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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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October 1976

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RESISTIVITY MODELLING FOR ARBITRARILY SHAPED

TWO DIMENSIONAL STRUCTURES

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

by

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October 1976

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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 1/4th dipole length (unit) resolution is sought in x-direction of the mesh and 1/6th 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 +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 K_y 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 sub-program 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.

<u>VARIABLE NAME</u>	<u>DIMENSION REQUIRED</u>
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)

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:

<u>VARIABLE NAME</u>	<u>DIMENSION REQUIRED</u>
X	NNODX
Z	NNODZ
ZSHIFT	NZSFT
ZRSHT	NZRSFT
YSHT	NYSFT
RESIS	10
PFE	10
DX	(NNODX-1)
DZ	(NNODZ-1)
ICONFIG	NARRAY

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_g words in SCM (Small Core Memory) and 215,000_g 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 coordi-

nodes 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.....    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,(NNCDX-1)  SEPARATION BETWEEN NODES IN X-DIRECTION
C          DZ(I),I=1,(NNCDZ-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.....    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.....    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 , NXENC -- 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 FOLE-DIPOLE
C      2, FOR RECONNAISSANCE BIPCLE-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 BIFOLE PERPENDICULAR TO
C      STRIKE FOR ICONFIG=2
C      INCLINE.EQ. 1 -- FOR TRANSMITTING BIFOLE 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 PCLE 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-CP
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 COORINATES....
C      NTX = NUMBER OF TRANSMITTING ELECTRODE NODES(PROJECTED AT Z=0)
C      NRX = NUMBER OF RECEIVER ELECTRODE NOCES(PROJECTED AT Z=0)
C      ITXP(I),I=1,NTX -- ARRAY OF NODE NUMEERS OF THE TRANSMITTER
C      ELECTRODES
C      IRXP(I),I=1,NRX -- ARRAY OF NCOE 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 = NUMEER OF SURFACE AND SUBSURFACE LAYERS OF RECEIVER
C      ELECTRODES
C      ZRSHT(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 MDELS ARE TO BE COMPUTED
C          MORE .NE. 0 -- IF MORE THAN ONE MDEL IS TO BE COMPUTED.
C          AT THE END OF THE LAST DATA SET MORE SHCULD BE READ .EQ. 0
C
C+++++
C
C
C          INTEGER OPTPUN
C          LARGE A(1808,17),RS(1808,23)
C          DIMENSION VKY(5000),V(1500)
C          DIMENSION X(120),Z(20),YKY(10),ITXP(60),IRXP(120),YSHIFT(40),
C          1ZSHIFT(20),ZRSHIFT(20),ICODE(20,120),RESIS(10),PFE(10),IXS(60),
C          2IZS(60),TITLE(3),COND(120,20),DX(120),DZ(20),ICONFIG(25)
C          DIMENSION XMAT(1808)
C          COMMON /PACK1/ INCLINE,ISHIFT,NRLIM
C          COMMON /GANG1/ OPTPUN,THETA,IPRINT
C          READ 1, NNODX,NNODZ,NKY,NXBEG,NXEND,NARRAY,XSCAL,ZSCAL,UNIT
C          NELX=NNODX-1
C          NELZ=NNODZ-1
C          READ 2, (DX(I),I=1,NELX)
C          READ 3, (DZ(J),J=1,NELZ)
C          READ 4, (YKY(K),K=1,NKY)
C          READ 5, (ICONFIG(I),I=1,NARRAY)
C          READ 6, NTX,NZSFT,NRX,NYSFT,NZRSFT
C          READ 7, (ITXP(I),I=1,NTX)
C          READ 8, (IRXP(J),J=1,NRX)
C          READ 9, (ZSHIFT(I),I=1,NZSFT)
C          READ 10, (ZRSHIFT(J),J=1,NZRSFT)
C          READ 11, (YSHIFT(K),K=1,NYSFT)
C          888 READ 12, IPKEY, (TITLE(I),I=1,3)
C          IF(IPKEY .NE. 0) GO TO 101
C          READ 14, (RESIS(I),I=1,10)
C          GO TO 102
C          101 READ 14, (RESIS(I),I=1,10)
C          READ 15, (PFE(I),I=1,10)
C          102 CONTINUE
C          DO 103 I=1,NNODZ
C          READ 16, (ICODE(I,J),J=NXBEG,NXEND)
C          103 CONTINUE
C          1 FORMAT(6I5,3F10.5)
C          2 FORMAT(20F4.0)
C          3 FORMAT(20F4.0)
C          4 FORMAT(8F10.5)
C          5 FORMAT(20I5)
C          6 FORMAT(5I6)
C          7 FORMAT(24I3)
C          8 FORMAT(24I3)
C          9 FORMAT(10F8.3)
C          10 FORMAT(10F8.3)
C          11 FORMAT(10F8.3)
C          12 FORMAT(I5,3A4)

