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# Dielectric Modeling of Biological Cells. Models and Algorithm

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Shell models pertinent to the dielectric analysis of biological cells and organelles are described. These include: 1) one-shell, 2) two-abutting-shell, 3) multi-shell, 4) vesicle-inclusion, and 5) composite-shell models, with their spherical or ellipsoidal variations. A systematic procedure for depicting the dielectric behavior of each model is also presented on the basis of the theory of interfacial polarization. As an example, data from a suspension measurement on lymphoid cells are analyzed using model 5.

KEY WORDS: Dielectric dispersion/ Permittivity/ Conductivity/ One-shell model/ Multi-shell model/ Spherical cell/ Ellipsoidal cell/

## I. INTRODUCTION

Biological cells, prokaryotic or eukaryotic, are demarcated from their environment by a diffusion barrier of lipidic nature, viz., the plasma membrane. In higher organisms, the cell develops within it a secondary structure of organelles, which are mostly membrane bounded, as is the case with the nucleus, mitochondria and endoplasmic reticulum.

In physical terms, all these membranes can be regarded as a shell dielectric that separates two more conducting aqueous compartments to form an interface on each side of the shell phase. This interface in turn becomes the site of charge accumulation or depletion (i.e., "polarization") depending on the electric field applied. When subjected to a. c. field, the degree of polarization across the interface varies with frequency. Thus, in cells and tissues, interfacial polarization is the major mechanism that is responsible for the dielectric relaxation phenomena we usually observe.

Impedance analysis of cells and tissues has long attracted biophysicists' attention partly because this method allows a noninvasive approach to the electrical properties of living cells. However, some workers, especially those who are electrically oriented, often end up with mere equivalent-circuit analyses, leaving the assignment of dielectric spectroscopic data behind. To some workers with a biomedical background, on the other hand, dielectric modeling and associated theories of interfacial polarization both seem too complicated to have a good command of these. Hence a systematic procedure should be desirable which is easy to apply in extracting the passive electrical prop-

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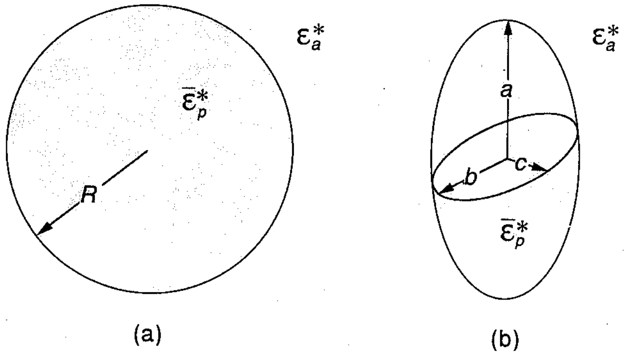


Fig. 1. Zero-shell model: (a) Sphere of radius $R$ and equivalent homogeneous permittivity $\bar{\varepsilon}_p{}^*$; (b) ellipsoid of revolution with semiaxes $a$, $b$ and $c$ $(=b)$, an ellipsoidal version of (a).

erties, such as relative permittivity and conductivity, of the component phases that comprise a cell.

In this article, we summarize the dielectric models of our routine use and present some examples of the models' predicted behavior, followed by a program list with which to execute relevant calculations.

## II. SUSPENSION EQUATIONS FOR THE TWO-PHASE SYSTEM

Complex relative permittivity $\varepsilon^*$ for a dilute suspension made up of medium $(\varepsilon_a^*)$ interspersed with spherical particles (Fig. 1a) was formulated by Wagner[1], on the basis of the theory of interfacial polarization, as

$$\varepsilon^* = \varepsilon_a^* \frac{2(1-\Phi)\varepsilon_a^* + (1+2\Phi)\bar{\varepsilon}_p^*}{(2+\Phi)\varepsilon_a^* + (1-\Phi)\bar{\varepsilon}_p^*} \tag{1}$$

where $\Phi$ is volume fraction.

For more concentrated suspensions, Hanai[2,3] derived an extended version of Eq. (1), which is of the form:

$$\left(\frac{\varepsilon^* - \bar{\varepsilon}_p^*}{\varepsilon_a^* - \bar{\varepsilon}_p^*}\right)\left(\frac{\varepsilon_a^*}{\varepsilon^*}\right)^{1/3} = 1 - \Phi \tag{2}$$

Combination of Eq. (1) or Eq. (2) with the expression for a particular model to be given in the following section enables calculation of $\varepsilon^*$ for the whole suspension of shelled spheres.

Suspension equations for ellipsoids (Fig. 1b) have been proposed by several authors. Among these, Sillars' extension[4] of the Maxwell-Wagner theory to non-spherical particles makes the starting point for subsequent modifications. (For a didactic derivation of Sillars' equation, see e. g. Takashima[5].) Pertinent equations have been derived by Asami et al.[6,7] for dilute systems and by Watanabe et al.[8] for concentrated systems, to name but a few.

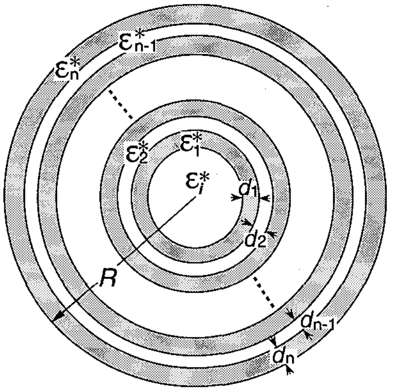


Fig. 2. Multi-shell model, spherical. The core of $\varepsilon_i$* is surrounded by $n$ concentric strata of $\varepsilon_k$*'s and thicknesses $d_k$'s (k=1, 2,..., $n$).

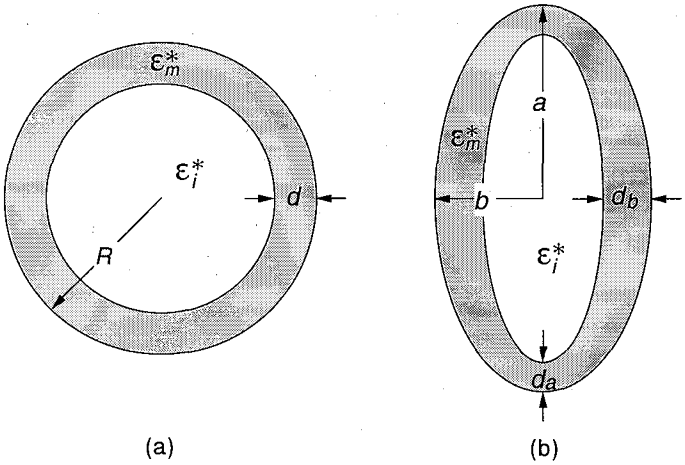


Fig. 3. One-shell model. (a) Sphere, (b) Ellipsoid of revolution.

## III. MODELS FOR THE SUSPENDED PHASE

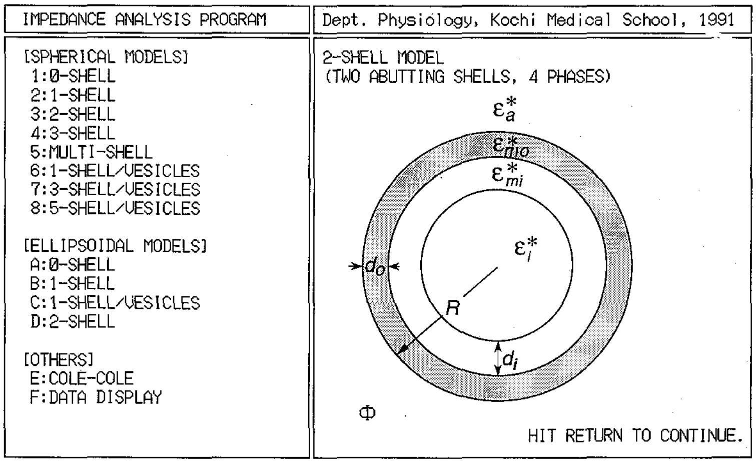
In the dielectric modeling of spherical cells, a sphere of concentric strata (Fig. 2), the number ($n$) of which is a parameter may be the basic model to start with. Fig. 3 shows the simplest possible versions. Hereafter, the spherical model (Fig. 3a) rather than the spheroidal one (Fig. 3b) will be focused on since mathematics would become too lengthy to give a full description to the latter.

Applying Maxwell's homogenization procedure[9,10] one can write down the homogeneous permittivity of the "one-shell" model as

$$\bar{\varepsilon}_p^* = \varepsilon_m^* \frac{2(1-v)\varepsilon_m^* + (1+2v)\varepsilon_i^*}{(2+v)\varepsilon_m^* + (1-v)\varepsilon_i^*} \qquad (3)$$

with $v=(1-d/R)^3$. Likewise, $\bar{\varepsilon}_p^*$ for a larger number of strata can be readily obtained through repeated applications of Eq. (3).

The model in Fig. 4 illustrates two abutting shells. This model applies to the case



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IMPEDANCE ANALYSIS PROGRAM        Dept. Physiology, Kochi Medical School, 1991

[SPHERICAL MODELS]                2-SHELL MODEL
 1:0-SHELL                        (TWO ABUTTING SHELLS, 4 PHASES)
 2:1-SHELL
 3:2-SHELL
 4:3-SHELL
 5:MULTI-SHELL
 6:1-SHELL/VESICLES
 7:3-SHELL/VESICLES
 8:5-SHELL/VESICLES

[ELLIPSOIDAL MODELS]
 A:0-SHELL
 B:1-SHELL
 C:1-SHELL/VESICLES
 D:2-SHELL

[OTHERS]
 E:COLE-COLE
 F:DATA DISPLAY
                                                      HIT RETURN TO CONTINUE.
```

Fig. 4. Two-abutting shell model (*right*). The whole picture is a hard copy of "main menu" displayed upon selecting model #3 in the program "IMPEDANCE ANALYSIS mini".

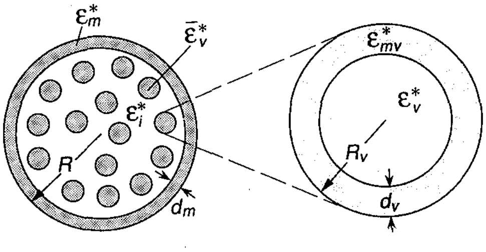

Fig. 5. Vesicle-inclusion model.

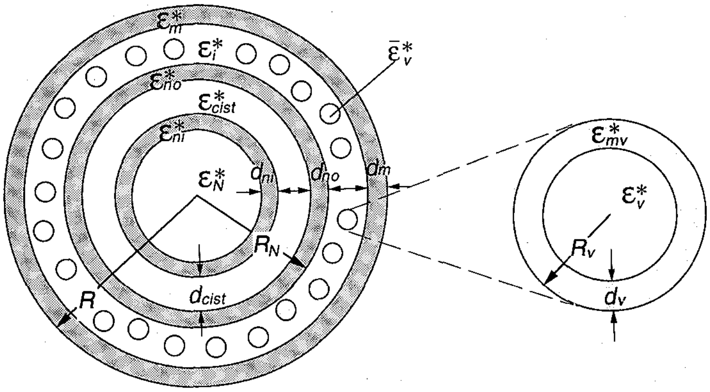

Fig. 6. Triple-shell model with vesicle inclusions.

where an overcoat- or an undercoat layer is closely attached to the membrane phase proper.

As previously reported by Irimajiri et al.[11], a multi-stratified sphere with $n$ discrete shells in general gives rise to $n+1$ different relaxations, reflecting that the number of emerging relaxations corresponds to the number of interfaces involved.

Single shells containing membrane-bounded vesicles as a secondary suspension may be modeled as in Fig. 5, which we have named the "vesicle-inclusion" model[12]. Although its theoretical basis is rather weak compared with the concentric shells described above, we attempt to define the $\bar{\varepsilon}_p^*$ of this model by incorporating the results from a suspension equation (Eq. (1) or (2)) for vesicles into the parameter $\varepsilon_i^*$ in Eq. (3). In this calculation, we prefer Eq. (2) to Eq. (1) because intracellular vesicles are usually resident in a high volume concentration.

Figure 6 depicts a more realistic model for cells, in which the nucleus, demarcated by a double membrane system, resides at the center of cytoplasm that has been simplified to a vesicular suspension.

Besides these, many other models that allow size distribution for the suspended particles as well as cytoplasmic structures have already been developed in our laboratories[8,13]. For brevity, however, these sophistications are omitted here.

## IV. OUTLINE OF THE PROGRAM "IMPEDANCE ANALYSIS mini"

One may start this program by simply choosing an intended model or operation from the "menu" listed in Fig. 4 (*left* block). For each model, both the calculation conditions (i.e., frequency range, number of points per decade, type of mixture equation, etc.) and parameter values can be easily entered while referring to the symbols displayed as in Fig. 4 (*right* block). The results of calculations will then be visualized in a colored format of dispersion curves or of Cole-Cole plots. Up to eighth previous calculations are to be stored and hence superimposable on the display for ready comparison. Finally, analyses of experiment by curve fitting are also feasible if the data to be handled are fed through the format "FEK" (cf. "menu"), which means "frequency(F)/relative permittivity(E)/conductivity(K)". The program list is in the

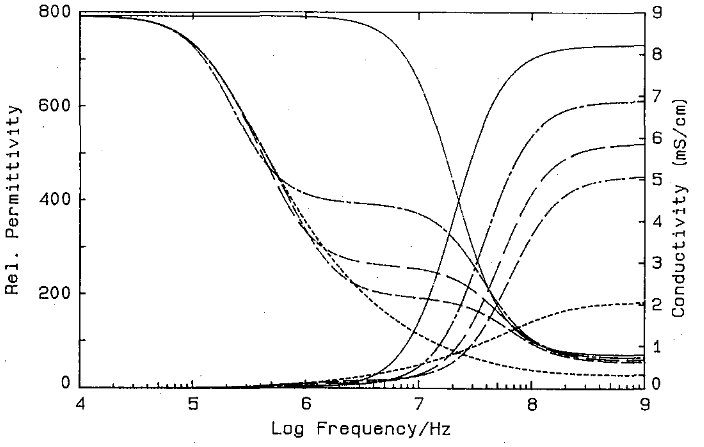

Fig. 7. Dispersion curves predicted from the "multi-shell" model for: $n=1$ (————), 3 (—-—-—), 5 (— — —), 7 (— - — -), and 99 (----------). Calculations employed the following parameters:
$\varepsilon_1=\varepsilon_3=\cdots=\varepsilon_{n(odd)}=8$, $\kappa_1=\kappa_3=\cdots=\kappa_{n(odd)}=0.1$ nS/cm,
$\varepsilon_i=\varepsilon_2=\cdots=\varepsilon_{n(even)}=78$, $\kappa_i=\kappa_2=\cdots=\kappa_{n(even)}=10$ mS/cm,
$d_1=d_2=\cdots=d_n=5$ nm, and $R=0.5$ $\mu$m.

attached Appendix. This program, written in $N_{88}$-BASIC (NEC), has been confirmed to run on NEC "PC-9801" series computers excepting PC-9801, PC-9801E, and PC-98LT.

## V. EXAMPLE OF PREDICTED DIELECTRIC BEHAVIOR

As stated in Section III, the "multi-shell" model may represent a variety of shelled particles composed of concentric strata, so that it is of general interest to depict the model's behavior predictable upon varying the number of shells involved in it. Figs. 7 and 8 show an example of such calculations where a dielectric shell and a conducting aqueous phase, both being of an identical thickness ($d=5$ nm), alternately build up to increase the number of strata towards filling up the core phase. Clearly, the "one-shell" model ($n=1$) traced a semicircle in the Cole-Cole plots (Fig. 8), while the final concentric structure ($n=99$) gave rise to a skewed-arc-like pattern indicative of the involvement of many relaxation times. The results of calculations for intermediate numbers of strata such as the "double-shell" ($n=3$) and "triple-shell" ($n=5$) models are also displayed in Fig. 8.

Figure 9 shows the behavior of the "vesicle-inclusion" model. In this calculation, we have chosen a thin-walled particle of 8 $\mu$m in diameter and changed the vesicle size ($R_v$), as a parameter, from 3 $\mu$m down to 0.1 $\mu$m with the intraparticulate volume fraction of those vesicles ($\phi_v$) fixed at 0.4234. Under such constraints, the case with $R_v=3$ $\mu$m corresponds to the "double-shell" model, which showed a flattened arc in the complex permittivity plane plot (Fig. 9, *top*). With a decrease in the vesicle size (i. e., with an increase in the vesicle number), separation between two major relaxation frequencies, one being due to the outer shell and the other due to the vesicle membrane,

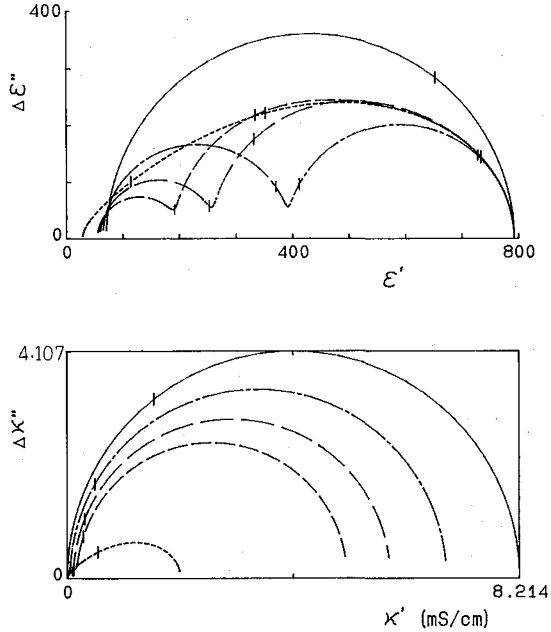

Fig. 8. Cole-Cole plots for curves in Fig. 7. Line specifications, same as in Fig. 7.

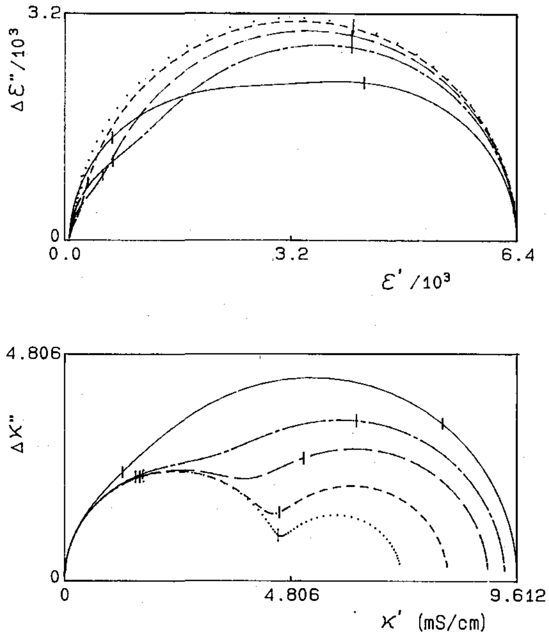

Fig. 9 Cole-Cole plots for the dielectric behavior predictable from model 6 (one-shell/vesicles) or the "vesicle-inclusion model" (Fig. 5). Calculations employed the following parameters: $\varepsilon_m=\varepsilon_{mv}=8$, $\varepsilon_i=\varepsilon_v=78$, $\kappa_m=\kappa_{mv}=0.1$ nS/cm, $\kappa_i=\kappa_v=10$ mS/cm, $d_m=d_v=$ 5nm. $R=4$ $\mu$m, $\phi_v$ (volume fraction of vesicles)$=0.4234$, and $R_v=3$ (————), 1 (—·—·—·—), 0.5 (— — — —), 0.2 (--------), and 0.1 (···········) $\mu$m.

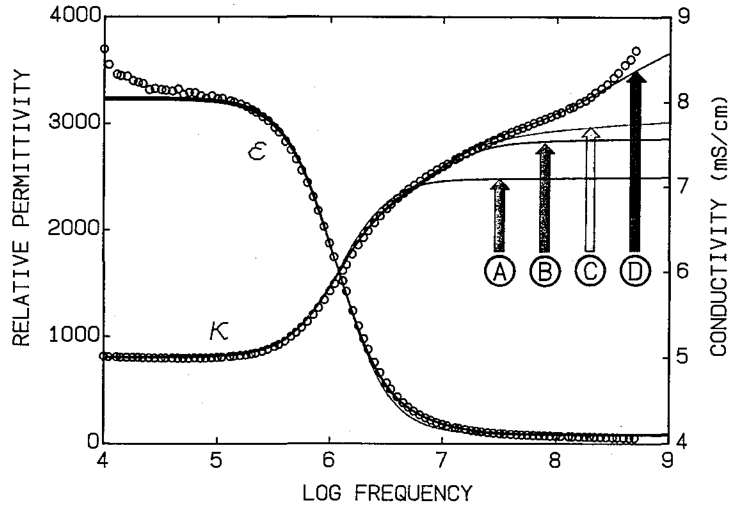

Fig. 10. Dielectric behavior of cultured lymphoma cells (L5178Y) in suspension. *Circles*, observed; *lines A-D*, best-fit theoretical curves calculated using Eq. (1) and models A-D with appropriate parameter values.

became dominant, as shown in Fig. 9 (*bottom*).

The last example'(Fig. 10) deals with simulation of the dispersion curves obtained from measurements with cultured lymphoma cells in suspension[14]. Here, model A refers to the "one-shell" or the simplest available model for living cells. Model B is the "triple-shell", a version of the "multiple shells", whose inner double-shell is meant for the nucleus. Models C and D are special versions of the "triple-shell with vesicle inclusions", or the "composite cell" model. The "vesicles" in model C represent mitochondria whose size (~0.6 $\mu$m) and cytoplasmic volume fraction ($\phi_v \simeq 0.05$) were both determined stereologically. In model D, the presence of vesicles smaller than the mitochondria was also considered. The most sophisticated model has thus been shown to mimic the dielectric behavior observed.

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## Appendix

By T. Suzaki and K. Asami

