E+02 | 90.10 | 82.78 | .11 | 82.93 | -11.74 |
| 8.50 | -7.468E+03 | 119.46 | 3.206E+03 | 74.32 | -1.404E+02 | 88.86 | 82.97 | .11 | 82.90 | -11.37 |
| 9.00 | -7.517E+03 | 115.39 | 3.552E+03 | 74.07 | -1.459E+02 | 87.70 | 83.16 | .12 | 82.89 | -11.07 |
| 9.50 | -7.647E+03 | 112.29 | 3.931E+03 | 73.80 | -1.518E+02 | 86.62 | 83.33 | .12 | 82.90 | -10.83 |

```
                              2-D MODEL  SECTION  MODEL B     -- RESISTIVITY
    -7      -6      -5      -4      -3      -2      -1       0       1       2       3       4       5       6       7
Z=0 *****************************************************************************************************************
    11111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
    *****************************************************************************************************************
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=1 000000000000000000000000000000000000000000000000*****************000000000000000000000000000000000000000000000000
    000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
    000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
    000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
Z=2 000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
    000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
    000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
    000000000000000000000000000000000000000000000000*222222222222222*000000000000000000000000000000000000000000000000
Z=3 000000000000000000000000000000000000000000000000*****************000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=4 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=5 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=6 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=7 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
Z=8 00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
    00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

                              INDEX FOR RESISTIVITY (OHM. M)
  0 =  100.00      1 =   30.00      2 =   10.00      3 =   -0.00      4 =   -0.00
  5 =   -0.00      6 =   -0.00      7 =   -0.00      8 =   -0.00      9 =   -0.00
  UNIT IN X SCALING =    1.00      UNIT IN Z SCALING =    1.00

                              CONFIGURATION DISTANCE UNIT =        4.000
```

CASE MODEL B

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1 -4.00 Y1= 0.00 AND AT X2= -2.00 Y2= 1.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY 0.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -2.390E+02 | 84.96 | 1.438E+03 | 77.62 | 2.014E+01 | 91.90 | 84.77 | .04 | 95.78 | -.80 |
| -9.00 | -1.852E+02 | 82.13 | 1.146E+03 | 77.31 | 1.707E+01 | 90.73 | 82.01 | .04 | 93.67 | -.53 |