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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,NNCDZ,NKY,NXBEG,NXEND,NARRAY,XSCAL,ZSCAL,UNIT
      PRINT 2, (DX(I),I=1,NELX)
      PRINT 3, (DZ(J),J=1,NELZ)
      PRINT 4, (YK(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, (ZRSHT(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,NNCDX
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,NNCDZ
      DO 106 IX=1,NNCDX
      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

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      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,NTXTCT,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. 1 ... INTEGRATION BY TRAPEZOIDAL RULE
      IOPT=0
      CALL YTRAN (NRX,NYSFT,NZRSFT,YSHIFT,NTX,NZSFT,NKY,NTXTOT,NRXTOT,
      1NRXTIT,YKY,VKY,V,ICPT,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,NTXTCT,NRXTIT,NNODTOT,

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2NBAND,NBAND2,NNOC2,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 (NNOC2,NTXCNT)
      DIMENSION XMAT (NNODE)
      DIMENSION IXS (1),IZS (1),C (60)
      DIMENSION VKY (NKY,NTXTOT,NRXTIT)
      DIMENSION COND (120,1),OX (1),OZ (1),ITXP (1),IRXP (1),X (1),Z (1),
1ZRS (1)
      DIMENSION NSOURCE (60)
      EXTERNAL AK0,AK1
      DATA PI/3.141592653/
      AMP=2.0*PI
      XCENR= (X (1)+X (NNODX))/2.0
      NELX=NNODX-1
      NELZ=NNODZ-1
      CALL SECND (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)*NNCOZ+IZSP
      DO 100 IX=1,NNODX
      DO 100 IZ=1,NNCOZ
      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,NNCOZ
      N= (IX-1)*NNODZ+IZ
      IF ( IX .EQ. 1 .OR. IX .EQ. NNODX) GO TO 310
      IF ( IZ .EQ. NNCOZ) GO TO 315
      IF ( IZ .EQ. 1) GO TO 320
C.....      COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF AN INTERIOR
C              NODE

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      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 (F A NODE
C LOCATED ON 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 (F 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 .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(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

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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)-XCENR)
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)*
1 DZ(IZ)/4.0)
XTX=ABS(X(IX)-XCENR)
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)-XCENR)
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)*CZ(IZ-1)*COS(THETA2)+C(NEND)*DX(IX)*COS(THETA1))*
1 YLAMDA*ARG3
C(NCENT)=- (C(N1)+C(NMIDL)+C(NMIDU)+C(NEND)-YLAMDA*YLAMDA*AREACON)+
1 CADD