```
[Program Name: RESET.BAS]
1000   ' SAVE "RESET.BAS",A
1010  CLEAR 0,32,1000,0
1020  DIM ND(15),DAT(40)
1030  FOR I=1 TO 31: READ DAT(I): NEXT I
1040  OPEN "PLOT.DAT" FOR OUTPUT AS #1: FOR I=1 TO 30
1050  PRINT #1, DAT(I);: NEXT I: PRINT #1, DAT(31): CLOSE #1: NPP=0
1060  CLPLS=0: OPEN "IAZ.DAT" FOR OUTPUT AS #1: PRINT #1, NPP,CLPLS
1070  CLOSE #1: READ NPD,NPT,MAX.NPT,MINF,MAXF: READ FILENAME$
1080  OPEN "CRTDAT.DAT" FOR OUTPUT AS #1
1090  PRINT #1,NPD;NPT;MAX.NPT;MINF;MAXF: PRINT #1,FILENAME$: CLOSE #1
1100  RESTORE 1200: FOR I=1 TO 13: READ ND(I): NEXT I: FOR I=1 TO 13
1110  FOR J=1 TO ND(I): READ DAT(J): NEXT J: A$=RIGHT$(STR$(I),1)
1120  IF I>8 THEN A$=CHR$(56+I)
1130  OPEN "IPMT"+A$+".DAT" FOR OUTPUT AS #1: FOR J=1 TO ND(I)-1
1140  PRINT #1, DAT(J);: NEXT J: PRINT #1, DAT(ND(I)): CLOSE #1
1150  NEXT I: FOR I=1 TO 6: READ LTLF(I): NEXT I
1160  OPEN "LTLF.DAT" FOR OUTPUT AS #1: PRINT #1, LTLF(1)
1170  FOR I=2 TO 6: PRINT #1, LTLF(I): NEXT I: CLOSE #1: RUN "IAZ.BAS"
1180  DATA 1,4,1,1,1,0,15,0,5,2,0,10,0,1,5,200,0,500,4,11,4,1,2,9,3,1
1190  DATA 0,0,0,0,40,0,0,8,3,9,""
1200  DATA 10,13,16,19,31,21,27,33,13,16,24,19,9,4,9,1,1,80,15,60,10,5
1210  DATA .5,4,9,1,1,80,15,60,10,8,.01,5,7,.5,4,9,1,1,80,12,60,10,8
1220  DATA .01,20,2,5,10,8,.4,4,9,1,1,80,12,60,10,8,5,8,.001,5,10,8,6
1230  DATA 5,4,.3,4,9,1,1,2,70,10,70,5,5,8,.001,5,80,10,5,100,5,.5,8
1240  DATA .001,8,70,12.2,150,8,.001,8,60,12.6,200,4,9,1,1,2,78,7,50,6
1250  DATA 50,1,8,.001,8,.001,6,8,.1,8,1,.1,4,9,1,1,1,78,7,45,6,34,25
1260  DATA 58,1,8,.001,17,102,13,.001,6,8,.3,7,3,40,.2,.05,4,9,1,2,1
1270  DATA 78,7,60,6,8,.1,18,19,20,100,8.2,.001,18,85,18,50,8,.001,6,8
1280  DATA .3,8,3,8,0,0,.2,0,4,9,1,1,20,80,3,50,.001,1,1,5,.5,4,9,1,1
1290  DATA 20,70,10,70,5,8,.001,5,5,10,8,.3,4,9,1,1,1,0,90,18,50,1,10
1300  DATA .001,25.58,5,5,8,.3,20,.001,50 ,5,.5,8,.5,4,9,1,1,80,10,80
1310  DATA 10,80,100,10,.001,2,3,4,8,8,.5,100,4,8,1,1,72,12,1,510,2,1
1320  DATA 1,0,400,0,100,5
```

```
[Program Name: IASTART.BAS]
1000   ' SAVE "IASTART.BAS",A
1010  DIM A(40): CLS 3: ON ERROR GOTO 1110
1020  OPEN "PLOT.DAT" FOR INPUT AS #1: FOR I=1 TO 31: INPUT #1, A(I)
1030  NEXT I: CLOSE #1: A(27)=0: OPEN "PLOT.DAT" FOR OUTPUT AS #1
1040  FOR I=1 TO 31: PRINT #1, A(I): NEXT I: CLOSE #1: NPP=0
1050  OPEN "\DAT\IAS.DAT" FOR OUTPUT AS #1: PRINT #1,NPP: CLOSE #1
1060  OPEN "CRTDAT.DAT" FOR INPUT AS #1
1070  INPUT #1,NPD,NPT,MAX.NPT,MINF,MAXF: INPUT #1,FILENAME$: CLOSE #1
1080  NPD=0: NPT=0: MAX.NPT=8: OPEN "CRTDAT.DAT" FOR OUTPUT AS #1
1090  PRINT #1,NPD;NPT;MAX.NPT;MINF;MAXF: PRINT #1,FILENAME$: CLOSE #1
1100  RUN "IAZ.BAS"
1110  IF ERR=53 THEN RUN "RESET.BAS"
1120  RESUME 1100
```