| -8.50 | -1.401E+02 | 79.00 | 8.952E+02 | 76.79 | 1.425E+01 | 89.18 | 78.95 | .04 | 91.35 | -.25 |
| -8.00 | -1.028E+02 | 75.51 | 6.814E+02 | 76.01 | 1.168E+01 | 87.18 | 75.52 | .03 | 88.78 | .06 |
| -7.50 | -7.272E+01 | 71.35 | 5.021E+02 | 74.88 | 9.361E+00 | 84.65 | 71.62 | .03 | 85.91 | .38 |
| -7.00 | -4.900E+01 | 67.02 | 3.543E+02 | 73.30 | 7.288E+00 | 81.48 | 67.14 | .03 | 82.69 | .73 |
| -6.50 | -3.093E+01 | 61.79 | 2.351E+02 | 71.01 | 5.462E+00 | 77.51 | 61.96 | .03 | 79.11 | 1.10 |
| -6.00 | -1.776E+01 | 55.66 | 1.420E+02 | 67.54 | 3.884E+00 | 72.49 | 55.87 | .02 | 75.20 | 1.50 |
| -5.50 | -8.774E+00 | 48.41 | 7.288E+01 | 61.79 | 2.551E+00 | 66.02 | 48.62 | .02 | 71.38 | 1.87 |
| -.50 | -2.531E+01 | 45.98 | 2.363E+01 | 49.40 | -3.718E+00 | 49.85 | 47.84 | .03 | 38.73 | 2.05 |
| 0.00 | -3.792E+01 | 46.21 | 4.665E+01 | 49.18 | -5.071E+00 | 51.18 | 47.42 | .04 | 38.43 | 1.76 |
| .50 | -5.571E+01 | 44.84 | 8.277E+01 | 48.82 | -6.704E+00 | 52.87 | 46.12 | .04 | 37.98 | 2.29 |
| 1.00 | -7.925E+01 | 44.19 | 1.351E+02 | 49.26 | -8.604E+00 | 55.22 | 45.54 | .05 | 38.19 | 2.78 |
| 1.50 | -1.092E+02 | 45.34 | 2.067E+02 | 50.60 | -1.076E+01 | 57.94 | 46.54 | .06 | 39.64 | 2.68 |
| 2.00 | -1.464E+02 | 47.65 | 3.006E+02 | 52.45 | -1.318E+01 | 60.66 | 48.61 | .06 | 41.96 | 2.23 |
| 2.50 | -1.915E+02 | 50.41 | 4.198E+02 | 54.46 | -1.585E+01 | 63.17 | 51.13 | .06 | 44.65 | 1.72 |
| 3.00 | -2.452E+02 | 53.22 | 5.675E+02 | 56.47 | -1.878E+01 | 65.40 | 53.75 | .06 | 47.42 | 1.26 |
| 3.50 | -3.083E+02 | 55.94 | 7.465E+02 | 58.39 | -2.195E+01 | 67.35 | 56.31 | .06 | 50.12 | .88 |
| 4.00 | -3.816E+02 | 58.49 | 9.600E+02 | 60.17 | -2.538E+01 | 69.03 | 58.73 | .07 | 52.69 | .56 |
| 4.50 | -4.657E+02 | 60.85 | 1.211E+03 | 61.81 | -2.906E+01 | 70.48 | 60.98 | .07 | 55.09 | .30 |
| 5.00 | -5.615E+02 | 63.02 | 1.502E+03 | 63.29 | -3.299E+01 | 71.71 | 63.06 | .07 | 57.32 | .08 |
| 5.50 | -6.696E+02 | 65.01 | 1.837E+03 | 64.63 | -3.717E+01 | 72.75 | 64.97 | .07 | 59.38 | -.11 |
| 6.00 | -7.909E+02 | 66.84 | 2.218E+03 | 65.82 | -4.161E+01 | 73.62 | 66.72 | .08 | 61.28 | -.28 |
| 6.50 | -9.261E+02 | 68.51 | 2.649E+03 | 66.87 | -4.629E+01 | 74.34 | 68.33 | .08 | 63.04 | -.43 |
| 7.00 | -1.076E+03 | 70.04 | 3.132E+03 | 67.80 | -5.122E+01 | 74.92 | 69.81 | .08 | 64.66 | -.57 |
| 7.50 | -1.241E+03 | 71.47 | 3.671E+03 | 68.61 | -5.641E+01 | 75.38 | 71.18 | .08 | 66.17 | -.70 |
| 8.00 | -1.422E+03 | 72.79 | 4.268E+03 | 69.30 | -6.184E+01 | 75.72 | 72.45 | .08 | 67.57 | -.83 |
| 8.50 | -1.620E+03 | 74.04 | 4.927E+03 | 69.89 | -6.753E+01 | 75.96 | 73.64 | .09 | 68.90 | -.96 |
| 9.00 | -1.836E+03 | 75.22 | 5.650E+03 | 70.37 | -7.346E+01 | 76.11 | 74.77 | .09 | 70.15 | -1.09 |
| 9.50 | -2.070E+03 | 76.37 | 6.441E+03 | 70.74 | -7.965E+01 | 76.16 | 75.86 | .09 | 71.36 | -1.24 |