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4503 DO 4511 KC=1,NBAND2
4511 A(N,KC)=C(KC)
      GO TO 350
330 CONTINUE
      DO 460 KC=1,NBAND
460 C(KC)=0.00
      IF (IZ .GT. 1 .AND. IZ .NE. NNODZ) GO TO 4601
      IF (IZ .EQ. NNODZ) GO TO 4602
C..... COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF 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 .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)=-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 (NEND)-YLAMDA*YLAMDA*AREACON)+
1 CADD
      GO TO 4603
C..... COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF 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 .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)=- ((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 (NEND)-YLAMDA*YLAMDA*AREACON)+
1 CADD
      GO TO 4603
C..... COEFFICIENTS FOR THE SELF ADJOINT EQUATION OF 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))*
1 YLAMDA*ARG3
      C(NCENT)=- (C(N1)+C(NMIDL)+C(NMIDU)+C(NENC)-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,NODE,NNODZ,NNODE,RS,NNODE,NTXCNT,14,D1,D2,NBAND2,
1 XMAT,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)
      IRDWNX=IRX+(IDWN-1)*NRX
      NRXCHK=(IRXX-1)*NNODZ+IZRS
      VKY(IKY,ITX,IRDWNX)=RS(NRXCHK,ITX)
C      PRINT 1411, IKY,YLAMDA,ITX,IRDWNX,VKY(IKY,ITX,IRCHNX)
C1411  FORMAT(2X,*IKY=*,I3,2X,*LAMDA=*,F12.5,2X,*ITX=*,I5,2X,*IRDWNX=*,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 MODIFIED BESSEL FUNCTION OF ORDER 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*3
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,IOGT,O1,O2,NBND,X,IER)

```

```

C
C
C FUNCTION          - LINEAR EQUATION SOLVER - SYMMETRIC BAND
C                   STORAGE MODE - SFACE 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                   AND THEREFORE HAS DIMENSION N BY (NC+1).
C                   (INPUT)
C                   ON OUTPUT, A IS REPLACED BY L WHERE
C                   A = L*L-TRANPOSE, 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                   RECIPROCAL FORM. (OUTPUT)
C                   N  - ORDER OF MATRIX A AND NUMBER OF ROWS IN B.
C                   (INPUT)
C                   NC - NUMBER OF UPPER OR LOWER CO-DIAGONALS OF A.
C                   (INPUT)
C                   NBND= NC+1
C                   IA - ROW DIMENSION OF A AS SPECIFIED IN THE MAIN

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```

C          PROGRAM.(INPUT)
C          B      - INPUT MATRIX OF DIMENSION N X M CONTAINING
C                  THE M RIGHT-HAND SIDES OF THE EQUATION
C                  AX = B.
C                  ON OUTPUT, THE N X M SOLUTION MATRIX X
C                  REPLACES B.
C          IB     - ROW DIMENSION OF B AS SPECIFIED IN THE MAIN
C                  PROGRAM.(INPUT)
C          M      - NUMBER OF RIGHT HAND SIDES (COLUMNS IN B)
C                  (INPUT)
C          IDGT   - THE ELEMENTS OF A ARE ASSUMED TO BE CORRECT
C                  TO ICG1 DECIMAL DIGITS (INPUT - CURRENTLY
C                  NOT USED)
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
C          LARGE A(IA,NBND) , B(IB,M)
C          DIMENSION X(N)
C          IER = 0
C
C                  DECOMPOSITION OF MATRIX A INTO
C                  L*L-TRANSPOSE
C          CALL LUCCMP(A,N,NC,IA,D1,D2,NBND,IER)
C          IF (IER .NE. 0) GO TO 9000
C          DO 5 I = 1,M
C
C                  SOLUTION OF AX = B
C          DO 51 IX=1,N
C          51 X(IX)=B(IX,I)
C          CALL SOLVE(A,X,N,NC,IA,NBND)
C          DO 52 IX=1,N
C          52 B(IX,I)=X(IX)
C          5 CONTINUE
C          9000 CONTINUE
C          RETURN
C          END
C          SUBROUTINE LUCCMP(A,N,NC,IA,D1,D2,NBND,IER)
C
C          FUNCTION      - LU DECOMPOSITION OF A POSITIVE DEFINITE
C                        SYMMETRIC BAND MATRIX - CHOLESKY
C                        DECOMPOSITION
C          PARAMETERS    A      - N X N POSITIVE DEFINITE SYMMETRIC BAND MATRIX
C                                STORED IN SYMMETRIC BAND STORAGE MODE.
C                                A SHOULD BE AN ARRAY OF SIZE N BY NC+1, AT
C                                LEAST. (INPUT)
C                                N      - ROW DIMENSION OF A FOR THE PRESENT CALL
C                                    (INPUT).
C                                NC     - NUMBER OF UPPER OR LOWER CO-DIAGONALS (INPUT)
C                                IA     - ROW DIMENSION OF A AS SPECIFIED IN THE MAIN
C                                    PROGRAM. (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                                    RECIPROCAL OF THE ACTUAL DIAGONAL ELEMENTS.
C                                IU     - ROW DIMENSION OF UL AS SPECIFIED IN THE MAIN
C                                    PROGRAM. (INPUT)
C                                D1,D2  - COMPONENTS OF THE DETERMINANT OF A.