```
[Program Name: IAZ.BAS]
1000   ' SAVE "IAZ.BAS",A
1010  WIDTH 80,25: CLEAR 0,32,4000,0
1020  CONSOLE 0,24,0,0: SCREEN 3,0,0,1: VIEW (0,0)-(639,399)
1030  DIM CCD(3,15),FD$(16): DD$="1991-08-31": COLOR ,0: CLS 3: HRC=1
1040  OPEN "IAZ.DAT" FOR INPUT AS #1: INPUT #1,NPP,CLPLS: CLOSE #1
1050  OPEN "DGET.DAT" FOR OUTPUT AS #1
1060  M1$="IAZ": PRINT #1,M1$: CLOSE #1: FOR I=1 TO 15: FOR J=1 TO 3
1070  READ CCD(J,I): NEXT J: NEXT I
1080  DATA 0,0,0,0,13,8,0,11,0,0,0,6,0,9,2,0,7,0,15,15,15,1,8,8
1090  DATA 2,3,4,3,5,4,-1,-1,-1,15,0,0,0,15,0,0,0,15,3,2,2
1100  FOR I=1 TO 14: READ FD$(I): NEXT I
1110  DATA "1:0-SHELL","2:1-SHELL","3:2-SHELL","4:3-SHELL"
1120  DATA "5:MULTI-SHELL","6:1-SHELL/VESICLES"
1130  DATA "7:3-SHELL/VESICLES","8:5-SHELL/VESICLES","A:0-SHELL"
1140  DATA "B:1-SHELL","C:1-SHELL/VESICLES","D:2-SHELL","E:COLE-COLE"
1150  DATA "F:DATA DISPLAY"
1160  FOR I=1 TO 3: FOR J=2 TO 13: CCD(I,J)=CCD(I,J)+CLPLS: NEXT J
1170  NEXT I: COLOR 7,0,0,7,2: GOSUB *COLORSET: C1=3: C2=7
1180  WIDTH 80,25: CONSOLE 0,20,0,1: WT=0: VIEW (0,0)-(639,399)
1190  IF NPP=14 THEN NP=0: NPP=0: GOTO 1220
1200  IF NPP=21 THEN NP=0: NPP=0: GOTO 1220
1210  IF NPP<>0 THEN NP=NPP: WT=1
1220  COLOR C2: CLS 3: CONSOLE 2,25,0,1: LINE (2,12)-(261,36),7,B
1230  LINE (2,40)-(261,395),7,B: LINE (265,12)-(637,36),7,B
1240  LINE (265,40)-(637,395),7,B: VIEW (268,41)-(636,392):LOCATE 1,1
1250  PRINT " IMPEDANCE ANALYSIS PROGRAM": LOCATE 34,1
1260  PRINT "Dept. Physiology, Kochi Medical School, 1991"
1270  LOCATE 1,3: COLOR C2: PRINT " [SPHERICAL MODELS]": LOCATE 1,13
1280  COLOR C2: PRINT " [ELLIPSOIDAL MODELS]": LOCATE 1,19: COLOR C2
1290  PRINT " [OTHERS]"
1300  FOR NI=1 TO 14: NJ=NI+2
1310  IF NI<9 THEN NJ=NJ-2
1320  IF NI>12 THEN NJ=NJ+2
1330  LOCATE 3,NJ+3: COLOR C1: IF NP=NI THEN COLOR C2
1340  PRINT FD$(NI): NEXT NI: COLOR C1: CLS 2: IF NP>8 THEN 1360
1350  ON NP GOSUB *S1,*S2,*S3,*S4,*S5,*S6,*S7,*S8: GOTO 1370
1360  ON NP-8 GOSUB *A,*B,*C,*D,*E,*F
1370  FOR I=1 TO 200
1380  KY$=INKEY$: IF KY$="" THEN 1400
1390  GOTO 1440
1400  IF WT=1 THEN I=1: GOSUB *HRC
1410  IF NPP<>0 THEN 1610
1420  NEXT I
1430  NP=NP+1: KY$="1": GOTO 1570
1440  WT=1: VK=VAL(KY$): IF VK>0 AND VK<9 THEN NP=VK
1450  AK=ASC(KY$): IF VK=0 AND AK=48 THEN NP=8
1460  IF AK=248 THEN GOSUB *COLORUP: GOTO 1400
1470  IF AK=249 THEN GOSUB *COLORDN: GOTO 1400
1480  IF AK=8 OR AK=27 THEN SYSTEM
1490  IF KY$="A" OR KY$="a" THEN NP=9
1500  IF KY$="B" OR KY$="b" THEN NP=10
1510  IF KY$="C" OR KY$="c" THEN NP=11
1520  IF KY$="D" OR KY$="d" THEN NP=12
1530  IF KY$="E" OR KY$="e" THEN NP=13
1540  IF KY$="F" OR KY$="f" THEN NP=14
1550  IF ASC(KY$)=31 THEN NP=NP+1
1560  IF ASC(KY$)=30 THEN NP=NP-1
1570  IF NP=0 THEN NP=14
1580  IF NP=15 THEN NP=1
1590  IF ASC(KY$)=13 THEN 1610
1600  GOTO 1300
1610  COLOR C1: VIEW (0,0)-(639,399): LINE (266,36)-(636,50),0,BF
1620  LINE (265,36)-(265,41): LINE (637,36)-(637,41)
1630  LINE (265,50)-(637,50): GOSUB *HEC2: GOSUB *HRC2
1640  VIEW (3,53)-(259,392): CLS 3
1650  OPEN "IAZ.DAT" FOR OUTPUT AS #1: PRINT #1, NP,CLPLS: CLOSE #1
1660  NPF$=RIGHT$(STR$(NP),1): IF NP>8 THEN NPF$=CHR$(56+NP)
1670  IF NP=14 THEN RUN "FMENU.BAS"
1680  RUN "DSET"+NPF$+".BAS"
1690 *HRC: LOCATE 56,23:COLOR 7: PRINT "HIT ";: COLOR 4
1700  PRINT "RETURN ";: COLOR 7: PRINT "TO CONTINUE.";
1710  LOCATE 55,22: COLOR 7: RETURN
1720 *D0: LOCATE 34,3: PRINT SPACE$(34): LOCATE 34,4
1730  PRINT SPACE$(34): COLOR 7: RETURN
1740 *CL: CIRCLE (150,190),CD,CL,,,,F: RETURN
1750 *DR: LINE (150,190)-(108,148),7: LINE (92,132)-(58,98)
1760  LINE (58,98)-(62,98): LINE (58,98)-(58,102)
1770  PUT (91,133),KANJI(&H2352),OR:RETURN
1780 *DRN: LINE (150,190)-(130,210): LINE (112,228)-(94,246),7
1790  LINE (94,246)-(94,242): LINE (94,246)-(98,246)
1800  PUT (112,210),KANJI(&H2352),OR: PUT (128,218),KANJI(&H14E),OR
1810  RETURN
1820 *DD: PUT (X-15,Y+7),KANJI(&H2364),OR,7,0: X0=1
1830  FOR I=1 TO LEN(L$): X0=X0+7:LL$=MID$(L$,I,1): KA=&H100+ASC(LL$)
1840  PUT (X+X0-11,Y+14),KANJI(KA),OR,7,0: NEXT I: RETURN
1850 *DF: PUT (X,Y),KANJI(&H2635),OR: RETURN
1860 *DE: GOSUB *EP: X0=0:FOR I=1 TO LEN(L$): X0=X0+8
1870  LL$=MID$(L$,I,1): KA=&H100+ASC(LL$)
1880  PUT (X+X0-1,Y+5),KANJI(KA),OR,7,0: NEXT I: RETURN
1890 *VESICLE: CIRCLE (310,85),40,2,,,,F: CIRCLE (310,85),25,1,,,,F
1900  LINE (310,85)-(282,57): LINE (282,57)-(286,57)
1910  LINE (282,57)-(282,61): RETURN
1920 *INSET1: GOSUB *VESICLE: X=340: Y=92: L$="mv": GOSUB *DE
1930  X=310: Y=92: L$="v": GOSUB *DE: X=285: Y=85: GOSUB *VARROW2
1940  PUT (255,40),KANJI(&H2352),OR: PUT (270,47),KANJI(&H156),OR
1950  PUT (242,75),KANJI(&H2364),OR: PUT (257,82),KANJI(&H156),OR
1960  PUT (331,29),KANJI(&H2655),OR
1970  PUT (347,36),KANJI(&H156),OR: RETURN
1980 *EL1: CIRCLE (150,190),59,7,,,3: LINE (150,190)-(132,208),7
1990  LINE (132,208)-(136,208): LINE (132,208)-(132,204)
2000  LINE (150,190)-(150,132),7: LINE (150,132)-(153,135)
2010  LINE (150,132)-(147,135): LINE (150,190)-(265,190),7
2020  LINE (265,190)-(262,187): LINE (265,190)-(262,193)
2030  PUT (235,259),KANJI(&H2635),OR: PUT (153,145),KANJI(&H61),OR
2040  PUT (135,181),KANJI(&H62),OR: PUT (205,190),KANJI(&H63),OR
2050  X=90:Y=190: L$="1": GOSUB *DE
2060  X=210:Y=80: L$="a": GOSUB *DE:RETURN
2070 *S1: GOSUB *D0: LOCATE 34,3: PRINT "0-SHELL MODEL"
2080  LOCATE 34,4: PRINT "(2 PHASES)": CD=130: CL=2: GOSUB *CL
2090  GOSUB *DR: X=35: Y=309: GOSUB *DF: X=340: Y=230: L$="a"
2100  GOSUB *DE: X=127: Y=250: L$="1": GOSUB *DE: RETURN
2110 *S2: GOSUB *D0: LOCATE 34,3: PRINT "1-SHELL MODEL": LOCATE 34,4
2120  PRINT "(SINGLE SHELL, 3 PHASES)": CD=130: CL=2: GOSUB *CL
2130  CD=115: CL=3: GOSUB *CL: GOSUB *DR: X=280: Y=185: L$=" "
2140  GOSUB *VARROW2: GOSUB *DD: X=35: L$=" ": GOSUB *VARROW2
2150  GOSUB *DD: X=35: Y=309: GOSUB *DF: X=340: Y=230: L$="a"
2160  GOSUB *DE: X=127: Y=250: L$="1": GOSUB *DE: X= 30: Y=230
2170  L$="m": GOSUB *DE: RETURN
2180 *S3: GOSUB *D0: LOCATE 34,3: PRINT "2-SHELL MODEL": LOCATE 34,4
2190  PRINT "(TWO ABUTTING SHELLS, 4 PHASES)": CD=130: CL=2: GOSUB *CL
2200  CD=115: CL=3: GOSUB *CL: CD=100: CL=0: GOSUB *CL: GOSUB *DR
2210  X=280: Y=185: L$="o": GOSUB *VARROW2: GOSUB *DD: X=50: Y=185
2220  L$="1": GOSUB *VARROW2: GOSUB *DD: GOSUB *VARROW2: GOSUB *DD
2230  X=30: Y=230: L$="mo": GOSUB *DE: X=340: Y=230: L$="a": GOSUB *DE
2240  X=35: Y=309: GOSUB *DF: X=229: Y=230: L$="mi": GOSUB *DE
2250  X=127: Y=250: L$="1": GOSUB *DE: RETURN
2260 *S4: GOSUB *D0: LOCATE 34,3: PRINT "3-SHELL MODEL": LOCATE 34,4
2270  PRINT "(DOUBLE-SHELL, 5 PHASES)": CD=130: CL=2: GOSUB *CL
2280  CD=115: CL=3: GOSUB *CL: CD=80: CL=2: GOSUB *CL: CD=65: CL=0
2290  GOSUB *CL: GOSUB *DR: GOSUB *DRN: X=280: Y=185: L$=" "
2300  GOSUB *VARROW2: GOSUB *DD: X=230: Y=185: L$="N": GOSUB *VARROW2
2310  GOSUB *DD: X=150: Y=170: L$="Np": GOSUB *DE: X=127: Y=250
2320  L$="N": GOSUB *DE: X=340: Y=230: L$="a": GOSUB *DE: X=30: Y=230
2330  L$="m": GOSUB *DE: X=240: Y=230: L$="1": GOSUB *DE: X=35: Y=309
2340  GOSUB *DF: RETURN
2350 *S5: GOSUB *D0: LOCATE 34,3: PRINT "MULTI-SHELL MODEL": CD=130
2360  CL=2: GOSUB *CL: CD=115: CL=3: GOSUB *CL: CD=100: CL=2
2370  GOSUB *CL: CD=85: CL=3: GOSUB *CL: CD=70: CL=2: GOSUB *CL
2380  CD=55: CL=0: GOSUB *CL: GOSUB *DR: X=280: Y=185: L$=" "
2390  GOSUB *VARROW2: GOSUB *DD: X=300: Y=260: L$="a": GOSUB *DE
2400  X=162: Y=170: L$="1": GOSUB *DE: X=35: Y=309: GOSUB *DF: RETURN
2410 *S6: GOSUB *D0: LOCATE 34,3: PRINT "VESICLE INCLUSION MODEL"
2420  *S61: CD=130: CL=2: GOSUB *CL: CD=115: CL=1: GOSUB *CL: IK=1
2430  FOR I=32 TO 265 STEP 13: IK=IK*(-1): FOR JJ=72 TO 305 STEP 16
2440  J=JJ:IF IK<0 THEN J=JJ-8
2450  IX=(150-I)*(150-I)+(190-J)*(190-J): IF IX>111*111 THEN 2480
2460  IF I=97 AND JJ=136 THEN 2480
2470  CIRCLE (I,J),4,2,,,,F: CIRCLE (I,J),2,1,,,,F
2480  NEXT JJ: NEXT I: GOSUB *INSET1: CIRCLE (240,144),6,7
2490  LINE (245,140)-(275,110),7: LINE (275,110)-(275,115),7
2500  LINE (275,110)-(270,110),7: GOSUB *DR: X=280: Y=185: L$=" "
2510  GOSUB *VARROW2: GOSUB *DD: X=35: Y=309: GOSUB *DF: X=295
2520  Y=272: L$="1": GOSUB *DE: X=340: Y=230: L$="a": GOSUB *DE
2530  X=30: Y=230: L$="m": GOSUB *DE: LINE (250,230)-(285,265)
2540  LINE (285,265)-(285,260): LINE (285,265)-(280,265): RETURN
2550 *S7: GOSUB *D0: LOCATE 34,3: PRINT "TWO CONCENTRIC SHELLS"
2560  *S71: LOCATE 34,4: PRINT "WITH VESICLE INCLUSIONS": GOSUB *S61
2570  CD=80: CL=2: GOSUB *CL: CD=65
2580  CL=3: GOSUB *CL: GOSUB *DR: GOSUB *DRN: X=230: Y=185: L$="N"
2590  GOSUB *VARROW2: GOSUB *DD: X=150: Y=170: L$="Np": GOSUB *DE
2600  X=127: Y=250: L$="N": GOSUB *DE: RETURN
2610 *S8: GOSUB *D0: LOCATE 34,3: PRINT "THREE CONCENTRIC SHELLS"
2620  GOSUB *S71: CD=50: CL=2: GOSUB *CL: CD=35: CL=3: GOSUB *CL
2630  GOSUB *DR: GOSUB *DRN: X=200: Y=185: L$="Ni": GOSUB *VARROW2
2640  GOSUB *DD: X=230: Y=185: L$="No": GOSUB *VARROW2: GOSUB *DD
2650  X=100: Y=185: L$="cist": GOSUB *VARROW2: GOSUB *DD: X=150
2660  Y=170: L$="Np": GOSUB *EP: GOSUB *DE: X=168: Y=130: L$="cist"
2670  GOSUB *EP: GOSUB *DE: X=158: Y=230: L$="Ni": GOSUB *EP
2680  GOSUB *DE: X=127: Y=250: L$="No": GOSUB *EP: GOSUB *DE: RETURN
2690 *A: GOSUB *D0: LOCATE 34,3: PRINT "0-SHELL MODEL": LOCATE 34,4
2700  PRINT "(2 PHASES)": CIRCLE (150,190),115,2,,,.5,F
2710  GOSUB *EL1: RETURN
2720 *B: GOSUB *D0: LOCATE 34,3: PRINT "1-SHELL MODEL": LOCATE 34,4
2730  PRINT "(3 PHASES)": CIRCLE (150,190),115,2,,,.5,F
2740  CIRCLE (150,190),100,3,,,.47,F: GOSUB *EL1: X=50: Y=190
2750  GOSUB *VARROW2
2760  *EL2: PUT (35,195),KANJI(&H2364),OR: X=70: Y=230: L$="m"
2770  L$="m": GOSUB *DE: RETURN
2780 *C: GOSUB *D0: LOCATE 34,3: PRINT "1-SHELL MODEL": LOCATE 34,4
2790  PRINT "WITH VESICLE INCLUSIONS": CIRCLE (150,190),115,2,,,.5,F
2800  CIRCLE (150,190),100,3,,,.47,F: X=50: Y=190: GOSUB *VARROW2
2810  IK=1: FOR I=29 TO 265 STEP 16: IK=IK*(-1)
2820  FOR JJ=72 TO 305 STEP 16: J=JJ: IF IK<0 THEN J=JJ-8
2830  IX=(150-I)*(150-I)+(190-J)*(190-J)*5: IF IX>99*99 THEN 2890
2840  IF IX>99*99 THEN 2890
2850  IF I=29+16*7 AND JJ=72+16*7 THEN 2890
2860  IF I=29+16*8 AND JJ=72+16*6 THEN 2890
2870  IF I=29+16*11 AND JJ=72+16*8 THEN 2890
2880  CIRCLE (I,J),4,2,,,,F: CIRCLE (I,J),2,1,,,,F
2890  NEXT JJ: NEXT I
2900  GOSUB *INSET1: CIRCLE (221,176),6,7: LINE (225,172)-(282,115),7
2910  LINE (282,115)-(278,115),7: LINE (282,115)-(282,120),7
2920  GOSUB *EL1: GOSUB *EL2: RETURN
2930 *D: GOSUB *D0: LOCATE 34,3: PRINT "2-SHELL MODEL"
2940  LOCATE 34,4: PRINT "(5 PHASES)": CIRCLE (150,190),115,2,,,.5,F
2950  CIRCLE (150,190),100,3,,,.47,F: CIRCLE (150,190),85,0,,,.41,F
2960  GOSUB *EL1: X=50: Y=190: L$="o": GOSUB *VARROW2: X=45: Y=160
2970  GOSUB *DD: X=65: Y=190: L$="i": GOSUB *VARROW2: GOSUB *DD
2980  X=100: Y=150: L$="mi": GOSUB *EP: GOSUB *DE: X=80: Y=230
2990  L$="mo": GOSUB *EP: GOSUB *DE: RETURN
3000 *E: GOSUB *D0: LOCATE 34,3: PRINT "SIMULATION WITH": LOCATE 34,4
3010  PRINT "COLE-COLE EQUATION": XO=20: YO=150: X=XO: Y=YO: GOSUB *EP
3020  X=XO+10: Y=YO-4: PUT(X,Y),KANJI(&H2161),OR: X=XO+40: Y=YO
3030  GOSUB *E2: X=XO+47: Y=YO+6: PUT(X,Y),KANJI(&H168),OR: X=XO+60
3040  Y=YO-4: PUT(X,Y),KANJI(&H215C),OR
3050  LINE (XO+85,YO+40)-(XO+85,YO-25)
3060  LINE (XO+85,YO+40)-(XO+90,YO+45)
3070  LINE (XO+85,YO-25)-(XO+90,YO-30)
3080  LINE (XO+90,YO+3)-(XO+210,YO+3): X=XO+90: Y=YO+10
3090  PUT(X,Y),KANJI(&H2331),OR: X=XO+105: Y=YO+10
3100  PUT(X,Y),KANJI(&H2B),OR: X=XO+115: Y=YO+10
3110  PUT(X,Y),KANJI(&H28),OR: X=XO+130: Y=YO+18: GOSUB *J
3120  X=XO+140: Y=YO+18: GOSUB *FI: LINE (XO+158,YO+8)-(XO+145,YO+30)
3130  X=XO+160: Y=YO+18: GOSUB *FI: X=XO+163: Y=YO+22
3140  PUT(X,Y),KANJI(&H163),OR: X=XO+173: Y=YO+24
3150  PUT(X,Y),KANJI(&H16E),OR: X=XO+180: Y=YO+10
3160  PUT(X,Y),KANJI(&H29),OR: X=XO+187:Y=YO+5
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3170  PUT(X,Y),KANJI(&H2642),OR: X=XO+200: Y=YO+15
3180  PUT(X,Y),KANJI(&H16E),OR: LINE (XO+135,YO-4)-(XO+142,YO-4)
3190  LINE (XO+142,YO-4)-(XO+139,YO-15)
3200  LINE (XO+135,YO-4)-(XO+139,YO-15): X=XO+145: Y=YO-17
3210  PUT(X,Y),KANJI(&H2645),OR: X=XO+158: Y=YO-6
3220  PUT(X,Y),KANJI(&H16E),OR: LINE (XO+215,YO+40)-(XO+215,YO-25)
3230  LINE (XO+215,YO+40)-(XO+210,YO+45)
3240  LINE (XO+215,YO-25)-(XO+210,YO-30): X=XO+218: Y=YO+35
3250  PUT(X,Y),KANJI(&H6E),OR: X=XO+220: Y=YO-4
3260  PUT(X,Y),KANJI(&H215C),OR: LINE (XO+240,YO+3)-(XO+325,YO+3)
3270  X=XO+245: Y=YO+18: GOSUB *J: X=XO+253: Y=YO+10
3280  PUT(X,Y),KANJI(&H28),OR: X=XO+262: Y=YO+10
3290  PUT(X,Y),KANJI(&H32),OR: X=XO+269: Y=YO+10
3300  PUT(X,Y),KANJI(&H2650),OR: X=XO+287: Y=YO+18: GOSUB *FI
3310  X=XO+294:Y=YO+10:PUT(X,Y),KANJI(&H29),OR
3320  X=XO+301:Y=YO+10:PUT(X,Y),KANJI(&H2645),OR
3330  X=XO+314:Y=YO+21:PUT(X,Y),KANJI(&H176),OR
3340  X=XO+270:Y=YO-18:PUT(X,Y),KANJI(&H264A),OR
3350  X=XO+278:Y=YO-15:PUT(X,Y),KANJI(&H2649),OR: RETURN
3360 *F: GOSUB *D0: RETURN
3370 *VARROW2: LINE (X,Y)-(X-15,Y),7
3380  LINE (X,Y)-(X-4,Y-4): LINE (X,Y)-(X-4,Y+4)
3390  LINE (X-15,Y)-(X-11,Y-4): LINE (X-15,Y)-(X-11,Y+4): RETURN
3400 *EP: CIRCLE (X,Y),5,7,.7,4.8,.5: CIRCLE (X,Y+6),5,7,1.5,5.5,.5
3410  XS=X+9: YS=Y-6: LINE (XS-3,YS)-(XS+3,YS)
3420  LINE (XS-2,YS-3)-(XS+2,YS+3)
3430  LINE (XS+2,YS-3)-(XS-2,YS+3): RETURN
3440 *E2: CIRCLE (X,Y),5,7,.7,4.8,.5: CIRCLE (X,Y+6),5,7,1.5,5.5,.5
3450  XS=X+9: YS=Y-6: RETURN
3460 *FI: CIRCLE (X+5,Y-6),2,7,.5,2.9,1: LINE (X+3,Y-6)-(X,Y+7)
3470  CIRCLE (X-3,Y+7),2,7,3.8,6.2,1
3480  LINE (X+4,Y-1)-(X-1,Y-1): RETURN
3490 *J: LINE (X+1,Y-1)-(X,Y+6): LINE (X+1,Y-1)-(X-2,Y+2)
3500  CIRCLE (X-3,Y+7),2,7,3.8,6.2,1: CIRCLE (X+1,Y-5),1
3510  PSET (X+1,Y-5): RETURN
3520 *COLORSET: FOR I=1 TO 15: FOR J=1 TO 3: CC(J)=CCD(J,I)
3530  IF CC(J)<0 THEN CC(J)=0
3540  IF CC(J)>15 THEN CC(J)=15
3550  NEXT J: CNUM=16*16*CC(1)+16*CC(2)+CC(3)
3560  COLOR=(I,CNUM): NEXT I: RETURN
3570 *COLORUP: FOR I=1 TO 3: FOR J=1 TO 15: CCD(I,J)=CCD(I,J)+1
3580  NEXT J: NEXT I: GOSUB *COLORSET: CLPLS=CLPLS+1: RETURN
3590 *COLORDN: FOR I=1 TO 3: FOR J=1 TO 15: CCD(I,J)=CCD(I,J)-1
3600  NEXT J: NEXT I: GOSUB *COLORSET: CLPLS=CLPLS-1: RETURN
3610 *HEC2: COLOR 7: LOCATE 1,1: X=2: Y=12: PRINT "HELP  MAIN MENU  "
3620  LINE (X+1,Y+1)-(X+129,Y+22),2,BF: LINE (X,Y)-(X+130,Y+23),7,B
3630  LINE (X+131,Y)-(X+131,Y+23),7,B
3640  LINE (X+132,Y)-(X+134,Y+24),0,BF
3650  LINE (X+2,Y+2)-(X+44,Y+21),1,BF: PRESET (X+131,Y)
3660  PRESET (X,Y+24): LINE (X+2,Y+2)-(X+44,Y+21),7,B: RETURN
3670 *HRC2: COLOR 7: LOCATE 17,1: PRINT "       CONTINUE": X=137: Y=12
3680  LINE (X+1,Y+1)-(X+122,Y+22),2,BF: LINE (X,Y)-(X+123,Y+23),7,B
3690  PRESET (X+124,Y): PRESET (X,Y+24)
3700  LINE (X+2,Y+2)-(X+37,Y+21),1,BF: LINE (X+2,Y+2)-(X+37,Y+21),7,B
3710  LINE (X+22,Y+4)-(X+25,Y+14),7,BF
3720  LINE (X+16,Y+10)-(X+21,Y+14),7,BF
3730  LINE (X+15,Y+5)-(X+15,Y+19): LINE (X+8,Y+12)-(X+15,Y+5)
3740  LINE (X+8,Y+12)-(X+15,Y+19): PAINT (X+9,Y+12),7
3750  LINE (2,40)-(260,394),7,B
3760  PRESET (2,395): PRESET (261,40): RETURN
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[Program Name: DSET1.BAS]