CASE MODEL B

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 0.00 AND AT X2= -2.00 Y2= 1.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY 2.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -3.770E+02 | 88.94 | 5.139E+02 | 83.71 | 2.583E+01 | 94.81 | 87.14 | .04 | 95.60 | -1.64 |
| -9.00 | -3.119E+02 | 86.22 | 3.965E+02 | 82.55 | 2.259E+01 | 93.99 | 84.84 | .04 | 93.31 | -1.20 |
| -8.50 | -2.567E+02 | 83.21 | 3.004E+02 | 81.07 | 1.960E+01 | 92.86 | 82.31 | .04 | 90.69 | -.74 |
| -8.00 | -2.107E+02 | 79.83 | 2.233E+02 | 79.22 | 1.689E+01 | 91.40 | 79.54 | .04 | 87.66 | -.22 |
| -7.50 | -1.738E+02 | 75.97 | 1.628E+02 | 76.97 | 1.445E+01 | 89.59 | 76.50 | .04 | 84.08 | .37 |
| -7.00 | -1.462E+02 | 71.47 | 1.163E+02 | 74.25 | 1.231E+01 | 87.41 | 73.19 | .04 | 79.84 | 1.06 |
| -6.50 | -1.294E+02 | 66.01 | 8.187E+01 | 71.02 | 1.048E+01 | 84.84 | 69.63 | .04 | 74.83 | 1.86 |
| -6.00 | -1.314E+02 | 58.54 | 5.729E+01 | 67.24 | 9.008E+00 | 81.96 | 65.93 | .04 | 69.08 | 2.77 |
| -5.50 | -2.158E+02 | 41.18 | 4.074E+01 | 62.90 | 7.982E+00 | 78.98 | 62.28 | .04 | 63.16 | 3.65 |
| -.50 | -2.184E+01 | 48.29 | -2.672E+01 | 46.81 | -3.261E+00 | 50.78 | 47.75 | .03 | 37.68 | .86 |
| 0.00 | -3.293E+01 | 47.70 | -5.714E+01 | 46.20 | -4.472E+00 | 51.71 | 47.33 | .03 | 38.58 | .78 |
| .50 | -4.853E+01 | 45.87 | -1.074E+02 | 44.87 | -5.941E+00 | 53.16 | 45.70 | .04 | 38.10 | .47 |
| 1.00 | -6.923E+01 | 45.02 | -1.914E+02 | 43.68 | -7.661E+00 | 55.36 | 44.86 | .05 | 38.05 | .54 |
| 1.50 | -9.572E+01 | 46.06 | -3.266E+02 | 42.95 | -9.629E+00 | 57.98 | 45.83 | .05 | 39.41 | 1.04 |
| 2.00 | -1.287E+02 | 48.26 | -5.386E+02 | 42.55 | -1.185E+01 | 60.61 | 47.97 | .05 | 41.74 | 1.54 |
| 2.50 | -1.689E+02 | 50.89 | -8.659E+02 | 42.05 | -1.431E+01 | 63.05 | 50.59 | .06 | 44.48 | 1.88 |
| 3.00 | -2.170E+02 | 53.59 | -1.368E+03 | 41.23 | -1.702E+01 | 65.24 | 53.32 | .06 | 47.31 | 2.06 |
| 3.50 | -2.738E+02 | 56.20 | -2.139E+03 | 39.84 | -1.998E+01 | 67.16 | 55.98 | .06 | 50.06 | 2.11 |
| 4.00 | -3.401E+02 | 58.66 | -3.343E+03 | 37.56 | -2.319E+01 | 68.82 | 58.48 | .06 | 52.67 | 2.08 |
| 4.50 | -4.164E+02 | 60.93 | -5.273E+03 | 33.85 | -2.664E+01 | 70.25 | 60.80 | .06 | 55.11 | 2.00 |
| 5.00 | -5.037E+02 | 63.03 | -8.530E+03 | 27.66 | -3.034E+01 | 71.48 | 62.94 | .07 | 57.37 | 1.90 |
| 5.50 | -6.027E+02 | 64.96 | -1.454E+04 | 16.50 | -3.430E+01 | 72.52 | 64.91 | .07 | 59.45 | 1.77 |
| 6.00 | -7.140E+02 | 66.73 | -2.767E+04 | 7.22 | -3.850E+01 | 73.39 | 66.71 | .07 | 61.38 | -358.36 |
| 6.50 | -8.385E+02 | 68.36 | -7.122E+04 | 83.91 | -4.295E+01 | 74.11 | 68.36 | .07 | 63.16 | -358.50 |
| 7.00 | -9.769E+02 | 69.86 | 1.116E+06 | 1974.07 | -4.764E+01 | 74.70 | 69.88 | .08 | 64.80 | 1.37 |
| 7.50 | -1.130E+03 | 71.25 | 9.157E+04 | 195.59 | -5.259E+01 | 75.17 | 71.28 | .08 | 66.32 | 1.23 |
| 8.00 | -1.298E+03 | 72.54 | 5.699E+04 | 133.82 | -5.779E+01 | 75.53 | 72.59 | .08 | 67.75 | 1.10 |
| 8.50 | -1.483E+03 | 73.77 | 4.586E+04 | 112.51 | -6.324E+01 | 75.78 | 73.82 | .08 | 69.10 | .97 |
| 9.00 | -1.684E+03 | 74.94 | 4.098E+04 | 101.79 | -6.893E+01 | 75.93 | 74.99 | .08 | 70.38 | .84 |
| 9.50 | -1.903E+03 | 76.07 | 3.870E+04 | 95.36 | -7.488E+01 | 76.00 | 76.13 | .09 | 71.62 | .71 |