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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
C  LARGE A(IA,NBND)
C  DATA                ZERO,ONE,FOUR,SIXTN,SIXTH/0.,1.,4.,16.,.0625/
C  IER = 0
C  RN = ONE/(N*SIXTN)
C  D1 = ONE
C  D2 = ZERO
C  NCP1 = NC+1
C  IF (NC .EQ. 0) GO TO 15
C
C          INITIALIZE ZERO ELEMENTS
C  DO 10 I = 1,NC
C    DO 5 J = I,NC
C      K = NCP1-J
C    A(I,K)=ZERO
C  5  CONTINUE
C 10  CONTINUE
C
C          I IS ROW INDEX OF ELEMENT BEING
C          COMPUTED
C 15  DO 60 I = 1,N
C    IMNCP1 = I-NCP1
C    I1 = MAX0(1,1-IMNCP1)
C
C          J IS COLUMN INDEX OF ELEMENT BEING
C          COMPUTED
C
C    DO 60 J = I1,NCP1
C
C          L IS ROW INDEX OF PREVIOUSLY COMPUTED
C          VECTOR BEING USED TO COMPUTE INNER
C          PRODUCT
C
C    L = IMNCP1+J
C    I2 = NCP1-J
C    SUM = A(I,J)
C    JM1 = J-1
C    IF (JM1) 30,30,20
C 20  DO 25 K = 1,JM1
C
C          M IS COLUMN INDEX
C
C    M = I2+K
C    SUM=SUM-A(I,K)*A(L,M)
C 25  CONTINUE
C 30  IF (J .NE. NCP1) GO TO 55
C    IF (A(I,J)+SUM*RN .LE. A(I,J)) GO TO 65
C  A(I,J)=ONE/SQRT(SUM)
C
C          UPDATE THE DETERMINANT
C
C    D1 = D1*SUM
C 35  IF (ABS(D1)-ONE) 45,45,40
C 40  D1 = D1*SIXTH
C    D2 = D2+FOUR
C    GO TO 35
C 45  IF (ABS(D1)-SIXTH) 50,50,60
C 50  D1 = D1*SIXTN
C    D2 = D2-FOUR
C    GO TO 45
C 55  A(I,J)=SUM*A(L,NCP1)
C 60  CONTINUE
C    GO TO 9005
C 65  IER=1
C 9005 RETURN

```