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1000  ' SAVE "DSET1.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50), DTT(50), PN$(50)
1030  GOSUB *INS: GOSUB *DATAREAD1: GOSUB *DATASET1
1040  GOSUB *DATAOUTPUT1: RUN "CALC1.BAS"
1050 *DATAREAD1: OPEN "IPMT1.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 10: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1070 *DATAOUTPUT1: OPEN "IPMT1.DAT" FOR OUTPUT AS #1
1080  FOR M=1 TO 10: PRINT #1, DTP(1,M);: NEXT M: CLOSE #1: RETURN
1090 *DATASET1: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,10: PRINT T3$: FOR I=1 TO 10: READ DTT(I): NEXT I
1110  FOR I=4 TO 10: READ PN$(I): NEXT I: FOR I=1 TO 10: READ DTP(2,I)
1120  NEXT I: FOR I=1 TO 10: READ DTP(3,I): NEXT I
1130  DATA 2,2,2,2,2,16,2,16,2,16,"","Ea:","Ka:","Ei:","Ki:","R:"
1140  DATA "VF:",6,6,16,19,6,20,6,20,6,20,5,6,7,8,11,11,12,12,13,13
1150  DTCMAX=10: DTC=1: DTCB=1: COLOR 7: FOR I=1 TO 10
1160  LOCATE DTT(I),DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1170  IF I=4 THEN ELSE PRINT DTP(1,I): GOTO 1190
1180  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1190  NEXT I
1200  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1210  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH
1220  IF DTC=4 THEN GOSUB *DISPEQ
1230  IF DTC=6 OR DTC=8 THEN GOSUB *DISPMS
1240  IF DTC=9  THEN GOSUB *DISPMM
1250  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1260  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1280
1270  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1280  COLOR 7
1290  K$=INKEY$: IF K$="" THEN 1290
1300  IF ASC(K$)=1 THEN GOTO *HLP
1310  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1490
1320  IF ASC(K$)=32 THEN ELSE 1340
1330  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1200
1340  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1200
1350  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1200
1360  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1290
1370  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1380  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1400
1390  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1400  IF ASC(K$)=30 AND DTC>=6 THEN DTC=DTC-2: GOTO 1460
1410  IF ASC(K$)=30 AND DTC<6 THEN DTC=DTC-1: GOTO 1460
1420  IF ASC(K$)=31 AND DTC>=5 THEN DTC=DTC+2: GOTO 1460
1430  IF ASC(K$)=31 AND DTC<5 THEN DTC=DTC+1: GOTO 1460
1440  IF ASC(K$)=28 AND DTC>=5 THEN DTC=DTC+1
1450  IF ASC(K$)=29 AND DTC>=6 THEN DTC=DTC-1
1460  IF DTC<=0 THEN DTC=10
1470  IF DTC=>11 THEN DTC=1
1480  GOTO 1200
1490  RETURN
```

[Program Name: DSET2.BAS]

```
1000  ' SAVE "DSET2.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50), DTT(50), PN$(50)
1030  GOSUB *INS: GOSUB *DATAREAD2: GOSUB *DATASET2
1040  GOSUB *DATAOUTPUT2: RUN "CALC2.BAS"
1050 *DATAREAD2: OPEN "IPMT2.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 13: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1070 *DATAOUTPUT2: OPEN "IPMT2.DAT" FOR OUTPUT AS #1
1080  FOR M=1 TO 13: PRINT #1, DTP(1,M);: NEXT M: CLOSE #1: RETURN
1090 *DATASET2: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,10: PRINT T3$: FOR I=1 TO 13: READ DTT(I): NEXT I
1110  FOR I=4 TO 13: READ PN$(I): NEXT I: FOR I=1 TO 13: READ DTP(2,I)
1120  NEXT I: FOR I=1 TO 13: READ DTP(3,I): NEXT I
1130  DATA 2,2,2,2,2,16,2,16,2,16,2,16,2,"","Ea:","Ka:","Ei:","Ki:"
1140  DATA "Em:","Km:","R:","d:","VF:",6,6,16,19,6,20,6,20,6,20,6,20,6
1150  DATA 5,6,7,8,11,11,12,12,13,13,14,14,15
1160  DTCMAX=13: DTC=1: DTCB=1: COLOR 7: FOR I=1 TO 13
1170  LOCATE DTT(I),DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1180  IF I=4 THEN ELSE PRINT DTP(1,I): GOTO 1200
1190  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1200  NEXT I
1210  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1220  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1280
1230  IF DTC=4 THEN GOSUB *DISPEQ: GOTO 1280
1240  IF DTC=6 OR DTC=8 THEN GOSUB *DISPMS: GOTO 1280
1250  IF DTC=10 THEN GOSUB *DISPCS: GOTO 1280
1260  IF DTC=11 THEN GOSUB *DISPMM: GOTO 1280
1270  IF DTC=12 THEN GOSUB *DISPNM: GOTO 1280
1280  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1290  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1310
1300  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1310  COLOR 7
1320  K$=INKEY$: IF K$="" THEN 1320
1330  IF ASC(K$)=1 THEN GOTO *HLP
1340  IF ASC(K$)=27 THEN 1530
1350  IF ASC(K$)=13 THEN 1530
1360  IF ASC(K$)=32 THEN ELSE 1380
1370  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1210
1380  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1210
1390  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1210
1400  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1320
1410  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1420  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1440
1430  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1440  IF ASC(K$)=30 AND DTC>=6 THEN DTC=DTC-2: GOTO 1500
1450  IF ASC(K$)=30 AND DTC<6 THEN DTC=DTC-1: GOTO 1500
1460  IF ASC(K$)=31 AND DTC>=5 THEN DTC=DTC+2: GOTO 1500
1470  IF ASC(K$)=31 AND DTC<5 THEN DTC=DTC+1: GOTO 1500
1480  IF ASC(K$)=28 AND DTC>=5 THEN DTC=DTC+1
1490  IF ASC(K$)=29 AND DTC>=6 THEN DTC=DTC-1
1500  IF DTC<=0 THEN DTC=13
1510  IF DTC=>14 THEN DTC=1
1520  GOTO 1210
1530  RETURN
```

[Program Name: DSET3.BAS]

```
1000  ' SAVE "DSET3.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,16), DTT(16), PN$(16)
1030  GOSUB *INS: GOSUB *DATAREAD3: GOSUB *DATASET3
1040  GOSUB *DATAOUTPUT3: RUN "CALC3.BAS"
1050 *DATAREAD3: OPEN "IPMT3.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 16: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1070 *DATAOUTPUT3: OPEN "IPMT3.DAT" FOR OUTPUT AS #1
1080  FOR M=1 TO 16: PRINT #1, DTP(1,M);: NEXT M: CLOSE #1: RETURN
1090 *DATASET3: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,10: PRINT T3$: FOR I=1 TO 16: READ DTT(I): NEXT I
1110  FOR I=4 TO 16: READ PN$(I): NEXT I: FOR I=1 TO 16: READ DTP(2,I)
1120  NEXT I: FOR I=1 TO 16: READ DTP(3,I): NEXT I
1130  DATA 2,2,2,2,2,16,2,16,2,16,2,16,2,16,2,16,"","Ea:","Ka:","Ei:"
1140  DATA "Ki:","Emo:","Kmo:","Emi:","Kmi:","R:","do:","di:","VF:",6
1150  DATA 6,16,19,6,20,6,20,6,20,6,20,6,20,6,20,5,6,7,8,11,11,12,12
1160  DATA 13,13,14,14,15,15,16,16
1170  DTCMAX=16: DTC=1: DTCB=1: COLOR 7: FOR I=1 TO 16
1180  LOCATE DTT(I),DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1190  IF I=4 THEN ELSE PRINT DTP(1,I): GOTO 1210
1200  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1210  NEXT I
1220  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1230  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1290
1240  IF DTC=4 THEN GOSUB *DISPEQ: GOTO 1290
1250  IF DTC=6 OR DTC=8 THEN GOSUB *DISPMS: GOTO 1290
1260  IF DTC=10 OR DTC=12 THEN GOSUB *DISPCS: GOTO 1290
1270  IF DTC=13 THEN GOSUB *DISPMM: GOTO 1290
1280  IF DTC=14 OR DTC=15 THEN GOSUB *DISPNM: GOTO 1290
1290  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1300  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1320
1310  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1320  COLOR 7
1330  K$=INKEY$: IF K$="" THEN 1330
1340  IF ASC(K$)=1 THEN GOTO *HLP
1350  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1530
1360  IF ASC(K$)=32 THEN ELSE 1380
1370  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1220
1380  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1220
1390  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1220
1400  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1330
1410  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1420  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1440
1430  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1440  IF ASC(K$)=30 AND DTC>=6 THEN DTC=DTC-2: GOTO 1500
1450  IF ASC(K$)=30 AND DTC<6 THEN DTC=DTC-1: GOTO 1500
1460  IF ASC(K$)=31 AND DTC>=5 THEN DTC=DTC+2: GOTO 1500
1470  IF ASC(K$)=31 AND DTC<5 THEN DTC=DTC+1: GOTO 1500
1480  IF ASC(K$)=28 AND DTC>=5 THEN DTC=DTC+1
1490  IF ASC(K$)=29 AND DTC>=6 THEN DTC=DTC-1
1500  IF DTC<=0 THEN DTC=16
1510  IF DTC=>17 THEN DTC=1
1520  GOTO 1220
1530  RETURN
```

[Program Name: DSET4.BAS]

```
1000  ' SAVE "DSET4.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50), DTT(50), PN$(50)
1030  GOSUB *INS: GOSUB *DATAREAD4: GOSUB *DATASET4
1040  GOSUB *DATAOUTPUT4: RUN "CALC4.BAS"
1050 *DATAREAD4: OPEN "IPMT4.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 19: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1070 *DATAOUTPUT4: OPEN "IPMT4.DAT" FOR OUTPUT AS #1
1080  FOR M=1 TO 19: PRINT #1, DTP(1,M);: NEXT M: CLOSE #1: RETURN
1090 *DATASET4: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,7: PRINT T2$
1100  LOCATE 1,9: PRINT T3$: FOR I=1 TO 19: READ DTT(I): NEXT I
1110  FOR I=4 TO 19: READ PN$(I): NEXT I: FOR I=1 TO 19: READ DTP(2,I)
1120  NEXT I: FOR I=1 TO 19: READ DTP(3,I): NEXT I
1130  DATA 2,15,2,2,2,16,2,16,2,16,2,16,2,16,2,16,2,16,2,"","Ea:"
1140  DATA "Ka:","Ei:","Ki:","Enp:","Knp:","Em:","Km:","En:","Kn:"
1150  DATA "R:","d:","Rn:","dn:","VF:",6,19,16,19,7,20,7,20,7,20,7,20
1160  DATA 7,20,7,20,7,20,7,5,5,6,7,10,10,11,11,12,12,13,13,14,14,15
1170  DATA 15,16,16,17
1180  DTCMAX=19: DTC=1: DTCB=1: COLOR 7: FOR I=1 TO 19
1190  LOCATE DTT(I),DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1200  IF I=4 THEN ELSE PRINT DTP(1,I): GOTO 1220
1210  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1220  NEXT I
1230  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1240  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1300
1250  IF DTC=4 THEN GOSUB *DISPEQ: GOTO 1300
1260  IF DTC=6 OR DTC=8 OR DTC=10 THEN GOSUB *DISPMS: GOTO 1300
1270  IF DTC=12 OR DTC=14 THEN GOSUB *DISPCS: GOTO 1300
1280  IF DTC=15 OR DTC=17 THEN GOSUB *DISPMM: GOTO 1300
1290  IF DTC=16 OR DTC=18 THEN GOSUB *DISPNM: GOTO 1300
1300  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1310  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1330
1320  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1330  COLOR 7
1340  K$=INKEY$: IF K$="" THEN 1340
1350  IF ASC(K$)=1 THEN GOTO *HLP
1360  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1500
1370  IF ASC(K$)=32 THEN ELSE 1390
1380  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1230
1390  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1230
1400  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1230
1410  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1340
```

```
1420  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1430  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1450
1440  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1450  IF ASC(K$)=28 OR ASC(K$)=31 THEN DTC=DTC+1
1460  IF ASC(K$)=29 OR ASC(K$)=30 THEN DTC=DTC-1
1470  IF DTC<=0 THEN DTC=19
1480  IF DTC=>20 THEN DTC=1
1490  GOTO 1230
1500  RETURN
```

[Program Name: DSET5.BAS]