CASE MODEL 8

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 0.00 AND AT X2= -2.00 Y2= 1.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY -6.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -1.224E+03 | 92.43 | -8.432E+02 | 93.12 | 3.939E+01 | 92.25 | 92.90 | .05 | 98.29 | -.20 |
| -9.00 | -1.223E+03 | 90.92 | -7.250E+02 | 92.56 | 3.701E+01 | 92.24 | 92.13 | .05 | 97.88 | -.44 |
| -8.50 | -1.261E+03 | 89.19 | -6.271E+02 | 91.95 | 3.491E+01 | 92.14 | 91.41 | .05 | 97.60 | -.69 |
| -8.00 | -1.363E+03 | 86.95 | -5.467E+02 | 91.34 | 3.310E+01 | 91.96 | 90.74 | .05 | 97.48 | -.96 |
| -7.50 | -1.585E+03 | 83.52 | -4.820E+02 | 90.71 | 3.161E+01 | 91.71 | 90.12 | .05 | 97.53 | -1.27 |
| -7.00 | -2.099E+03 | 76.69 | -4.311E+02 | 90.07 | 3.047E+01 | 91.36 | 89.56 | .05 | 97.74 | -1.69 |
| -6.50 | -3.780E+03 | 54.75 | -3.928E+02 | 89.33 | 2.969E+01 | 90.91 | 89.04 | .05 | 98.05 | -2.29 |
| -6.00 | 2.058E+05 | 2949.34 | -3.662E+02 | 88.32 | 2.934E+01 | 90.29 | 88.48 | .05 | 98.36 | -3.30 |
| -5.50 | 3.083E+03 | 163.27 | -3.513E+02 | 86.74 | 2.949E+01 | 89.37 | 88.14 | .05 | 98.96 | -5.60 |
| -.50 | 6.511E+02 | 71.54 | 2.931E+03 | 104.21 | 2.338E+02 | 16.50 | 73.41 | .10 | 72.31 | -5.41 |
| 0.00 | 7.608E+02 | 63.87 | 1.688E+03 | 91.02 | 7.608E+02 | 210.47 | 69.21 | .11 | 68.21 | -8.45 |
| .50 | 9.183E+02 | 58.32 | 1.304E+03 | 84.02 | -8.325E+02 | 361.06 | 67.93 | .11 | 67.47 | -10.26 |
| 1.00 | 1.145E+03 | 54.72 | 1.144E+03 | 79.43 | -3.059E+02 | 168.94 | 68.21 | .11 | 68.24 | -10.44 |
| 1.50 | 1.475E+03 | 51.58 | 1.080E+03 | 76.45 | -2.034E+02 | 130.45 | 68.80 | .11 | 69.18 | -9.92 |
| 2.00 | 1.973E+03 | 47.32 | 1.069E+03 | 74.53 | -1.617E+02 | 114.10 | 69.30 | .11 | 69.95 | -9.47 |
| 2.50 | 2.764E+03 | 40.90 | 1.093E+03 | 73.30 | -1.404E+02 | 105.13 | 69.80 | .11 | 70.62 | -9.13 |
| 3.00 | 4.132E+03 | 30.30 | 1.145E+03 | 72.52 | -1.285E+02 | 99.50 | 70.35 | .11 | 71.23 | -8.88 |
| 3.50 | 6.885E+03 | 9.72 | 1.219E+03 | 72.04 | -1.217E+02 | 95.66 | 70.96 | .11 | 71.80 | -8.67 |
| 4.00 | 1.456E+04 | 46.19 | 1.316E+03 | 71.78 | -1.181E+02 | 92.88 | 71.61 | .11 | 72.33 | -8.49 |
| 4.50 | 1.080E+05 | 717.29 | 1.433E+03 | 71.65 | -1.167E+02 | 90.78 | 72.27 | .11 | 72.85 | -8.32 |
| 5.00 | -2.782E+04 | 255.59 | 1.570E+03 | 71.63 | -1.168E+02 | 89.13 | 72.95 | .11 | 73.34 | -8.16 |
| 5.50 | -1.437E+04 | 158.09 | 1.730E+03 | 71.67 | -1.180E+02 | 87.79 | 73.62 | .11 | 73.81 | -8.01 |
| 6.00 | -1.064E+04 | 130.15 | 1.912E+03 | 71.75 | -1.202E+02 | 86.67 | 74.28 | .12 | 74.26 | -7.87 |
| 6.50 | -9.006E+03 | 117.10 | 2.118E+03 | 71.86 | -1.231E+02 | 85.71 | 74.91 | .12 | 74.70 | -7.74 |
| 7.00 | -8.171E+03 | 109.68 | 2.348E+03 | 71.97 | -1.266E+02 | 84.87 | 75.51 | .12 | 75.12 | -7.62 |