```

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

```



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25     CONTINUE
30     X(K) = SUM*UL(K,NC1)
35     CONTINUE
40     RETURN
      END
      SUBROUTINE YTRAN (NRX,NYSFT,NZRSFT,YSHIFT,NTX,NZSFT,NKY,NTXTOT,
1NRXTCT,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 FCURIER 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+++++
      DIMENSION VKY(NKY,NTXTOT,NRXTIT),V(NTXTCT,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)

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      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,NNCDZ,UNIT)
C+++++
C.....      AUTHOR ....      AEHIJIT 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,NTXTCT,NRXTOT,NRX,IRXP,NTX,ITXP,
1NYSFT,YSHIFT,V,NNODX,NNODZ)
      GO TO 99
2 CALL RECON2D(X,Z,NTXTCT,NRXTOT,NTX,NRX,ITXP,IRXP,NYSFT,YSHIFT,
1TITLE,V,NNODX,NNCDZ)
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,NNCDX,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),GEOMFC(20),GECMFP(20),APRES1(25
1),APRES2(25),AFIF1(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 GECMFD/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
1,0.966,0.97,0.97,0.97,0.97,0.97,0.97,0.97,0.97/
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(BCY))
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=(IBCY-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)

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DYD=ABS(ABS(YBTX-YCRX)-YSHIFT(IBDY))
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))*GEOMFO(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)=((APFOC1(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
URATION 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
ATION 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. 1) 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 CONFIGURATI(N
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*)

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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....
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(1+1)
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....
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*)

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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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XCENR=(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)-XCENR
TXB=X(NIB)-XCENR
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
C JRX=0
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)-XCENR
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)

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RAD2=1.0/SQRT(AD2*AD2+RYD2*RYD2)
RBD2=1.0/SQRT(BD2*BD2+RYD2*RYD2)
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+FAC*RAC-TXLONG*TXLONG)/(2.0*RAC*RBC)
DELTA=ACOS(COSDEL)
C..... EVALUATE RESISTIVITY PARAMETERS A LA KELLEF
DENOM1=RAC3-RBC3-RAD1+RBC1
DENOM2=RAC3-RBC3-RAD2+RBC2
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))
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 HOMOGENECUS 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,*ANC*
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) .EG. 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(NIE)
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)-XCENR