```
1000  ' SAVE "DSET5.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50),ES(20),KS(20),THICK(20)
1030  GOSUB *INS: GOSUB *DATAREAD5: GOSUB *DATASET5
1040  GOSUB *DATAOUTPUT5: RUN "CALC5.BAS"
1050  RUN "CALC5.BAS"
1060 *DATAREAD5: OPEN "IPMT5.DAT" FOR INPUT AS #1
1070  FOR I=1 TO 12: INPUT #1, DTP(1,I): NEXT I
1080  INPUT #1, ES,KS,THICKS,EIS,KIS,THICKI,NSHELL
1090  NOPIS=DTP(1,6): MSNCOM=DTP(1,5)
1100  IF NOPIS>9 THEN NOPIS=9
1110  IF MSNCOM=1 THEN 1140
1120  FOR I=NOPIS-1 TO 1 STEP -1
1130  INPUT #1, ES(I),KS(I),THICK(I): NEXT I
1140  CLOSE #1: RETURN
1150 *DATAOUTPUT5: IF MSNCOM=1 THEN 1180
1160  NOPIS=DTP(1,6): FOR I=1 TO NOPIS-1: ES(I)=DTP(1,I*3+12-2)
1170  KS(I)=DTP(1,I*3+12-1): THICK(I)=DTP(1,I*3+12): NEXT I: GOTO 1200
1180  NSHELL=DTP(1,6): ES=DTP(1,13): KS=DTP(1,14): THICKS=DTP(1,15)
1190  EIS=DTP(1,16): KIS=DTP(1,17): THICKI=DTP(1,18)
1200  OPEN "IPMT5.DAT" FOR OUTPUT AS #1: FOR I=1 TO 12
1210  PRINT #1, DTP(1,I);: NEXT I: PRINT #1, ES;KS;THICKS;EIS;KIS;
1220  PRINT #1, THICKI;NSHELL: IF MSNCOM=1 THEN 1250
1230  FOR I=NOPIS-1 TO 1 STEP -1: PRINT #1, ES(I),KS(I),THICK(I)
1240  NEXT I
1250  CLOSE #1: RETURN
1260 *DATASET5: COLOR 5: LOCATE 1,4: PRINT T1$: LOCATE 1,7: PRINT T2$
1270  LOCATE 1,9: PRINT "INTERIOR COMPONENTS": LOCATE 1,12: PRINT T3$
1280  COLOR 7: FOR I=1 TO 12: READ DTT(I): NEXT I: FOR I=4 TO 12
1290  READ PN$(I): NEXT I: FOR I=1 TO 12: READ DTP(2,I): NEXT I
1300  FOR I=1 TO 12: READ DTP(3,I): NEXT I
1310  DATA 2,15,2,2,2,2,2,15,2,15,2,17,"","","NUMBER OF PHASES:       "
1320  DATA "Ea:","Ka:","E1:","Ki:","Radius:","VF:",6,19,16,2,2,20,5,18
1330  DATA 5,18,9,20,5,5,6,8,10,11,13,13,14,14,15,15
1340  COM3$="3-COMPONENT": COMM$="MULTI-COMPONENT"
1350  IF MSNCOM=1 THEN PN$(6)="NUMBER OF SHELLLS:       "
1360  IF MSNCOM=1 THEN DTP(1,6)=NSHELL ELSE DTP(1,6)=NOPIS
1370  LOCATE 35,15: PRINT SPACE$(15): LOCATE 35,15
1380  IF MSNCOM=2 THEN PRINT NOPIS-1; "% 3 2 1"
1390  FOR I=16 TO 23: LOCATE 2,I: PRINT SPACE$(30):NEXT I
1400  FOR I=1 TO 12: LOCATE DTT(I),DTP(3,I): PRINT PN$(I): NEXT I
1410  FOR I=1 TO 12: LOCATE DTP(2,I),DTP(3,I)
1420  IF I=4 OR I=5 THEN ELSE PRINT DTP(1,I): GOTO 1470
1430  IF I=4 THEN ELSE GOTO 1450
1440  IF DTP(1,4)=1 THEN PRINT W$ ELSE PRINT H$
1450  IF I=5 THEN ELSE GOTO 1470
1460  IF DTP(1,5)=1 THEN PRINT COM3$ ELSE PRINT COMM$+SPACE$(20)
1470  NEXT I
1480  IF MSNCOM=1 THEN 1610
1490  FOR I=1 TO NOPIS-1: DTP(1,I*3+12-2)=ES(I): DTP(1,I*3+12-1)=KS(I)
1500  DTP(1,I*3+12)=THICK(I): DTP(2,I*3+12-2)=5: DTP(2,I*3+12-1)=14
1510  DTP(2,I*3+12)=26: DTP(3,I*3+12-2)=15+I: DTP(3,I*3+12-1)=15+I
1520  DTP(3,I*3+12)=15+I: PN$(I*3+10)="E"+RIGHT$(STR$(I),1)+":"
1530  PN$(I*3+11)="K"+RIGHT$(STR$(I),1)+":"
1540  PN$(I*3+12)="d"+RIGHT$(STR$(I),1)+":": LOCATE 2,DTP(3,I*3+10)
1550  PRINT PN$(I*3+10): LOCATE 11,DTP(3,I*3+11): PRINT PN$(I*3+11)
1560  LOCATE 23,DTP(3,I*3+12): PRINT PN$(I*3+12)
1570  LOCATE DTP(2,I*3+12-2),DTP(3,I*3+12-2): PRINT DTP(1,I*3+12-2)
1580  LOCATE DTP(2,I*3+12-1),DTP(3,I*3+12-1): PRINT DTP(1,I*3+12-1)
1590  LOCATE DTP(2,I*3+12),DTP(3,I*3+12): PRINT DTP(1,I*3+12): NEXT I
1600  NUM.DATA=NOPIS*3+9: GOTO 1740
1610  COLOR 6:LOCATE 2,16: PRINT "SHELL:": COLOR 7: DTP(1,13)=ES
1620  DTP(1,14)=KS: DTP(1,15)=THICKS: DTP(2,13)=5: DTP(2,14)=5
1630  DTP(2,15)=5: DTP(3,13)=17: DTP(3,14)=18: DTP(3,15)=19
1640  PN$(13)="E:": PN$(14)="K:": PN$(15)="d:": COLOR 6: LOCATE 2,20
1650  PRINT "INTERSHELL SPACE:": COLOR 7: DTP(1,16)=EIS
1660  DTP(1,17)=KIS: DTP(1,18)=THICKI: DTP(2,16)=5: DTP(2,17)=5
1670  DTP(2,18)=5: DTP(3,16)=21: DTP(3,17)=22: DTP(3,18)=23
1680  PN$(16)="E:": PN$(17)="K:": PN$(18)="d:": FOR I=13 TO 18
1690  LOCATE 2,DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1700  PRINT DTP(1,I): NEXT I: NUM.DATA=18: COLOR 6
1710  RR=(DTP(1,15)+DTP(1,18))*DTP(1,6)/1000+DTP(1,18)/1000
1720  RINNER=DTP(1,11)-RR: LOCATE 17,10: PRINT "(Ri=";
1730  PRINT USING "##.###"; RINNER;: PRINT "um)": COLOR 7
1740  DTC=1: DTCA=DTC
1750  GOSUB *DISPNULL
1760  IF DTC>=3 OR DTC<=5 THEN ELSE 1810
1770  IF DTC=4 AND DTCA=3 THEN 1790
1780  IF DTC=5 AND DTCA=6 THEN ELSE 1810
1790  COLOR 7: LOCATE DTP(2,DTCA),DTP(3,DTCA): PRINT DTP(1,DTCA)
1800  GOTO 1890
1810  IF DTC=3 AND DTCA=4 THEN 1830
1820  IF DTC=6 AND DTCA=5 THEN ELSE 1850
1830  COLOR 4:LOCATE DTP(2,DTC),DTP(3,DTC):PRINT DTP(1,DTC): COLOR 7
1840  GOTO 1890
1850  IF DTC=4 AND DTCA=5 THEN 1890
1860  IF DTC=5 AND DTCA=4 THEN 1890
1870  COLOR 7:LOCATE DTP(2,DTCA),DTP(3,DTCA):PRINT DTP(1,DTCA)
1880  COLOR 2:LOCATE DTP(2,DTC),DTP(3,DTC):PRINT DTP(1,DTC): COLOR 7
1890  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 2010
1900  IF DTC=4 THEN GOSUB *DISPEQ: GOTO 2010
1910  IF DTC=5 THEN GOSUB *DISP3M: GOTO 2010
1920  IF DTC=8 OR DTC=10 THEN GOSUB *DISPMS: GOTO 2010
1930  IF DTC=11 THEN GOSUB *DISPMM: GOTO 2010
1940  IF MSNCOM=1 THEN ELSE 1970
1950  IF DTC=14 OR DTC=17 THEN GOSUB *DISPMS: GOTO 2010
1960  IF DTC=15 OR DTC=18 THEN GOSUB *DISPNM: GOTO 2010
1970  IF DTC>12 THEN ELSE 2000
1980  IF DTC-(DTC\3)*3=2 THEN GOSUB *DISPMS: GOTO 2010
1990  IF DTC-(DTC\3)*3=0 THEN GOSUB *DISPNM: GOTO 2010
2000  GOSUB *DISPNULL
2010  IF DTCA=4 THEN ELSE 2040
2020  COLOR 7: LOCATE 2,8: IF DTP(1,4)=1 THEN PRINT W$ ELSE PRINT H$
2030  GOTO 2060
2040  IF DTC=4 THEN ELSE 2060
2050  COLOR 2: LOCATE 2,8: IF DTP(1,4)=1 THEN PRINT W$ ELSE PRINT H$
2060  IF DTCA=5 THEN ELSE 2100
2070  COLOR 7: LOCATE 2,10
2080  IF DTP(1,5)=1 THEN PRINT COM3$+"    " ELSE PRINT COMM$
2090  COLOR 7: GOTO 2130
2100  IF DTC=5 THEN ELSE 2130
2110  COLOR 2: LOCATE 2,10
2120  IF DTP(1,5)=1 THEN PRINT COM3$+"    " ELSE PRINT COMM$
2130  DDAT=DTP(1,DTC)
2140  K$=INKEY$
2150  IF K$="" THEN 2140
2160  IF ASC(K$)=1 THEN GOTO *HLP
2170  IF ASC(K$)=13 OR ASC(K$)=27 THEN 2530
2180  IF ASC(K$)=32 THEN ELSE 2210
2190  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1750
2200  IF DTC=5 THEN GOSUB *DATAGET5: GOTO 1350
2210  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN ELSE 2270
2220  GOSUB *DATAGET
2230  IF DTC=7 AND MSNCOM=1 THEN NSHELL=DTP(1,6)
2240  IF DTC=7 AND MSNCOM=2 THEN NOPIS=DTP(1,6)
2250  IF NOPIS>9 THEN NOPIS=9: DTP(1,6)=9
2260  IF DTC=7 THEN 1370 ELSE 1750
2270  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 2140
2280  DTCA=DTC:DDATA=DDAT
2290  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
2300  IF MSNCOM=2 THEN 2390
2310  IF ASC(K$)=30 THEN ELSE 2350
2320  IF DTC=2 THEN DTC=DTC-2: GOTO 2470
2330  IF DTC>7 AND DTC<13 THEN DTC=DTC-2: GOTO 2470
2340  DTC=DTC-1: GOTO 2470
2350  IF ASC(K$)=31 THEN ELSE 2470
2360  IF DTC=1 THEN DTC=DTC+2: GOTO 2470
2370  IF DTC>6 AND DTC<12 THEN DTC=DTC+2: GOTO 2470
2380  DTC=DTC+1: GOTO 2470
2390  IF ASC(K$)=30 THEN ELSE 2430
2400  IF DTC=2 OR DTC=8 OR DTC=9 OR DTC=10 THEN DTC=DTC-1
2410  IF DTC>12 THEN DTC=DTC-2
2420  DTC=DTC-1
2430  IF ASC(K$)=31 THEN ELSE 2470
2440  IF DTC=1 OR DTC=7 OR DTC=8 OR DTC=9 THEN DTC=DTC+1
2450  IF DTC>12 THEN DTC=DTC+2
2460  DTC=DTC+1
2470  IF ASC(K$)=28 THEN DTC=DTC+1
2480  IF ASC(K$)=29 THEN DTC=DTC-1
2490  IF DTC<=0 THEN DTC=NUM.DATA
2500  IF DTC>NUM.DATA THEN DTC=1
2510  DTCB=DTCA
2520  GOTO 1750
2530  RETURN
```

[Program Name: DSET6.BAS]

```
1000  ' SAVE "DSET6.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREAD6: GOSUB *DATASET6
1040  GOSUB *DATAOUTPUT6: RUN "CALC6.BAS"
1050 *DATAREAD6: OPEN "IPMT6.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 21: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1070 *DATAOUTPUT6: OPEN "IPMT6.DAT" FOR OUTPUT AS #1: FOR M=1 TO 21
1090  PRINT #1, DTP(1,M);: NEXT M: CLOSE #1: RETURN
1100 *DATASET6: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1110  LOCATE 1,11: PRINT T3$: FOR I=1 TO 21: READ DTT(I): NEXT I
1120  FOR I=4 TO 21: READ PN$(I): NEXT I: FOR I=1 TO 21: READ DTP(2,I)
1130  NEXT I: FOR I=1 TO 21: READ DTP(3,I): NEXT I
1140  DATA 2,15,2,2,16,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2,15
1150  DATA "OUTER:","INNER:","Ea:","Ka:","E1:","Ki:","Ev:","Kv:","Em:"
1160  DATA "Km:","Emv:","Kmv:","R:","d:","Rv:","dv:","VF:","VFv:",6,19
1170  DATA 16,9,23,6,19,6,19,6,19,6,19,6,19,6,19,6,19,6,19,5,5,6,9,9
1180  DATA 12,12,13,13,14,14,15,15,16,16,17,17,18,18,19,19
1190  DTCMAX=21: DTC=1: DTCB=1: COLOR 7: FOR I=1 TO 21
1200  LOCATE DTT(I),DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1210  IF I=4 OR I=5 THEN ELSE PRINT DTP(1,I): GOTO 1230
1220  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1230  NEXT I
1240  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1250  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1320
1260  IF DTC=4 OR DTC=5 THEN GOSUB *DISPEQ: GOTO 1320
1270  IF DTC=7 OR DTC=9 THEN GOSUB *DISPMS: GOTO 1320
1280  IF DTC=11 THEN GOSUB *DISPMS: GOTO 1320
1290  IF DTC=13 OR DTC=15 THEN GOSUB *DISPCS: GOTO 1320
1300  IF DTC=16 OR DTC=18 THEN GOSUB *DISPMM: GOTO 1320
1310  IF DTC=17 OR DTC=19 THEN GOSUB *DISPNM
1320  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1330  IF DTC=4 OR DTC=5 THEN ELSE PRINT DDAT: GOTO 1350
1340  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1350  COLOR 7
1360  K$=INKEY$: IF K$="" THEN 1360
1370  IF ASC(K$)=1 THEN GOSUB *HLP
1380  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1670
1390  IF ASC(K$)=32 THEN ELSE 1410
1400  IF DTC=4 OR DTC=5 THEN GOSUB *DATAGET2: GOTO 1240
1410  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1240
1420  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1240
1430  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1360
1440  DTCA=DTC
1450  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1460  IF DTC=4 OR DTC=5 THEN ELSE PRINT DDAT: GOTO 1480
1470  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1480  IF ASC(K$)=30 AND DTC=3 THEN ELSE 1510
1490  IF DTCB=4 THEN DTC=1: GOTO 1650
1500  IF DTCB=5 THEN DTC=2: GOTO 1650
1510  IF ASC(K$)=30 AND DTC=4 THEN DTC=3: GOTO 1650
1520  IF ASC(K$)=30 THEN DTC=DTC-2
1530  IF ASC(K$)=31 AND  DTC=1 THEN DTC=3: GOTO 1650
1540  IF ASC(K$)=31 AND  DTC=2 THEN DTC=3: GOTO 1650
1550  IF ASC(K$)=31 AND  DTC=3 THEN ELSE 1580
1560  IF DTCB=1 THEN DTC=4: GOTO 1650
1570  IF DTCB=2 THEN DTC=5: GOTO 1650
1580  IF ASC(K$)=31 THEN DTC=DTC+2
1590  IF ASC(K$)=28 THEN DTC=DTC+1
1600  IF ASC(K$)=29 THEN DTC=DTC-1
1610  IF DTC<=-1 THEN DTC=20
1620  IF DTC=0 THEN DTC=21
1630  IF DTC=>23 THEN DTC=2
1640  IF DTC=22 THEN DTC=1
1650  DTCB=DTCA
1660  GOTO 1240
1670  RETURN
```

[Program Name: DSET7.BAS]

```
1000  ' SAVE "DSET7.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREAD7: GOSUB *DATASET7
1040  GOSUB *DATAOUTPUT7: RUN "CALC7.BAS"
1050 *DATAREAD7: OPEN "IPMT7.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 27: INPUT #1, DTP(1,I): NEXT I: CLOSE #1
1070  DTP(1,24)=DTP(1,24)/DTP(1,20): RETURN
1080 *DATAOUTPUT7: OPEN "IPMT7.DAT" FOR OUTPUT AS #1
1090  FOR M=1 TO 27: PRINT #1, DTP(1,M);: NEXT M: CLOSE #1: RETURN
1100 *DATASET7: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,7: PRINT T2$
1110  LOCATE 1,9: PRINT T3$: FOR I=1 TO 27: READ DTT(I): NEXT I
1120  FOR I=4 TO 27: READ PN$(I): NEXT I: FOR I=1 TO 27: READ DTP(2,I)
1130  NEXT I: FOR I=1 TO 27: READ DTP(3,I): NEXT I
1140  DATA 2,15,2,2,16,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2
1150  DATA 15,2,15,"OUTER:","INNER:","Ea:","Ka:","E1:","Ki","Enp:"
1160  DATA "Knp:","Ev:","Kv:","Em:","Km:","En:","Kn:","Emv:","Kmv:"
1170  DATA "R:","d:","Rv:","dv:","Rn/R:","dn:","VF:","VFv:",6,19,16,9
1180  DATA 23,5,18,5,18,6,19,5,18,5,18,6,19,6,19,4,17,5,18,7,19,5,19,5
1190  DATA 5,6,8,8,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18
1200  DATA 18,19,19,20,20
1210  DTCMAX=27: DTC=1: DTCB=1: COLOR 7: FOR I=1 TO 27
1220  LOCATE DTT(I),DTP(3,I): PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I)
1230  LOCATE DTP(2,I),DTP(3,I)
1240  IF I=4 OR I=5 THEN ELSE PRINT DTP(1,I): GOTO 1260
1250  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1260  NEXT I
1270  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1280  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1350
1290  IF DTC=4 OR DTC=5 THEN GOSUB *DISPEQ: GOTO 1350
1300  IF DTC=7 OR DTC=9 THEN GOSUB *DISPMS: GOTO 1350
1310  IF DTC=11 OR DTC=13 THEN GOSUB *DISPMS: GOTO 1350
```

```
1320  IF DTC=15 OR DTC=17 OR DTC=19 THEN GOSUB *DISPCS: GOTO 1350
1330  IF DTC=20 OR DTC=22 THEN GOSUB *DISPMM: GOTO 1350
1340  IF DTC=21 OR DTC=23 OR DTC=25 THEN GOSUB *DISPNM: GOTO 1350
1350  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1360  IF DTC=4 OR DTC=5 THEN ELSE PRINT DDAT: GOTO 1380
1370  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1380  COLOR 7
1390  K$=INKEY$: IF K$="" THEN 1390
1400  IF ASC(K$)=1 THEN GOTO *HLP
1410  IF ASC(K$)=27 OR ASC(K$)=13 THEN 1670
1420  IF ASC(K$)=32 THEN ELSE 1440
1430  IF DTC=4 OR DTC=5 THEN GOSUB *DATAGET2: GOTO 1270
1440  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1270
1450  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1270
1460  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1390
1470  DTCA=DTC: COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1480  IF DTC=4 OR DTC=5 THEN ELSE PRINT DDAT: GOTO 1500
1490  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1500  IF ASC(K$)=30 AND DTC=3 THEN ELSE 1530
1510  IF DTCB=4 THEN DTC=1: GOTO 1650
1520  IF DTCB=5 THEN DTC=2: GOTO 1650
1530  IF ASC(K$)=30 AND DTC=4 THEN DTC=3: GOTO 1650
1540  IF ASC(K$)=30 THEN DTC=DTC-2
1550  IF ASC(K$)=31 AND  DTC=1 THEN DTC=3: GOTO 1650
1560  IF ASC(K$)=31 AND  DTC=2 THEN DTC=3: GOTO 1650
1570  IF ASC(K$)=31 AND  DTC=3 THEN ELSE 1600
1580  IF DTCB=1 THEN DTC=4: GOTO 1650
1590  IF DTCB=2 THEN DTC=5: GOTO 1650
1600  IF ASC(K$)=31 THEN DTC=DTC+2
1610  IF ASC(K$)=28 THEN DTC=DTC+1
1620  IF ASC(K$)=29 THEN DTC=DTC-1
1630  IF DTC<=0 THEN DTC=27
1640  IF DTC=>28 THEN DTC=1
1650  DTCB=DTCA
1660  GOTO 1270
1670  DTP(1,24)=DTP(1,24)*DTP(1,20)
1680  RETURN
```

[Program Name: DSET8.BAS]