| 7.50 | -7.733E+03 | 104.99 | 2.606E+03 | 72.08 | -1.307E+02 | 84.10 | 76.09 | .12 | 75.52 | -7.52 |
| 8.00 | -7.525E+03 | 101.83 | 2.891E+03 | 72.17 | -1.354E+02 | 83.40 | 76.63 | .12 | 75.92 | -7.44 |
| 8.50 | -7.468E+03 | 99.63 | 3.206E+03 | 72.24 | -1.404E+02 | 82.73 | 77.14 | .12 | 76.30 | -7.39 |
| 9.00 | -7.517E+03 | 98.07 | 3.552E+03 | 72.28 | -1.459E+02 | 82.08 | 77.63 | .12 | 76.67 | -7.37 |
| 9.50 | -7.647E+03 | 96.97 | 3.931E+03 | 72.28 | -1.518E+02 | 81.45 | 78.09 | .13 | 77.03 | -7.39 |

```
                                 2-D MODEL SECTION  MODEL C     -- RESISTIVITY
    -7        -6        -5        -4        -3        -2        -1         0         1         2         3         4         5         6         7
Z=0 *********************************************************************************************************************************************
    000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
--  *********************************************************************************************************************************************
    111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
Z=1 111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
    111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
    *******************************************************************************************11111111111111111111111111111111111111111111111111
    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
Z=2 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
Z=3 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
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    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
Z=4 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
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Z=5 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
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Z=6 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
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Z=7 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
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Z=8 222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111
    222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222*11111111111111111111111111111111111111111111111111

                                 INDEX FOR RESISTIVITY (OHM. M)
   C =   10.00      1 =  200.00     2 =    50.00      3 =    -0.00     4 =   -0.00
   5 =   -0.00      6 =   -0.00     7 =    -0.00      8 =    -0.00     9 =   -0.00
   UNIT IN X SCALING =     1.00     UNIT IN Z SCALING =     1.00

                                 CONFIGURATION DISTANCE UNIT =        4.000
```