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+J-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=JCCX-NRX-1
      JEE1X=JCCX+1
      JEE2X=JCCX-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,JCC)
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
DENQM2=RAC3-RBC3-RAD2+RBC2
COSDEL=(RBC*RBC+RAC*RAC-TXLONG*TXLONG)/(2.0*RAC*RBC)
DELTA=ACCS(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)=ETCT*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*CELVX+DELVY*CELVY)
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,DELV
C3139 FORMAT(10X,*RXP=*,F10.3,*YSHIFT=*,F10.3,*GMF=*,E12.4,*DELV=*,
C 1E14.5)
APRES1(JRX)=ABS(CELV1*GMF1(JRX))
APRES2(JRX)=ABS(CELV2*GMF2(JRX))
APRESX(JRX)=ABS(CELVX*GMFX(JRX))
APRESY(JRX)=ABS(CELVY*GMFY(JRX))
APRESP(JRX)=ABS(CELV*GMFP(JRX))*CRFX(JRX)
C.... EVALUATE THE TOTAL APPARENT RESISTIVITY IN THE VECTOR E-FIELD
C DIRECTION
RXTL=RXL
DELVT=ETCT*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(HOELV1 .NE. 0.0) BETA=ATAN2(HOELV2,+CELV1)
      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
1 INCLINED 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
1 THE RECEIVER DIPOLES ARE *,F10.3,/)
      PRINT 912, RYY
912 FORMAT (/,20X,*POINTS OF OBSERVATION ARE SITUATED ON A LINE SHIFTE
1 0 ON Y-AXIS BY *,F12.4,/)
      PRINT 1110
      PRINT 914, ((RXP(JRX),GMFX(JRX),APRESX(JRX),GMFY(JRX),APRESY(JRX),
1 GMFP(JRX),APRESP(JRX),RESKEL(JRX),CONKEL(JRX),APREST(JRX),THETA(JR
1 X)),JRX=1,NJRX)
914 FORMAT(7X,F8.2,4X,E10.3,2X,F8.2,2X,E10.3,2X,F8.2,2X,E10.3,2X,
1 F8.2,2X,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,NJRX
C      DO 1444 I=1,NRLX
C      IF(APRESF(J) .NE. 0.00) GO TO 1444
C      APRESP(J)=(APRESF(J-1)+APRESF(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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2-D MODEL SECTION MCEL A -- RESISTIVITY

	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
Z=0	*****														
Z=1	*****														
Z=2	*****														
Z=3	*****														
Z=4	*****														
Z=5	*****														
Z=6	*****														
Z=7	*****														
Z=8	*****														

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

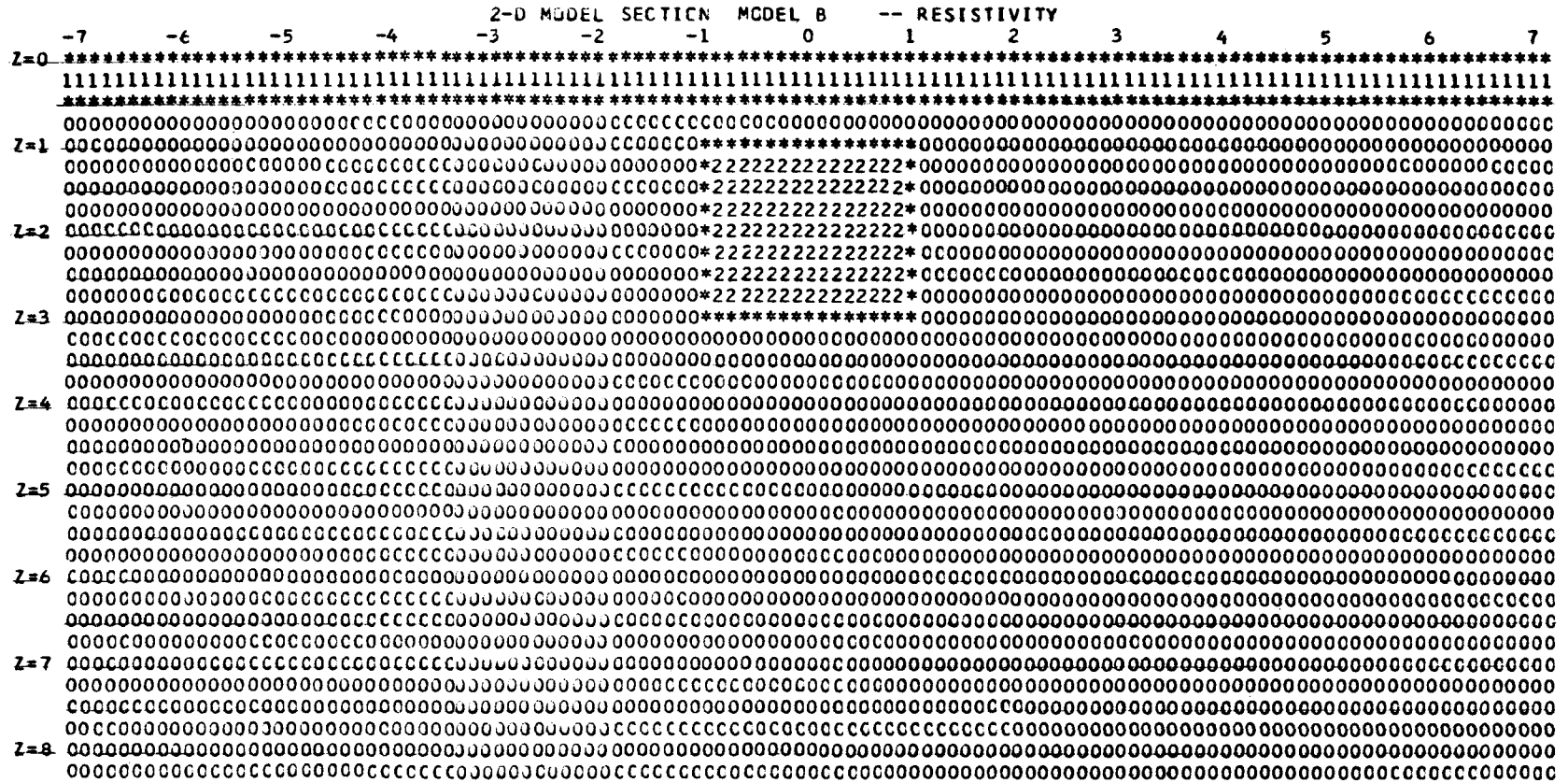
CONFIGURATION DISTANCE UNIT = 4.000

CASE MODEL A
 DIPPLE-DIPPLE CONFIGURATION OF ELECTRODES
 PROFILE-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	85.9	84.5	102.8	101.0	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	87.0	81.1	87.0	88.8	100.3	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	88.7	82.1	82.1	88.7	85.3	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	84.9	82.0	84.1	82.0	84.5	82.4	108.5	107.1	103.6	102.0	101.5	102.1	4
5					103.5	103.5	105.2	109.1	105.8	80.7	83.4	84.5	89.8	84.5	83.4	80.7	109.8	109.1	105.2	103.5	103.5		5
6						105.7	107.1	111.0	110.9	79.5	82.7	87.2	84.9	87.0	84.5	87.2	82.7	85.5	110.9	111.0	107.1	105.7	6
7							109.5	113.0	111.9	78.5	82.4	89.6	89.1	82.4	82.4	89.1	85.0	82.4	78.5	111.9	113.0	109.5	7
8								115.5	113.1	77.8	82.3	81.7	82.3	82.4	82.4	82.3	81.7	82.3	77.8	113.1	115.5		8
9									114.8	77.4	82.3	83.5	84.9	82.3	80.8	82.3	84.9	82.3	77.4	114.8			9
10										77.7	82.6	85.1	87.0	83.2	83.2	81.5	87.0	85.1	82.6	77.7			10
11											83.2	86.8	88.8	83.2	85.0	85.6	85.0	83.2	86.8	83.2			11
12												84.0	81.1	85.3	86.0	87.6	87.6	86.0	85.3	81.1	84.0		12