```
1000  ' SAVE "DSET8.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50),CCD(3,11),CC(11)
1030  GOSUB *INS: GOSUB *DATAREAD8: GOSUB *DATASET8
1040  GOSUB *DATAOUTPUT8: RUN "CALC8.BAS"
1050 *DATAREAD8: OPEN "IPMT8.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 33: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1070 *DATAOUTPUT8: OPEN "IPMT8.DAT" FOR OUTPUT AS #1
1080  FOR I=1 TO 33: PRINT #1, DTP(1,I);: NEXT I: CLOSE #1: RETURN
1090 *DATASET8: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,7: PRINT T2$
1100  LOCATE 1,9: PRINT T3$: COLOR 7: DTP(1,28)=DTP(1,28)/DTP(1,24)
1110  FOR I=1 TO 33: READ DTT(I): NEXT I: FOR I=4 TO 33: READ PN$(I)
1120  NEXT I: FOR I=1 TO 33: READ DTP(2,I): NEXT I: FOR I=1 TO 33
1130  READ DTP(3,I): NEXT I
1140  DATA 2,15,2,2,16,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2,15,2
1150  DATA 15,2,15,2,15,2,15,2,15,"OUTER:","INNER:","Ea:","Ka:","Ei:"
1160  DATA "Ki","Ecist:","Kcist:","Enp:","Knp:","Ev:","Kv:","Em:"
1170  DATA "Km:","Eno:","Kno:","Eni:","Kni:","Emv:","Kmv:","R:","d:"
1180  DATA "Rv:","dv:","Rn/R:","dno:","dni:","dcist:","VF:","VFv:"
1190  DATA 6,19,16,9,23,5,18,5,18,8,21,6,19,5,18,5,18,6,19,6,19,6,19,4
1200  DATA 17,5,18,7,19,6,21,5,19,5,5,6,8,8,10,10,11,11,12,12,13,13,14
1210  DATA 14,15,15,16,16,17,17,18,18,19,19,20,20,21,21,22,22,23,23
1220  DTCMAX=33: DTC=1: DTCB=1: FOR I=1 TO 33: LOCATE DTT(I),DTP(3,I)
1230  PRINT PN$(I): NEXT I: FOR I=1 TO 33: LOCATE DTP(2,I),DTP(3,I)
1240  IF I=4 OR I=5 THEN ELSE PRINT DTP(1,I): GOTO 1260
1250  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1260  NEXT I
1270  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1280  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1370
1290  IF DTC=4 OR DTC=5 THEN GOSUB *DISPEQ: GOTO 1370
1300  IF DTC=7 OR DTC=9 OR DTC=11 THEN GOSUB *DISPMS: GOTO 1370
1310  IF DTC=13 OR DTC=15 THEN GOSUB *DISPMS: GOTO 1370
1320  IF DTC=17 OR DTC=19 OR DTC=21 THEN GOSUB *DISPCS: GOTO 1370
1330  IF DTC=23 THEN GOSUB *DISPCS: GOTO 1370
1340  IF DTC=24 OR DTC=26 THEN GOSUB *DISPMM: GOTO 1370
1350  IF DTC=25 OR DTC=27 OR DTC=29 THEN GOSUB *DISPNM: GOTO 1370
1360  IF DTC=30 OR DTC=31 THEN GOSUB *DISPNM
1370  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1380  IF DTC=4 OR DTC=5 THEN ELSE PRINT DDAT: GOTO 1400
1390  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1400  COLOR 7
1410  K$=INKEY$: IF K$="" THEN 1410
1420  IF ASC(K$)=1 THEN GOSUB *HLP
1430  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1700
1440  IF ASC(K$)=32 THEN ELSE 1460
1450  IF DTC=4 OR DTC=5 THEN GOSUB *DATAGET2: GOTO 1270
1460  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1270
1470  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1270
1480  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1410
1490  DTCA=DTC: COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1500  IF DTC=4 OR DTC=5 THEN ELSE PRINT DDAT: GOTO 1520
1510  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1520  IF ASC(K$)=30 AND DTC=3 THEN ELSE 1550
1530  IF DTCB=4 THEN DTC=1: GOTO 1680
1540  IF DTCB=5 THEN DTC=2: GOTO 1680
1550  IF ASC(K$)=30 AND DTC=4 THEN DTC=3: GOTO 1680
1560  IF ASC(K$)=30 THEN DTC=DTC-2
1570  IF ASC(K$)=31 THEN ELSE 1640
1580  IF DTC=1 THEN DTC=3: GOTO 1680
1590  IF DTC=2 THEN DTC=3: GOTO 1680
1600  IF DTC=3 THEN ELSE 1630
1610  IF DTCB=1 THEN DTC=4: GOTO 1680
1620  IF DTCB=2 THEN DTC=5: GOTO 1680
1630  DTC=DTC+2
1640  IF ASC(K$)=28 THEN DTC=DTC+1
1650  IF ASC(K$)=29 THEN DTC=DTC-1
1660  IF DTC<=0 THEN DTC=33
1670  IF DTC=>34 THEN DTC=1
1680  DTCB=DTCA
1690  GOTO 1270
1700  DTP(1,28)=DTP(1,28)*DTP(1,24): RETURN
```

[Program Name: DSETA.BAS]

```
1000  ' SAVE "DSETA.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREADA: GOSUB *DATASETA
1040  GOSUB *DATAOUTPUTA: RUN "CALCA.BAS"
1050 *DATAOUTPUTA: OPEN "IPMTA.DAT" FOR OUTPUT AS #1
1060  FOR I=1 TO 13: PRINT #1, DTP(1,I);: NEXT I: CLOSE #1: RETURN
1070 *DATAREADA: OPEN "IPMTA.DAT" FOR INPUT AS #1
1080  FOR I=1 TO 13: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1090 *DATASETA: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,11: PRINT T3$: FOR I=1 TO 13: READ DTT(I): NEXT I
1110  FOR I=4 TO 13: READ PN$(I): NEXT I: FOR I=1 TO 13: READ DTP(2,I)
1120  NEXT I: FOR I=1 TO 13: READ DTP(3,I): NEXT I: COLOR 7
1130  DATA 2,2,2,2,2,2,16,2,16,2,16,2,16,"","INT.STEPS:"
1140  DATA "Ea:","Ka:","Ei:","Ki:","a:","b:","c:","VF:",6,6,16,19,13
1150  DATA 6,20,6,20,6,20,6,20,5,6,7,8,9,12,12,13,13,14,14,15,15
1160  DTCMAX=13: DTC=1: DTCB=1: FOR I=1 TO 13: LOCATE DTT(I),DTP(3,I)
1170  PRINT PN$(I): LOCATE DTP(2,I),DTP(3,I): IF I=4 THEN ELSE 1200
1180  IF DTP(1,I)=1 THEN PRINT D$ ELSE PRINT C$
1190  GOTO 1220
1200  IF I=5 AND DTP(1,4)=1 THEN GOTO 1220
1210  LOCATE DTP(2,I),DTP(3,I): PRINT DTP(1,I)
1220  NEXT I
1230  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1240  LOCATE DTT(5),DTP(3,5): PRINT SPACE$(20)
1250  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1310
1260  IF DTC=4 THEN GOSUB *DISPEQ2: GOTO 1310
1270  IF DTC=5 THEN GOSUB *DISPNI: GOTO 1310
1280  IF DTC=7 OR DTC=9 THEN GOSUB *DISPMS: GOTO 1310
1290  IF DTC=10 OR DTC=11 THEN GOSUB *DISPMM: GOTO 1310
1300  IF DTC=12 THEN GOSUB *DISPMM: GOTO 1310
1310  IF DTP(1,4)=2 THEN GOTO 1330
1320  LOCATE DTT(5),DTP(3,5): PRINT SPACE$(20): GOTO 1350
1330  LOCATE DTT(5),DTP(3,5): PRINT PN$(5)
1340  LOCATE DTP(2,5),DTP(3,5): PRINT DTP(1,5)
1350  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1360  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1380
1370  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1380  COLOR 7
1390  K$=INKEY$: IF K$="" THEN 1390
1400  IF ASC(K$)=1 THEN GOTO *HLP
1410  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1620
1420  IF ASC(K$)=32 THEN ELSE 1440
1430  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1230
1440  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1230
1450  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1230
1460  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1390
1470  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1480  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1500
1490  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1500  IF ASC(K$)=30 AND DTC>=7 THEN DTC=DTC-2: GOTO 1560
1510  IF ASC(K$)=30 AND DTC<7 THEN DTC=DTC-1: GOTO 1560
1520  IF ASC(K$)=31 AND DTC>=6 THEN DTC=DTC+2: GOTO 1560
1530  IF ASC(K$)=31 AND DTC<6 THEN DTC=DTC+1: GOTO 1560
1540  IF ASC(K$)=28 AND DTC>=6 THEN DTC=DTC+1
1550  IF ASC(K$)=29 AND DTC>=7 THEN DTC=DTC-1
1560  IF DTC<=0 THEN DTC=13
1570  IF DTC=>14 THEN DTC=1
1580  IF DTC=5 AND DTP(1,4)=1 THEN ELSE GOTO 1610
1590  IF ASC(K$)=29 OR ASC(K$)=30 THEN DTC=4
1600  IF ASC(K$)=28 OR ASC(K$)=31 THEN DTC=6
1610  GOTO 1230
1620  RETURN
```

[Program Name: DSETB.BAS]

```
1000  ' SAVE "DSETB.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREADB: GOSUB *DATASETB
1040  GOSUB *DATAOUTPUTB: RUN "CALCB.BAS"
1050 *DATAOUTPUTB: OPEN "IPMTB.DAT" FOR OUTPUT AS #1
1060  FOR I=1 TO 16: PRINT #1, DTP(1,I);: NEXT I: CLOSE #1: RETURN
1070 *DATAREADB: OPEN "IPMTB.DAT" FOR INPUT AS #1
1080  FOR I=1 TO 16: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1090 *DATASETB: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,11: PRINT T3$: COLOR 7: FOR I=1 TO 16: READ DTT(I)
1110  NEXT I: FOR I=4 TO 16: READ PN$(I): NEXT I: FOR I=1 TO 16
1120  READ DTP(2,I): NEXT I: FOR I=1 TO 16: READ DTP(3,I): NEXT I
1130  DATA 2,2,2,2,2,2,16,2,16,2,16,2,16,2,16,2,"","INT. STEPS:","Ea:"
1140  DATA "Ka:","Ei:","Ki:","Em:","Km:","a:","b:","c:","d:","VF:",6,6
1150  DATA 16,19,13,6,20,6,20,6,20,6,20,6,20,6,5,6,7,8,9,12,12,13,13
1160  DATA 14,14,15,15,16,16,17
1170  DTCMAX=16: DTC=1: DTCB=1: FOR I=1 TO 16
1180  IF I=5 AND DTP(1,4)=1 THEN GOTO 1200
1190  LOCATE DTT(I),DTP(3,I): PRINT PN$(I)
1200  NEXT I
1210  FOR I=1 TO 16: LOCATE DTP(2,I),DTP(3,I): IF I=4 THEN ELSE 1240
1220  IF DTP(1,I)=1 THEN PRINT D$ ELSE PRINT C$
1230  GOTO 1260
1240  IF I=5 AND DTP(1,4)=1 THEN GOTO 1260
1250  COLOR 7: LOCATE DTP(2,I),DTP(3,I): PRINT DTP(1,I): COLOR 7
1260  NEXT I
1270  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1280  LOCATE DTT(5),DTP(3,5): PRINT SPACE$(20)
1290  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1370
1300  IF DTC=4 THEN GOSUB *DISPEQ2: GOTO 1370
1310  IF DTC=5 THEN GOSUB *DISPNI: GOTO 1370
1320  IF DTC=7 OR DTC=9 THEN GOSUB *DISPMS: GOTO 1370
1330  IF DTC=11 THEN GOSUB *DISPCS: GOTO 1370
1340  IF DTC=12 OR DTC=13 THEN GOSUB *DISPMM: GOTO 1370
1350  IF DTC=14 THEN GOSUB *DISPMM: GOTO 1370
1360  IF DTC=15 THEN GOSUB *DISPNM: GOTO 1370
1370  IF DTP(1,4)=2 THEN GOTO 1390
1380  LOCATE DTT(5),DTP(3,5): PRINT SPACE$(20): GOTO 1410
1390  LOCATE DTT(5),DTP(3,5): PRINT PN$(5)
1400  LOCATE DTP(2,5),DTP(3,5): PRINT DTP(1,5)
1410  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1420  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1440
1430  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1440  COLOR 7
1450  K$=INKEY$: IF K$="" THEN 1450
1460  IF ASC(K$)=1 THEN GOTO *HLP
1470  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1680
1480  IF ASC(K$)=32 THEN ELSE 1500
1490  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1270
1500  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1270
1510  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1270
1520  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1450
1530  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1540  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1560
1550  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1560  IF ASC(K$)=30 AND DTC>=7 THEN DTC=DTC-2: GOTO 1620
1570  IF ASC(K$)=30 AND DTC<7 THEN DTC=DTC-1: GOTO 1620
1580  IF ASC(K$)=31 AND DTC>=6 THEN DTC=DTC+2: GOTO 1620
1590  IF ASC(K$)=31 AND DTC<6 THEN DTC=DTC+1: GOTO 1620
1600  IF ASC(K$)=28 AND DTC>=6 THEN DTC=DTC+1
1610  IF ASC(K$)=29 AND DTC>=7 THEN DTC=DTC-1
1620  IF DTC<=0 THEN DTC=16
1630  IF DTC=>17 THEN DTC=1
1640  IF DTC=5 AND DTP(1,4)=1 THEN ELSE GOTO 1670
1650  IF ASC(K$)=29 OR ASC(K$)=30 THEN DTC=4
1660  IF ASC(K$)=28 OR ASC(K$)=31 THEN DTC=6
1670  GOTO 1270
1680  RETURN
```

[Program Name: DSETC.BAS]

```
1000  ' SAVE "DSETC.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREADC: GOSUB *DATASETC
1040  GOSUB *DATAOUTPUTC: RUN "CALCC.BAS"
1050 *DATAOUTPUTC: OPEN "IPMTC.DAT" FOR OUTPUT AS #1
1060  FOR I=1 TO 24: PRINT #1, DTP(1,I);: NEXT I: CLOSE #1: RETURN
1070 *DATAREADC: OPEN "IPMTC.DAT" FOR INPUT AS #1
1080  FOR I=1 TO 24: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1090 *DATASETC: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,12: PRINT T3$: COLOR 7: FOR I=1 TO 24: READ DTT(I)
1110  NEXT I: FOR I=4 TO 24: READ PN$(I): NEXT I: FOR I=1 TO 24
1120  READ DTP(2,I): NEXT I: FOR I=1 TO 24: READ DTP(3,I): NEXT I
1130  DATA 2,2,2,2,2,16,2,16,2,16,2,16,2,16,2,16,2,2,16,2,16,2,16,2
1140  DATA "INNER:","OUTER:","INT.STEPS:","Ea:","Ka:","Ei:","Ki:"
1150  DATA "Em:","Km:","a:","b:","c:","d:","VF:","Emv:","Kmv:","Ev:"
1160  DATA "Kv:","Rv:","dv:","VFv:",6,6,16,9,9,26,6,20,6,20,6,20,6,20
1170  DATA 6,20,6,6,20,6,20,6,20,6,5,6,7,9,10,10,13,13,14,14,15,15,16
1180  DATA 16,17,17,18,19,19,20,20,21,21,22
1190  DTCMAX=24: DTC=1: DTCB=1: FOR I=1 TO 24
```

```
1200  IF I=6 AND DTP(1,5)=2 THEN 1220
1210  LOCATE DTT(I),DTP(3,I): PRINT PN$(I)
1220  NEXT I
1230  FOR I=1 TO 24: LOCATE DTP(2,I),DTP(3,I): IF I=4 THEN ELSE 1260
1240  IF DTP(1,I)=1 THEN PRINT W$ ELSE PRINT H$
1250  GOTO 1310
1260  IF I=5 THEN ELSE 1290
1270  IF DTP(1,I)=1 THEN PRINT D$ ELSE PRINT C$
1280  GOTO 1310
1290  IF I=6 AND DTP(1,5)=1 THEN PRINT SPACE$(10): GOTO 1310
1300  PRINT DTP(1,I)
1310  NEXT I
1320  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1330  LOCATE DTT(6),DTP(3,6): PRINT SPACE$(15)
1340  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1430
1350  IF DTC=4 THEN GOSUB *DISPEQ: GOTO 1430
1360  IF DTC=5 THEN GOSUB *DISPEQ2: GOTO 1430
1370  IF DTC=6 THEN GOSUB *DISPNI: GOTO 1430
1380  IF DTC=8 OR DTC=10 OR DTC=21 THEN GOSUB *DISPMS: GOTO 1430
1390  IF DTC=12 OR DTC=19 THEN GOSUB *DISPCS: GOTO 1430
1400  IF DTC=13 OR DTC=14 THEN GOSUB *DISPMM: GOTO 1430
1410  IF DTC=15 OR DTC=22 THEN GOSUB *DISPMM: GOTO 1430
1420  IF DTC=16 OR DTC=23 THEN GOSUB *DISPNM
1430  LOCATE DTT(6),DTP(3,6): IF DTP(1,5)=2 THEN GOTO 1450
1440  PRINT SPACE$(15): GOTO 1460
1450  PRINT PN$(6): LOCATE DTP(2,6),DTP(3,6): PRINT DTP(1,6)
1460  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC): IF DTC=4 THEN ELSE 1490
1470  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1480  GOTO 1530
1490  IF DTC=5 THEN ELSE 1520
1500  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1510  GOTO 1530
1520  PRINT DDAT
1530  COLOR 7
1540  K$=INKEY$: IF K$="" THEN 1540
1550  IF ASC(K$)=1 THEN GOTO *HLP
1560  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1880
1570  IF ASC(K$)=32 THEN ELSE 1590
1580  IF DTC=4 OR DTC=5 THEN GOSUB *DATAGET2: GOTO 1320
1590  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1320
1600  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1320
1610  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1540
1620  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1630  IF DTC=4 THEN ELSE 1660
1640  IF DDAT=1 THEN PRINT W$ ELSE PRINT H$
1650  GOTO 1700
1660  IF DTC=5 THEN ELSE 1690
1670  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1680  GOTO 1700
1690  PRINT DDAT
1700  IF ASC(K$)=30 THEN ELSE 1730
1710  IF DTC>=6 AND DTC<>18 THEN DTC=DTC-2: GOTO 1810
1720  IF DTC<6 OR DTC=18 THEN DTC=DTC-1: GOTO 1810
1730  IF ASC(K$)=31 THEN ELSE 1770
1740  IF DTC=16 THEN DTC=DTC+1: GOTO 1810
1750  IF DTC>=5 AND DTC<>17 THEN DTC=DTC+2: GOTO 1810
1760  IF DTC<5 OR DTC=17 THEN DTC=DTC+1: GOTO 1810
1770  IF ASC(K$)=28 THEN ELSE 1790
1780  IF DTC>=5 THEN DTC=DTC+1
1790  IF ASC(K$)=29 THEN ELSE 1810
1800  IF DTC>=6 THEN DTC=DTC-1
1810  IF DTC<=0 THEN DTC=24
1820  IF DTC=>25 THEN DTC=1
1830  IF DTC=6 AND DTP(1,5)=1 THEN ELSE 1870
1840  IF ASC(K$)=28 THEN DTC=5
1850  IF ASC(K$)=29 THEN DTC=7
1860  IF ASC(K$)=30 THEN DTC=8
1870  GOTO 1320
1880  RETURN
```

[Program Name: DSETD.BAS]