CASE MODEL C

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 1.50 AND AT X2= -2.00 Y2= 0.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY 0.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -3.187E+02 | 49.98 | -5.104E+02 | 54.99 | 2.377E+01 | 53.78 | 51.43 | .08 | 55.91 | -2.51 |
| -9.00 | -2.565E+02 | 47.54 | -3.915E+02 | 53.67 | 2.053E+01 | 53.18 | 49.46 | .07 | 54.04 | -3.26 |
| -8.50 | -2.038E+02 | 44.78 | -2.932E+02 | 51.99 | 1.755E+01 | 52.26 | 47.25 | .07 | 51.92 | -4.10 |
| -8.00 | -1.596E+02 | 41.65 | -2.136E+02 | 49.89 | 1.483E+01 | 50.98 | 44.78 | .07 | 49.52 | -5.07 |
| -7.50 | -1.234E+02 | 38.09 | -1.505E+02 | 47.36 | 1.238E+01 | 49.28 | 42.06 | .07 | 46.85 | -6.20 |
| -7.00 | -9.464E+01 | 34.02 | -1.020E+02 | 44.34 | 1.019E+01 | 47.12 | 39.13 | .07 | 43.96 | -7.55 |
| -6.50 | -7.283E+01 | 29.29 | -6.616E+01 | 40.81 | 8.280E+00 | 44.44 | 36.06 | .06 | 40.94 | -9.15 |
| -6.00 | -5.816E+01 | 23.45 | -4.084E+01 | 36.80 | 6.667E+00 | 41.20 | 32.99 | .06 | 38.07 | -10.97 |
| -5.50 | -5.329E+01 | 14.70 | -2.411E+01 | 32.37 | 5.385E+00 | 37.42 | 30.11 | .06 | 35.82 | -12.74 |
| -.50 | -1.247E+01 | 23.69 | -6.440E+01 | 36.25 | -2.475E+00 | 35.90 | 24.26 | .05 | 17.72 | -5.54 |
| 0.00 | -2.307E+01 | 28.48 | -1.191E+02 | 43.03 | -3.761E+00 | 41.71 | 29.13 | .05 | 22.82 | -5.35 |
| .50 | -3.802E+01 | 32.73 | -1.893E+02 | 47.97 | -5.286E+00 | 46.69 | 33.45 | .06 | 27.35 | -5.05 |
| 1.00 | -5.806E+01 | 36.47 | -2.767E+02 | 51.84 | -7.054E+00 | 51.07 | 37.25 | .06 | 31.37 | -4.76 |
| 1.50 | -8.391E+01 | 39.77 | -3.829E+02 | 55.06 | -9.066E+00 | 55.01 | 40.60 | .06 | 34.94 | -4.52 |
| 2.00 | -1.163E+02 | 42.76 | -5.102E+02 | 57.85 | -1.132E+01 | 58.63 | 43.63 | .06 | 38.18 | -4.30 |
| 2.50 | -1.560E+02 | 45.60 | -6.606E+02 | 60.35 | -1.383E+01 | 62.00 | 46.49 | .07 | 41.23 | -4.07 |
| 3.00 | -2.037E+02 | 48.38 | -8.361E+02 | 62.59 | -1.658E+01 | 65.13 | 49.28 | .07 | 44.17 | -3.80 |
| 3.50 | -2.603E+02 | 51.11 | -1.039E+03 | 64.62 | -1.958E+01 | 68.05 | 52.01 | .07 | 47.01 | -3.51 |
| 4.00 | -3.263E+02 | 53.79 | -1.271E+03 | 66.45 | -2.283E+01 | 70.75 | 54.66 | .07 | 49.77 | -3.20 |
| 4.50 | -4.026E+02 | 56.40 | -1.534E+03 | 68.10 | -2.632E+01 | 73.25 | 57.23 | .07 | 52.43 | -2.88 |
| 5.00 | -4.900E+02 | 58.94 | -1.830E+03 | 69.60 | -3.007E+01 | 75.57 | 59.71 | .08 | 55.00 | -2.56 |
| 5.50 | -5.891E+02 | 61.41 | -2.162E+03 | 70.95 | -3.406E+01 | 77.69 | 62.12 | .08 | 57.48 | -2.23 |
| 6.00 | -7.008E+02 | 63.81 | -2.531E+03 | 72.16 | -3.830E+01 | 79.65 | 64.44 | .08 | 59.88 | -1.91 |
| 6.50 | -8.257E+02 | 66.14 | -2.939E+03 | 73.24 | -4.280E+01 | 81.44 | 66.68 | .08 | 62.19 | -1.59 |
| 7.00 | -9.646E+02 | 68.40 | -3.388E+03 | 74.21 | -4.754E+01 | 83.08 | 68.86 | .08 | 64.43 | -1.27 |
| 7.50 | -1.118E+03 | 70.61 | -3.881E+03 | 75.06 | -5.253E+01 | 84.56 | 70.97 | .09 | 66.60 | -.96 |
| 8.00 | -1.288E+03 | 72.78 | -4.419E+03 | 75.81 | -5.777E+01 | 85.90 | 73.02 | .09 | 68.72 | -.64 |
| 8.50 | -1.473E+03 | 74.90 | -5.005E+03 | 76.44 | -6.326E+01 | 87.10 | 75.03 | .09 | 70.79 | -.32 |
| 9.00 | -1.676E+03 | 77.00 | -5.639E+03 | 76.97 | -6.900E+01 | 88.16 | 77.00 | .09 | 72.81 | .01 |
| 9.50 | -1.896E+03 | 79.09 | -6.325E+03 | 77.39 | -7.499E+01 | 89.09 | 78.95 | .09 | 74.82 | .34 |