13													83.5	87.2	88.5	89.0	89.2	89.0	88.5	87.2	83.5		13
14														89.1	89.9	90.1	90.1	90.1	90.1	89.9	89.1		14
15															91.6	91.3	91.0	90.9	91.0	91.3	91.6		15

CASE PDEEL #
 DIPOLE-DIPOLE CONFIGURATION OF ELECTRODES
 PSFWD-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	1.0	1.0	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	1.0	1.0	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	.9	.5	.8	.9	.9	1.0	1.0		3
4				.9	.9	.8	.7	.4	.2	1.9	5.6	8.0	8.6	8.0	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														6.9	4.8	4.6	4.6	4.6	4.6	4.6	4.8	4.9		14
15															4.6	4.5	4.4	4.3	4.3	4.4	4.5	4.6		15



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 = 1.00	UNIT IN Z SCALING = 1.00			

CONFIGURATION DISTANCE UNIT = 4.000

CASE MODEL B
 DIPOLY-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						87.0	88.2	90.2	89.9	73.5	57.0	55.1	57.3	58.1	57.3	55.1	57.0	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	58.7	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	81.0	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	85.1	84.8	84.1	14	
15															87.1	87.0	86.9	86.9	86.9	87.0	87.1	15	

CASE MODEL C
 DIPOLE-DIPOLE CONFIGURATION OF ELECTRODES
 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	
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	18.0	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	36.5	36.8	36.7	36.6	36.5	36.4	36.3	36.1	35.9	35.8	36.2	36.9	37.0	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	45.1	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	64.3	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	64.7	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	83.3	88.0	14	
15															67.4	69.0	71.0	73.3	76.0	79.1	82.7	87.2	15	

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
-5.00	-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

CBS.PT.	GMFX	APRES(X)	GMFY	APRES(Y)	GMFP	APRESP	RESKEL	CONKEL	APREST	T-ETA
-9.50	-3.770E+02	112.30	5.139E+02	97.11	2.582E+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	1.685E+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	-3.52
-5.00	-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	-5.541E+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	-1.589E+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= 0.00 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

CBS.PT.	GMFX	APRES(X)	GMFY	APRES(Y)	GMFP	APRESP	RESKEL	CONKEL	APREST	T-THETA
9.50	-1.224E+03	106.60	-8.432E+02	106.30	3.939E+01	59.60	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	3.043E+03	188.76	-3.513E+02	104.48	2.845E+01	99.59	105.99	.04	118.92	-5.12
-5.00	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	82.29	-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	-10.82

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

CBS.PT.	GMFX	APRES(X)	GMFY	APRES(Y)	GMFP	APRESP	RESKEL	CONKEL	APREST	THET/
-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	71.55	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
-5.00	-2.531E+01	45.98	2.362E+01	49.40	-3.718E+00	49.85	47.84	.03	38.73	2.05
0.00	-3.752E+01	46.21	4.065E+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	9.500E+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	.20
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	-1.05
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