```
1000  ' SAVE "DSETD.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREADD: GOSUB *DATASETD
1040  GOSUB *DATAOUTPUTD: RUN "CALCD.BAS"
1050 *DATAOUTPUTD: OPEN "IPMTD.DAT" FOR OUTPUT AS #1
1060  FOR I=1 TO 19: PRINT #1, DTP(1,I);: NEXT I: CLOSE #1: RETURN
1070 *DATAREADD: OPEN "IPMTD.DAT" FOR INPUT AS #1
1080  FOR I=1 TO 19: INPUT #1, DTP(1,I): NEXT I: CLOSE #1: RETURN
1090 *DATASETD: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,8: PRINT T2$
1100  LOCATE 1,10: PRINT T3$: COLOR 7: FOR I=1 TO 19: READ DTT(I)
1110  NEXT I: FOR I=4 TO 19: READ PN$(I): NEXT I: FOR I=1 TO 19
1120  READ DTP(2,I): NEXT I: FOR I=1 TO 19: READ DTP(3,I): NEXT I
1130  DATA 2,2,2,2,2,16,2,16,2,16,2,16,2,16,2,16,2,16,2,"","Ea:","Ka:"
1140  DATA "Ei:","Ki:","Emo:","Kmo:","Emi:","Kmi:","a:","b:","c:"
1150  DATA "do:","di:","VF:","INT. STEPS:",6,6,16,19,6,20,6,20,6,20,6
1160  DATA 20,6,20,6,20,6,20,13,5,6,7,8,11,11,12,12,13,13,14,14,15,15
1170  DATA 16,16,17,17,18
1180  DTC=1: DTCB=1: DTCMAX=19
1190  FOR I=1 TO DTCMAX :LOCATE DTT(I),DTP(3,I)
1200  IF I=19 AND DTP(1,4)=1 THEN ELSE PRINT PN$(I)
1210  NEXT I: FOR I=1 TO DTCMAX: LOCATE DTP(2,I),DTP(3,I)
1220  IF I=4 THEN ELSE 1250
1230  IF DTP(1,I)=1 THEN PRINT D$ ELSE PRINT C$
1240  GOTO 1260
1250  IF I=19 AND DTP(1,4)=1 THEN ELSE PRINT DTP(1,I)
1260  NEXT I
1270  DDAT=DTP(1,DTC): GOSUB *DISPNULL
1280  LOCATE DTT(19),DTP(3,19): PRINT SPACE$(20)
1290  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1360
1300  IF DTC=4 THEN GOSUB *DISPEQ2: GOTO 1360
1310  IF DTC=19 THEN GOSUB *DISPNI: GOTO 1360
1320  IF DTC=6 OR DTC=8 THEN GOSUB *DISPMS: GOTO 1360
1330  IF DTC=10 OR DTC=12 THEN GOSUB *DISPCS: GOTO 1360
1340  IF DTC=13 OR DTC=14 OR DTC=16 THEN GOSUB *DISPMM: GOTO 1360
1350  IF DTC=17 THEN GOSUB *DISPNM: GOTO 1360
1360  IF DTP(1,4)=2 THEN GOTO 1390
1370  LOCATE DTT(19),DTP(3,19): PRINT SPACE$(20)
1380  GOTO 1410
1390  LOCATE DTT(19),DTP(3,19): PRINT PN$(19)
1400  LOCATE DTP(2,19),DTP(3,19): PRINT DTP(1,19)
1410  COLOR 2: LOCATE DTP(2,DTC),DTP(3,DTC)
1420  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1440
1430  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1440  COLOR 7
1450  K$=INKEY$: IF K$="" THEN 1450
1460  IF ASC(K$)=1 THEN GOTO *HLP
1470  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1680
1480  IF ASC(K$)=32 THEN ELSE 1500
1490  IF DTC=4 THEN GOSUB *DATAGET2: GOTO 1270
1500  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1270
1510  IF ASC(K$)=46 THEN GOSUB *DATAGET: GOTO 1270
1520  IF ASC(K$)<=31 AND ASC(K$)>=28 THEN ELSE 1450
1530  COLOR 7: LOCATE DTP(2,DTC),DTP(3,DTC)
1540  IF DTC=4 THEN ELSE PRINT DDAT: GOTO 1560
1550  IF DDAT=1 THEN PRINT D$ ELSE PRINT C$
1560  IF ASC(K$)=30 AND DTC>=6 THEN DTC=DTC-2: GOTO 1620
1570  IF ASC(K$)=30 AND DTC<6 THEN DTC=DTC-1: GOTO 1620
1580  IF ASC(K$)=31 AND DTC>=5 THEN DTC=DTC+2: GOTO 1620
1590  IF ASC(K$)=31 AND DTC<5 THEN DTC=DTC+1: GOTO 1620
1600  IF ASC(K$)=28 AND DTC>=5 THEN DTC=DTC+1
1610  IF ASC(K$)=29 AND DTC>=6 THEN DTC=DTC-1
1620  IF DTC<=0 THEN DTC=DTCMAX
1630  IF DTC=>DTCMAX+1 THEN DTC=1
1640  IF DTC=19 AND DTP(1,4)=1 THEN ELSE GOTO 1670
1650  IF ASC(K$)=29 OR ASC(K$)=30 THEN DTC=18
1660  IF ASC(K$)=28 OR ASC(K$)=31 THEN DTC=1
1670  GOTO 1270
1680  RETURN
```

[Program Name: DSETE.BAS]

```
1000  ' SAVE "DSETE.BAS",A
1010  CHAIN MERGE "DISP.BAS",1020
1020  DIM DTP(3,50),DTT(50),PN$(50)
1030  GOSUB *INS: GOSUB *DATAREADE: GOSUB *DATASETE
1040  GOSUB *DATAOUTPUTE: RUN "CALCE.BAS"
1050 *DATAREADE: OPEN "IPMTE.DAT" FOR INPUT AS #1
1060  FOR I=1 TO 6: INPUT #1, DTP(1,I): NEXT I: FOR I=1 TO DTP(1,4)
1070  INPUT #1, DE(I),FC(I),B(I): NEXT I: CLOSE #1: RETURN
1080 *DATAOUTPUTE: OPEN "IPMTE.DAT" FOR OUTPUT AS #1
1090  FOR I=1 TO 6: PRINT #1, DTP(1,I);: NEXT I: FOR I=1 TO DTP(1,4)
1100  PRINT #1, DE(I);FC(I);B(I): NEXT I: CLOSE #1: RETURN
1110 *DATASETE: LOCATE 1,4: COLOR 5: PRINT T1$: LOCATE 1,9: PRINT T3$
1120  LOCATE 3,14: PRINT "n:": COLOR 7: FOR I=1 TO 9: DTT(I)=2: NEXT I
1130  FOR I=4 TO 9: READ PN$(I): NEXT I: FOR I=1 TO 9: READ DTP(2,I)
1140  NEXT I: FOR I=1 TO 9: READ DTP(3,I): NEXT I
1150  DATA "n:","Eh:","Kl:","dE:","fc:","Beta:",6,6,16,5,5,5,14,14,14
1160  DATA 5,6,7,10,11,12,15,16,17
1170  FOR I=1 TO 9: LOCATE DTT(I),DTP(3,I): PRINT PN$(I): NEXT I
1180  DTC=1: IGRU=1
1190  DTA(1)=DE(IGRU-1): DTA(2)=FC(IGRU-1): DTA(3)=B(IGRU-1)
1200  DTB(1)=DE(IGRU): DTB(2)=FC(IGRU): DTB(3)=B(IGRU)
1210  DTC(1)=DE(IGRU+1): DTC(2)=FC(IGRU+1): DTC(3)=B(IGRU+1)
1220  IF DTC=1 OR DTC=2 THEN GOSUB *DISPLH: GOTO 1260
1230  IF DTC=8 THEN GOSUB *DISPMH: GOTO 1260
1240  IF DTC=6 THEN GOSUB *DISPMS: GOTO 1260
1250  GOSUB *DISPNULL
1260  FOR I=1 TO 6: IF I=DTC THEN COLOR 2 ELSE COLOR 7
1270  LOCATE DTP(2,I),DTP(3,I): PRINT DTP(1,I): NEXT I: COLOR 7
1280  IF DTC<>1 AND DTC<6 THEN 1390
1290  LOCATE 7,14: PRINT SPACE$(28): COLOR 5: LOCATE 14,14
1300  PRINT IGRU: FOR I=7 TO 9: IF I=DTC THEN COLOR 2 ELSE COLOR 7
1310  LOCATE DTP(2,I)-7,DTP(3,I): PRINT SPACE$(23)
1320  LOCATE DTP(2,I),DTP(3,I): PRINT DTB(I-6): COLOR 7: NEXT I
1330  IF IGRU>1 THEN ELSE 1360
1340  COLOR 5: LOCATE 7,14: PRINT IGRU-1: COLOR 7: FOR I=7 TO 9
1350  LOCATE DTP(2,I)-7,DTP(3,I): PRINT DTA(I-6): NEXT I
1360  IF IGRU+1<=DTP(1,4) THEN ELSE 1390
1370  COLOR 5: LOCATE 21,14: PRINT IGRU+1: COLOR 7: FOR I=7 TO 9
1380  LOCATE DTP(2,I)+7,DTP(3,I): PRINT DTC(I-6): NEXT I
1390  K$=INKEY$: IF K$="" THEN 1390
1400  IF ASC(K$)=1 THEN GOSUB *HLP
1410  IF ASC(K$)=13 OR ASC(K$)=27 THEN 1590
1420  IF ASC(K$)<=57 AND ASC(K$)>=48 THEN GOSUB *DATAGET: GOTO 1570
1430  IF ASC(K$)=46 OR ASC(K$)=32 THEN GOSUB *DATAGET: GOTO 1570
1440  IF DTC<7 THEN ELSE 1490
1450  IF ASC(K$)=31 THEN DTC=DTC+1
1460  IF ASC(K$)=30 THEN DTC=DTC-1
1470  IF DTC<1 THEN DTC=9
1480  GOTO 1570
1490  IF ASC(K$)=28 THEN IGRU=IGRU+1
1500  IF ASC(K$)=29 THEN IGRU=IGRU-1
1510  IF ASC(K$)=30 THEN DTC=DTC-1
1520  IF ASC(K$)=31 THEN DTC=DTC+1
1530  IF IGRU=>DTP(1,4) THEN IGRU=DTP(1,4)
1540  IF IGRU<=1 THEN IGRU=1
1550  IF DTC>9 THEN DTC=1
1560  GOTO 1580
1570  DE(IGRU)=DTB(1): FC(IGRU)=DTB(2): B(IGRU)=DTB(3)
1580  GOTO 1190
1590  RETURN
```

[Program Name: DISP.BAS]

```
10000  'SAVE "DISP.BAS",A
10010 *INS
10020  PN$(1)="MIN:"
10030  OPEN "IAZ.DAT" FOR INPUT AS #1: PN$(2)="MAX:"
10040  INPUT #1, NPP,CLPLS: CLOSE #1: PN$(3)="POINTS/DECADE:"
10050  SB$=" <--- SPACE BAR ---> ": T3$="PARAMETERS": WIDTH 80,25
10060  T1$="FREQUENCY RANGE": T2$="MIXTURE EQUATION": GOSUB *HER
10070  W$="WAGNER": H$="HANAI ": D$="DILUTE": C$="CONC. ": RETURN
10080 *DATAGET: DAT$=K$: COLOR 4: LOCATE DTP(2,DTC)+1,DTP(3,DTC)
10090  PRINT "       ": LOCATE DTP(2,DTC)+1,DTP(3,DTC): PRINT DAT$
10100  LOCATE DTP(2,DTC)+2,DTP(3,DTC): LINE INPUT "",AD$
10110  DAT$=DAT$+AD$: IF NPP=13 AND DTC>6 THEN ELSE GOTO 10170
10120  DTB(DTC-6)=VAL(DAT$)
10130  IF DTP(1,4)>10 THEN DTP(1,4)=10: GOTO 10160
10140  IF DTP(1,4)<1 THEN DTP(1,4)=1: GOTO 10160
10150  DTC=DTC+1: IF DTC=10 THEN DTC=1:GOTO 10160
10160  GOTO 10190
10170  DTP(1,DTC)=VAL(DAT$): COLOR 6: LOCATE DTP(2,DTC)+1,DTP(3,DTC)
10180  PRINT DAT$: COLOR 7: DTC=DTC+1: IF DTC=DTCMAX+1 THEN DTC=1
10190  RETURN
10200 *DATAGET2: COLOR 6: IF DDAT=1 THEN ELSE 10250
10210  LOCATE DTP(2,DTC),DTP(3,DTC)
10220  IF NPP=9 OR NPP=10 THEN PRINT C$: GOTO 10300
10240  PRINT H$: GOTO 10300
10250  IF DDAT=2 THEN ELSE 10300
10260  LOCATE DTP(2,DTC),DTP(3,DTC)
10270  IF NPP=9 OR NPP=10 THEN PRINT D$: GOTO 10300
10290  PRINT W$
10300  IF DDAT=1 THEN 10320
10310  DTP(1,DTC)=1: GOTO 10330
10320  DTP(1,DTC)=2
10330  COLOR 7: IF DTC=DTCMAX+1 THEN DTC=1
10340  RETURN
10350 *DATAGET5: COLOR 6
10360  IF DDAT=1 THEN LOCATE 2,10: PRINT "MULTI-COMPONENT"
10370  IF DDAT=2 THEN LOCATE 2,10: PRINT "3-COMPONENT    "
10380  IF DDAT=1 THEN ELSE 10420
10390  DTP(1,DTC)=2: MSNCOM=2: ES=DTP(1,13): KS=DTP(1,14)
10400  THICKS=DTP(1,15): EIS=DTP(1,16): KIS=DTP(1,17)
10410  THICKI=DTP(1,18): NUM.DATA=NOPIS*3+9: GOTO 10450
10420  DTP(1,DTC)=1: MSNCOM=1: FOR I=1 TO NOPIS-1
10430  ES(I)=DTP(1,I*3+12-2): KS(I)=DTP(1,I*3+12-1)
10440  THICK(I)=DTP(1,I*3+12): NEXT I: NUM.DATA=12
10450  COLOR 7: DTC=DTC+1: IF DTC=NUM.DAT THEN DTC=1
10460  RETURN
10470 *DISPLH: LOCATE 52,2: PRINT "(Log F/Hz)": RETURN
10480 *DISPEQ: LOCATE 40,2: PRINT W$;SB$;H$: RETURN
10490 *DISPEQ2: LOCATE 40,2: PRINT D$;SB$;C$: RETURN
10500 *DISPMH: LOCATE 54,2: PRINT "(MHz)": RETURN
10510 *DISPNULL: LOCATE 35,1: PRINT SPACE$(45): LOCATE 35,2
10520  PRINT SPACE$(45): COLOR 4: RETURN
10530 *DISPMS: LOCATE 53,2: PRINT "(mS/cm)": RETURN
10540 *DISPCS: LOCATE 53,2: PRINT "(uS/cm)": RETURN
10550 *DISPMM: LOCATE 54,2: PRINT "(um)": RETURN
10560 *DISPNM: LOCATE 54,2: PRINT "(nm)": RETURN
10570 *DISP3M: LOCATE 40,2: PRINT "3-COMP.";SB$;"MULTI-COMP.":RETURN
10580 *DISPRAD: LOCATE 52,1: PRINT "RADIUS(um)": LOCATE 41,2
10590  PRINT "RADIUS";SB$;"DIAMETER": LOCATE 2,IL: PRINT "R:": RETURN
10600 *DISPRAD2: LOCATE 52,1: PRINT "RADIUS(um)": LOCATE 2,IL
10610  PRINT "R:": RETURN
10620 *DISPRADN: LOCATE 39,1: PRINT "RADIUS OF NUCLEUS (% of Cell ";
10630  PRINT "Radius)": LOCATE 2,IL: PRINT "Rn:": RETURN
10640 *DISPDIA: LOCATE 51,1: PRINT "DIAMETER(um)": LOCATE 41,2
10650  PRINT "RADIUS";SB$;"DIAMETER": LOCATE 2,IL: PRINT "D:": RETURN
```