CASE MODEL C

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 1.50 AND AT X2= -2.00 Y2= 0.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY 3.0000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -2.450E+02 | 51.02 | 1.436E+03 | 45.92 | 1.937E+01 | 54.74 | 51.47 | .07 | 57.61 | -1.05 |
| -9.00 | -1.955E+02 | 49.50 | 9.435E+02 | 44.93 | 1.660E+01 | 54.22 | 49.32 | .06 | 55.64 | -1.05 |
| -8.50 | -1.538E+02 | 47.11 | 6.156E+02 | 43.63 | 1.406E+01 | 53.40 | 46.91 | .06 | 53.38 | -1.00 |
| -8.00 | -1.191E+02 | 44.42 | 3.968E+02 | 42.02 | 1.176E+01 | 52.26 | 44.22 | .06 | 50.78 | -.86 |
| -7.50 | -9.093E+01 | 41.39 | 2.514E+02 | 40.08 | 9.709E+00 | 50.75 | 41.24 | .06 | 47.77 | -.58 |
| -7.00 | -6.852E+01 | 38.00 | 1.561E+02 | 37.80 | 7.896E+00 | 48.84 | 37.96 | .06 | 44.30 | -.11 |
| -6.50 | -5.135E+01 | 34.20 | 9.474E+01 | 35.16 | 6.325E+00 | 46.49 | 34.42 | .05 | 40.27 | .67 |
| -6.00 | -3.902E+01 | 29.92 | 5.637E+01 | 32.14 | 5.000E+00 | 43.68 | 30.66 | .05 | 35.61 | 1.94 |
| -5.50 | -3.167E+01 | 24.94 | 3.335E+01 | 28.76 | 3.930E+00 | 40.47 | 26.82 | .05 | 30.28 | 4.08 |
| -.50 | 2.082E+02 | 50.63 | -8.541E+01 | 44.44 | -2.815E+01 | 57.63 | 45.38 | .08 | 38.29 | -2.74 |
| 0.00 | -6.584E+02 | 74.33 | -9.748E+01 | 45.89 | -2.311E+01 | 56.91 | 46.68 | .08 | 40.31 | -5.06 |
| .50 | -3.431E+03 | 98.76 | -1.179E+02 | 48.00 | -2.210E+01 | 58.36 | 48.09 | .08 | 42.56 | -6.01 |
| 1.00 | -8.396E+02 | 17.78 | -1.467E+02 | 50.36 | -2.266E+01 | 60.50 | 49.70 | .08 | 44.89 | -6.38 |
| 1.50 | -6.376E+02 | 30.93 | -1.849E+02 | 52.83 | -2.409E+01 | 62.91 | 51.47 | .08 | 47.23 | -6.54 |
| 2.00 | -6.010E+02 | 37.27 | -2.336E+02 | 55.33 | -2.610E+01 | 65.44 | 53.31 | .08 | 49.50 | -6.57 |
| 2.50 | -6.187E+02 | 41.83 | -2.942E+02 | 57.82 | -2.858E+01 | 68.00 | 55.22 | .08 | 51.70 | -6.45 |
| 3.00 | -6.652E+02 | 45.74 | -3.682E+02 | 60.24 | -3.143E+01 | 70.51 | 57.17 | .08 | 53.85 | -6.17 |
| 3.50 | -7.321E+02 | 49.31 | -4.573E+02 | 62.57 | -3.463E+01 | 72.95 | 59.15 | .09 | 55.94 | -5.78 |
| 4.00 | -8.160E+02 | 52.65 | -5.631E+02 | 64.79 | -3.815E+01 | 75.26 | 61.14 | .09 | 57.99 | -5.33 |
| 4.50 | -9.156E+02 | 55.80 | -6.872E+02 | 66.88 | -4.197E+01 | 77.44 | 63.11 | .09 | 60.00 | -4.84 |
| 5.00 | -1.030E+03 | 58.78 | -8.314E+02 | 68.85 | -4.607E+01 | 79.49 | 65.06 | .09 | 61.96 | -4.33 |
| 5.50 | -1.160E+03 | 61.63 | -9.975E+02 | 70.68 | -5.045E+01 | 81.39 | 66.98 | .09 | 63.87 | -3.83 |
| 6.00 | -1.306E+03 | 64.36 | -1.187E+03 | 72.37 | -5.510E+01 | 83.15 | 68.86 | .09 | 65.74 | -3.32 |
| 6.50 | -1.467E+03 | 66.98 | -1.403E+03 | 73.94 | -6.003E+01 | 84.78 | 70.70 | .09 | 67.57 | -2.82 |
| 7.00 | -1.645E+03 | 69.50 | -1.645E+03 | 75.38 | -6.522E+01 | 86.26 | 72.50 | .10 | 69.36 | -2.32 |
| 7.50 | -1.839E+03 | 71.94 | -1.917E+03 | 76.69 | -7.067E+01 | 87.61 | 74.25 | .10 | 71.10 | -1.83 |
| 8.00 | -2.052E+03 | 74.32 | -2.220E+03 | 77.87 | -7.638E+01 | 88.83 | 75.97 | .10 | 72.81 | -1.33 |
| 8.50 | -2.283E+03 | 76.63 | -2.556E+03 | 78.92 | -8.235E+01 | 89.92 | 77.65 | .10 | 74.49 | -.84 |
| 9.00 | -2.533E+03 | 78.90 | -2.926E+03 | 79.84 | -8.858E+01 | 90.88 | 79.30 | .10 | 76.14 | -.33 |
| 9.50 | -2.802E+03 | 81.15 | -3.334E+03 | 80.63 | -9.506E+01 | 91.72 | 80.93 | .10 | 77.78 | .18 |