CBS.PT.	GMFX	APRF (X)	GMFY	APRES (Y)	GMFP	APRESP	RESKEL	CONKEL	APREST	THETA
-9.50	-3.770E+02	88.94	5.139E+02	82.71	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	-1.254E+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	5.008E+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	78.58	62.28	.04	63.16	3.65
-5.00	-2.184E+01	48.29	-2.872E+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	-5.625E+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	1.50
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	-258.50
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	74.95	.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 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 -6.0000

CBS.PT.	GMFX	APRES(X)	GMFY	APRES(Y)	GMFP	APRESP	RESKEL	CCNKEL	APREST	THETA
-9.50	-1.224E+03	92.43	-8.432E+02	93.12	3.939E+01	92.25	92.90	.05	98.29	-2.20
-9.00	-1.223E+03	90.92	-7.250E+02	92.56	3.701E+01	92.24	92.13	.05	97.88	-2.44
-8.50	-1.261E+03	89.19	-6.271E+02	91.95	3.491E+01	92.14	91.41	.05	97.60	-2.69
-8.00	-1.363E+03	86.95	-5.467E+02	91.34	3.210E+01	91.96	90.74	.05	97.48	-2.96
-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	2549.34	-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
-5.00	6.511E+02	71.54	2.931E+03	104.21	2.338E+02	16.50	73.41	.10	77.31	-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	-7.35

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	APRF (X)	GMFY	APRES (Y)	GMFP	APRESP	RESKEL	CCNKEL	APREST	TI-ETA
-9.50	-3.167E+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	28.09	-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
-5.00	-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	65.12	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	62.15	-1.55
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	-0.96
8.00	-1.288E+03	72.78	-4.419E+03	75.81	-5.777E+01	85.90	73.02	.09	68.72	-0.64
8.50	-1.473E+03	74.90	-5.005E+03	76.44	-6.326E+01	87.10	75.03	.09	70.79	-0.32
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	.24

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

CBS.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
-5.00	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	-6.28
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	-5.23
4.50	-9.154E+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	-2.282E+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 INCL INEC 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+C5	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+C3	69.57	-4.935E+02	56.04	7.575E+01	48.72	56.65	.11	61.69	-2.69
-8.00	1.304E+C3	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+C2	59.13	-3.764E+02	55.16	1.307E+02	38.48	56.53	.10	62.67	-1.90
-6.50	3.676E+C2	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
-5.00	-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	3.030E+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+C3	63.68	-2.937E+01	75.37	59.84	.07	55.40	1.79
5.00	-6.510E+02	61.13	1.513E+03	66.05	-3.263E+01	77.14	61.90	.07	57.39	1.66
5.50	-7.450E+C2	63.26	1.940E+03	68.44	-3.613E+01	78.81	63.95	.07	59.38	1.55
6.00	-8.503E+C2	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+C3	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
9.50	-1.570E+C3	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+C3	79.16	1.283E+04	91.02	-7.285E+01	88.18	79.45	.09	75.02	1.28