CASE MODEL C

TRANSMITTING DIPOLE IS INCLINED TO THE STRIKE OF THE INHOMOGENEITY

CURRENT ELECTRODE POSITIONS ARE AT X1= -4.00 Y1= 1.50 AND AT X2= -2.00 Y2= 0.00
LENGTH OF THE RECEIVER DIPOLES ARE .250

POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTED ON Y-AXIS BY -3.5000

| OBS.PT. | GMFX | APRES(X) | GMFY | APRES(Y) | GMFP | APRESP | RESKEL | CONKEL | APREST | THETA |
|---|---|---|---|---|---|---|---|---|---|---|
| -9.50 | -1.454E+05 | 417.41 | -6.438E+02 | 56.84 | 7.294E+01 | 50.21 | 56.87 | .12 | 60.97 | -2.12 |
| -9.00 | 6.048E+03 | 83.09 | -5.614E+02 | 56.47 | 7.328E+01 | 49.66 | 56.75 | .12 | 61.30 | -2.47 |
| -8.50 | 2.411E+03 | 69.57 | -4.935E+02 | 56.04 | 7.575E+01 | 48.72 | 56.65 | .11 | 61.69 | -2.69 |
| -8.00 | 1.304E+03 | 64.44 | -4.396E+02 | 55.61 | 8.190E+01 | 47.17 | 56.57 | .11 | 62.10 | -2.71 |
| -7.50 | 7.997E+02 | 61.35 | -4.000E+02 | 55.26 | 9.566E+01 | 44.43 | 56.53 | .10 | 62.47 | -2.47 |
| -7.00 | 5.279E+02 | 59.13 | -3.764E+02 | 55.16 | 1.307E+02 | 38.48 | 56.53 | .10 | 62.67 | -1.90 |
| -6.50 | 3.676E+02 | 57.48 | -3.740E+02 | 55.69 | 2.879E+02 | 14.23 | 56.60 | .10 | 62.58 | -.91 |
| -6.00 | 2.683E+02 | 56.39 | -4.084E+02 | 57.70 | -4.084E+02 | 118.01 | 56.79 | .09 | 62.09 | .61 |
| -5.50 | 2.051E+02 | 56.17 | -5.406E+02 | 64.28 | -9.555E+01 | 70.70 | 57.25 | .09 | 61.33 | 2.69 |
| -.50 | -3.110E+02 | 40.57 | 8.993E+01 | 42.86 | -1.012E+01 | 56.88 | 42.69 | .06 | 42.24 | .82 |
| 0.00 | -2.534E+02 | 41.66 | 1.097E+02 | 44.04 | -1.088E+01 | 58.08 | 43.68 | .06 | 42.65 | 1.14 |
| .50 | -2.396E+02 | 43.16 | 1.386E+02 | 45.74 | -1.193E+01 | 59.63 | 45.11 | .06 | 43.43 | 1.42 |
| 1.00 | -2.457E+02 | 44.77 | 1.791E+02 | 47.70 | -1.324E+01 | 61.40 | 46.70 | .06 | 44.40 | 1.71 |
| 1.50 | -2.643E+02 | 46.41 | 2.342E+02 | 49.81 | -1.482E+01 | 63.33 | 48.34 | .06 | 45.49 | 2.00 |
| 2.00 | -2.928E+02 | 48.15 | 3.080E+02 | 52.02 | -1.664E+01 | 65.36 | 50.02 | .06 | 46.74 | 2.21 |
| 2.50 | -3.301E+02 | 50.10 | 4.053E+02 | 54.30 | -1.870E+01 | 67.43 | 51.81 | .07 | 48.17 | 2.28 |
| 3.00 | -3.760E+02 | 52.22 | 5.322E+02 | 56.62 | -2.101E+01 | 69.51 | 53.73 | .07 | 49.79 | 2.22 |
| 3.50 | -4.307E+02 | 54.43 | 6.961E+02 | 58.97 | -2.356E+01 | 71.54 | 55.72 | .07 | 51.57 | 2.09 |
| 4.00 | -4.944E+02 | 56.57 | 9.062E+02 | 61.32 | -2.634E+01 | 73.50 | 57.77 | .07 | 53.45 | 1.94 |
| 4.50 | -5.676E+02 | 58.90 | 1.174E+03 | 63.68 | -2.937E+01 | 75.37 | 59.84 | .07 | 55.40 | 1.79 |
| 5.00 | -6.510E+02 | 61.10 | 1.513E+03 | 66.05 | -3.263E+01 | 77.14 | 61.90 | .07 | 57.39 | 1.66 |
| 5.50 | -7.450E+02 | 63.26 | 1.940E+03 | 68.44 | -3.613E+01 | 78.81 | 63.95 | .07 | 59.38 | 1.55 |
| 6.00 | -8.503E+02 | 65.37 | 2.478E+03 | 70.86 | -3.988E+01 | 80.37 | 65.97 | .08 | 61.38 | 1.46 |
| 6.50 | -9.676E+02 | 67.44 | 3.151E+03 | 73.33 | -4.386E+01 | 81.81 | 67.96 | .08 | 63.37 | 1.40 |
| 7.00 | -1.098E+03 | 69.46 | 3.995E+03 | 75.88 | -4.809E+01 | 83.15 | 69.93 | .08 | 65.35 | 1.34 |
| 7.50 | -1.241E+03 | 71.44 | 5.053E+03 | 78.53 | -5.255E+01 | 84.38 | 71.87 | .08 | 67.30 | 1.31 |
| 8.00 | -1.398E+03 | 73.40 | 6.379E+03 | 81.32 | -5.726E+01 | 85.49 | 73.78 | .08 | 69.24 | 1.29 |
| 8.50 | -1.570E+03 | 75.33 | 8.047E+03 | 84.29 | -6.222E+01 | 86.50 | 75.67 | .08 | 71.17 | 1.28 |
| 9.00 | -1.757E+03 | 77.24 | 1.015E+04 | 87.50 | -6.741E+01 | 87.39 | 77.56 | .09 | 73.09 | 1.27 |
| 9.50 | -1.961E+03 | 79.16 | 1.283E+04 | 91.02 | -7.285E+01 | 88.18 | 79.45 | .09 | 75.02 | 1.28 |