```
10660 *DISPVFR: LOCATE 45,1: PRINT "RELATIVE VF (Total VFr = 1) "
10670  LOCATE 39,2: PRINT "ABSOLUTE";SB$;"RELATIVE"
10680  LOCATE 2,IL: PRINT "VFr:": RETURN
10690 *DISPVFA: LOCATE 45,1: PRINT "ABSOLUTE VF (Total VFa = VF)"
10700  LOCATE 39,2: PRINT "ABSOLUTE";SB$;"RELATIVE"
10710  LOCATE 2,IL: PRINT "VFa:": RETURN
10720 *DISPNI: LOCATE 35,2: PRINT "Number of Steps for Numerical ";
10730  PRINT "Integration.": RETURN
10740 *HER: LOCATE 1,1: PRINT "HELP  MAIN MENU": LOCATE 23,1
10750  PRINT "CONTINUE": RETURN
10760 *HLP: NPP=0: OPEN "IAZ.DAT" FOR OUTPUT AS #1
10770  PRINT #1, NPP,CLPLS: CLOSE #1: RUN "IAZ.BAS"
10780 *ALL: LOCATE 14,DTE: COLOR 7: PRINT DTB(DTF): LOCATE 6,DTE
10790  COLOR 4: PRINT "ALL:":COLOR 7
10800  K$=INKEY$: IF K$="" THEN 10800
10810  IF ASC(K$)>=48 AND ASC(K$)<=57 THEN 10830
10820  IF ASC(K$)=46 THEN ELSE 10800
10830  LOCATE 10,DTE: PRINT K$:LOCATE 11,DTE: INPUT "",RALLA$
10840  RALL=VAL(K$+RALLA$):LOCATE 5,DTE: PRINT "        "
10850  LOCATE 6,DTE: PRINT "      ": RETURN
```

[Program Name: CALC1.BAS]

```
1000  ' SAVE "CALC1.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC1"
1240 *DATA.GET: OPEN "IPMT1.DAT" FOR INPUT AS #1
1250  INPUT #1, QMIN,QMAX,QPD,QOUTER,QEA,QKA,QEI,QKI,QR,QVF: CLOSE #1
1260  GOSUB *FPCAL: RETURN
1270 *CALC: GOSUB *PARAM.1: GOSUB *XDS1: FOR M=1 TO TNFP+2
1280  F=F(M): IF QVF=0 THEN ELSE 1300
1290  E(M)=EA: K(M)=KA: GOTO 1330
1300  P1=EI: P2=-KI*C/F: P3=EA: P4=-KA*C/F
1310  P7=VF: ON WORH GOSUB *WAGNER,*HANAI
1320  E(M)=P5: K(M)=-P6/C*F
1330  GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1340 *PARAM.1: WORH=QOUTER: EA=QEA: KA=QKA
1350  EI=QEI: KI=QKI: VF=QVF: RETURN
```

[Program Name: CALC2.BAS]

```
1000  ' SAVE "CALC2.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC2"
1230 *DATA.GET: OPEN "IPMT2.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QEA,QKA,QEI,QKI,QEM,QKM
1250  INPUT #1, QR,QD,QVF: CLOSE #1: GOSUB *FPCAL: RETURN
1260 *CALC: GOSUB *PARAM.2: GOSUB *XDS1: FOR M=1 TO TNFP+2: F=F(M)
1270  P1=EI: P2=-KI*C/F: P3=ES: P4=-KS*C/F: P7=VFS: GOSUB *WAGNER
1280  P1=P5: P2=P6: P3=EA: P4=-KA*C/F: P7=VF
1290  ON WORH GOSUB *WAGNER,*HANAI
1300  E(M)=P5:K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1310 *PARAM.2: WORH=QOUTER: EA=QEA: KA=QKA: ES=QEM: KS=QKM/1000
1320  EI=QEI: KI=QKI: RADIUS=QR: THICK=QD: VF=QVF
1330  VFS=((RADIUS-THICK*10^-3)/RADIUS)^3: RETURN
```

[Program Name: CALC3.BAS]

```
1000  ' SAVE "CALC3.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC3"
1230 *DATA.GET: OPEN "IPMT3.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QEA,QKA,QEI,QKI,QEMO,QKMO,QEMI
1250  INPUT #1, QKMI,QR,QDO,QDI,QVF: CLOSE #1: GOSUB *FPCAL: RETURN
1260 *CALC: GOSUB *PARAM.3: GOSUB *XDS1: FOR M=1 TO TNFP+2: F=F(M)
1270  P1=EI: P2=-KI*C/F: P3=ESI: P4=-KSI*C/F: P7=VFSI: GOSUB *WAGNER
1280  P1=P5: P2=P6: P3=ESO: P4=-KSO*C/F: P7=VFSO: GOSUB *WAGNER
1290  P1=P5: P2=P6: P3=EA: P4=-KA*C/F: P7=VF
1300  ON WORH GOSUB *WAGNER,*HANAI
1310  E(M)=P5:K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1320 *PARAM.3: WORH=QOUTER: EA=QEA: KA=QKA: ESO=QEMO: KSO=QKMO/1000
1330  ESI=QEMI: KSI=QKMI/1000: EI=QEI: KI=QKI: RADIUS=QR: THICKO=QDO
1340  THICKI=QDI: VF=QVF: VFSO=((RADIUS-THICKO*10^-3)/RADIUS)^3
1350  VFSI=((RADIUS-(THICKO+THICKI)*10^-3)/(RADIUS-THICKO*10^-3))^3
1360  RETURN
```

[Program Name: CALC4.BAS]

```
1000  ' SAVE "CALC4.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC4"
1230 *DATA.GET: OPEN "IPMT4.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QEA,QKA,QEI,QKI,QENP,QKNP,QEM
1250  INPUT #1, QKM,QEN,QKN,QR,QD,QRN,QDN,QVF: CLOSE #1: GOSUB *FPCAL
1260  RETURN
1270 *CALC: GOSUB *PARAM.4: GOSUB *XDS1: FOR M=1 TO TNFP+2: F=F(M)
1280  P1=EII: P2=-KII*C/F: P3=ESI: P4=-KSI*C/F: P7=VFS1: GOSUB *WAGNER
1290  P1=P5: P2=P6: P3=EI: P4=-KI*C/F: P7=VFS2: GOSUB *WAGNER
1300  P1=P5: P2=P6: P3=ESO: P4=-KSO*C/F: P7=VFS3: GOSUB *WAGNER
1310  P1=P5: P2=P6: P3=EA: P4=-KA*C/F: P7=VF
1320  ON WORH GOSUB *WAGNER,*HANAI
1330  E(M)=P5: K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1340 *PARAM.4: WORH=QOUTER: EA=QEA: KA=QKA: ESO=QEM: KSO=QKM/1000
1350  ESI=QEN: KSI=QKN/1000: EII=QENP: KII=QKNP: RADIUSO=QR
1360  THICKO=QD: RADIUSI=QRN: THICKI=QDN: VF=QVF: EI=QEI: KI=QKI
1370  VFS3 = ((RADIUSO-THICKO*10^-3)/RADIUSO)^3
1380  VFS2 = (RADIUSI/(RADIUSO-THICKO*10^-3))^3
1390  VFS1 = ((RADIUSI-THICKI*10^-3)/RADIUSI)^3: RETURN
```

[Program Name: CALC5.BAS]

```
1000  ' SAVE "CALC5.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC5"
1230 *DATA.GET: OPEN "IPMT5.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QMSNCOM,QNOPIS,QEA,QKA,QEI,QKI
1250  IF QNOPIS>9 THEN QNOPIS=9
1260  INPUT #1, QRADIUS,QVF,QES,QKS,QTHICKS,QEIS,QKIS,QTHICKI,QNSHELL
1270  IF QMSNCOM=1 THEN 1300
1280  FOR I=QNOPIS-1 TO 1 STEP -1
1290  INPUT #1, QES(I),QKS(I),QTHICK(I): NEXT I
1300  CLOSE #1: GOSUB *FPCAL: RETURN
1310 *CALC: WORH=QOUTER: GOSUB *PARAM.5: GOSUB *XDS1
1320  FOR M=1 TO TNFP+2: F=F(M): QEA=-KA*C/F: QEI=-KI*C/F
1330  FOR L=1 TO NOPIS-1: QESH(L)=-KSH(L)*C/F: NEXT L
1340  P1=EI:P2=QEI:P3=ESH(1):P4=QESH(1):P7=VFSH(1): GOSUB *WAGNER
1350  FOR L=2 TO NOPIS-1: P1=P5: P2=P6: P3=ESH(L): P4=QESH(L)
1360  P7=VFSH(L): GOSUB *WAGNER: NEXT L: P1=P5: P2=P6: P3=EA: P4=QEA
1370  P7=VF: ON WORH GOSUB *WAGNER,*HANAI
1380  E(M)=P5: K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1390 *PARAM.5: MSNCOM=QMSNCOM: RADIUS=QRADIUS: VF=QVF: EA=QEA: KA=QKA
1400  ON MSNCOM GOTO *TWOCOM,*MULCOM
1410  *TWOCOM: ES=QES: KS=QKS: THICKS=QTHICKS: EIS=QEIS: KIS=QKIS
1420  THICKI=QTHICKI: EI=QEI:KI=QKI: NSHELL=QNSHELL: RADIUSO=RADIUS
1430  RADIUSI=RADIUSO-(NSHELL*(THICKS+THICKI)-THICKI)*.001
1440  FOR I=1 TO NSHELL: ESH(2*I-1)=ES:KSH(2*I-1)=KS
1450  IF I>1 THEN ESH(2*(I-1))=EIS
1460  IF I>1 THEN KSH(2*(I-1))=KIS
1470  VFSH(2*I-1)=((RADIUSI)/(RADIUSI+THICKS*.001))^3
1480  IF I>1 THEN VFSH(2*(I-1))=((RADIUSI-THICKI*.001)/RADIUSI)^3
1490  RADIUSI=RADIUSI+(THICKS+THICKI)*.001: NEXT I: NOPIS=2*NSHELL
1500  RETURN
1510  *MULCOM: NOPIS=QNOPIS: RADIUSO=RADIUS
1520  FOR I=NOPIS-1 TO 1 STEP -1: ESH(I)=QES(I): KSH(I)=QKS(I)
1530  THICK(I)=QTHICK(I): VFSH(I)=((RADIUSO-THICK(I)*.001)/RADIUSO)^3
1540  RADIUSO=RADIUSO-THICK(I)*.001: NEXT I: EI=QEI: KI=QKI: RETURN
```

[Program Name: CALC6.BAS]

```
1000  ' SAVE "CALC6.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC6"
1230 *DATA.GET: OPEN "IPMT6.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QINNER,QEA,QKA,QEI,QKI,QEV,QKV
1250  INPUT #1, QEM,QKM,QEMV,QKMV,QR,QD,QRV,QDV,QVF,QVFI
1260  CLOSE #1: GOSUB *FPCAL: RETURN
1270 *CALC: GOSUB *PARAM.6: GOSUB *XDS1: FOR M=1 TO TNFP+2: F=F(M)
1280  IEA#=-KA*C/F: IESO#=-KSO*C/F: IEIO#=-KIO*C/F: IESI#=-KSI*C/F
1290  IEII#=-KII*C/F: P1=EII: P2=IEII#: P3=ESI: P4=IESI#: P7=VFS1
1300  GOSUB *WAGNER: P1=P5: P2=P6: P3=EIO: P4=IEIO#: P7=VFI
1320  ON WORHI GOSUB *WAGNER,*HANAI
1330  P1=P5: P2=P6: P3=ESO: P4=IESO#: P7=VFS2: GOSUB *WAGNER
1340  P1=P5: P2=P6: P3=EA: P4=IEA#: P7=VF
1350  ON WORHO GOSUB *WAGNER,*HANAI
1360  E(M)=P5: K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1370 *PARAM.6: WORHO=QOUTER: WORHI=QINNER: EA=QEA: KA=QKA: ESO=QEM
1380  KSO=QKM/1000: EIO=QEI: KIO=QKI: ESI=QEMV: KSI=QKMV/1000: EII=QEV
1390  KII=QKV: RADIUSO=QR: THICKO=QD: RADIUSI=QRV: THICKI=QDV: VF=QVF
1400  VFI=QVFI: VFS2=((RADIUSO-THICKO*10^-3)/RADIUSO)^3
1410  VFS1=((RADIUSI-THICKI*10^-3)/RADIUSI)^3: RETURN
```

[Program Name: CALC7.BAS]

```
1000  ' SAVE "CALC7.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC7"
1230 *DATA.GET: OPEN "IPMT7.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QINNER,QEA,QKA,QEI,QKI,QENP,QKNP
1250  INPUT #1, QEV,QKV,QEM,QKM,QEN,QKN,QEMV,QKMV,QR,QD,QRV,QDV,QRN
1260  INPUT #1, QDN,QVF,QVFI: CLOSE #1: GOSUB *FPCAL: RETURN
1270 *CALC: WORHO=QOUTER: WORHI=QINNER: GOSUB *PARAM.7: GOSUB *XDS1
1280  FOR M=1 TO TNFP+2: F=F(M): IEA#=-KA*C/F: IESO#=-KSO*C/F
1290  IEIO#=-KIO*C/F: IESI#=-KSI*C/F: IEIIO#=-KIIO*C/F
1300  IESI2#=-KSI2*C/F: IEII#=-KII*C/F: IESN#=-KSN*C/F
1310  IEIN#=-KIN*C/F: IF RADIUSN=0 THEN GOTO 1340
1320  P1=EIN: P2=IEIN#: P3=ESN: P4=IESN#: P7=VFS1: GOSUB *WAGNER
1330  EHS=P5: IEHS#=P6
1340  P1=EII: P2=IEII#: P3=ESI: P4=IESI#: P7=VFS2: GOSUB *WAGNER
1350  P1=P5: P2=P6: P3=EIO: P4=IEIO#: P7=VFI
1360  ON WORHI GOSUB *WAGNER,*HANAI
1370  IF RADIUSN=0 THEN GOTO 1390
1380  P1=EHS: P2=IEHS#: P3=P5: P4=P6: P7=VFS4: GOSUB *WAGNER
1390  P1=P5: P2=P6: P3=ESO: P4=IESO#: P7=VFS3: GOSUB *WAGNER
1400  P1=P5: P2=P6: P3=EA: P4=IEA#: P7=VF
1410  ON WORHO GOSUB *WAGNER,*HANAI
1420  E(M)=P5: K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1430 *PARAM.7: EA=QEA: KA=QKA: EA=QEA: KA=QKA: ESO=QEM: KSO=QKM/1000
1440  EIO=QEI: KIO=QKI: ESI=QEMV: KSI=QKMV/1000: EII=QEV: KII=QKV
1450  ESN=QEN: KSN=QKN/1000: EIN=QENP: KIN=QKNP: RADIUSO=QR
1460  THICKO=QD: RADIUSI=QRV: THICKI=QDV: RADIUSI2=RADIUSI-THICKI*.001
1470  THICKI2=QDOC: RADIUSI3=RADIUSI2-THICKI2*.001: THICKI3=QDV
1480  RADIUSN=QRN: THICKN=QDN: VF=QVF: VFI=QVFI
1490  VFS3=((RADIUSO-THICKO*.001)/RADIUSO)^3
1500  VFS2=((RADIUSI-THICKI*.001)/RADIUSI)^3
1510  VFS21=((RADIUSI2-THICKI2*.001)/RADIUSI2)^3
1520  VFS22=((RADIUSI3-THICKI3*.001)/RADIUSI3)^3
1530  IF RADIUSN=0 THEN GOTO 1550
1540  VFS1=((RADIUSN-THICKN*.001)/RADIUSN)^3
1550  VFS4=(RADIUSN/(RADIUSO-THICKO*.001))^3: RETURN
```

[Program Name: CALC8.BAS]

```
1000  ' SAVE "CALC8.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALC8"
1230 *DATA.GET: OPEN "IPMT8.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QINNER,QEA,QKA,QEI,QKI,QECIST
1250  INPUT #1, QKCIST,QENP,QKNP,QEV,QKV,QEM,QKM,QENO,QKNO,QENI,QKNI
1260  INPUT #1, QEMV,QKMV,QR,QD,QRV,QDV,QRN,QDNO,QDNI,QDCIST,QVF,QVFI
1270  CLOSE #1: GOSUB *FPCAL: RETURN
1280 *CALC: WORHO=QOUTER: WORHI=QINNER: GOSUB *PARAM.8: GOSUB *XDS1
1290  FOR M=1 TO TNFP+2: F=F(M): IEA#=-KA*C/F: IESO#=-KSO*C/F
1300  IEIO#=-KIO*C/F: IESI#=-KSI*C/F: IEII#=-KII*C/F: IESNO#=-KSNO*C/F
1310  IESNI#=-KSNI*C/F: IEIN#=-KIN*C/F: IECIST#=-KCIST*C/F
1320  P1=EIN: P2=IEIN#: P3=ESNI: P4=IESNI#: P7=VFSNI: GOSUB *WAGNER
1330  P1=P5: P2=P6: P3=ECIST: P4=IECIST#: P7=VFS5: GOSUB *WAGNER
1340  P1=P5: P2=P6: P3=ESNO: P4=IESNO#: P7=VFSNO: GOSUB *WAGNER
1350  EHS=P5: IEHS#=P6
1360  P1=EII: P2=IEII#: P3=ESI: P4=IESI#: P7=VFS2: GOSUB *WAGNER
1370  P1=P5: P2=P6: P3=EIO: P4=IEIO#: P7=VFI
1380  ON WORHI GOSUB *WAGNER,*HANAI
1390  P1=EHS: P2=IEHS#: P3=P5: P4=P6: P7=VFS4: GOSUB *WAGNER
1400  P1=P5: P2=P6: P3=ESO: P4=IESO#: P7=VFS3: GOSUB *WAGNER
1410  P1=P5: P2=P6: P3=EA: P4=IEA#: P7=VF
1420  ON WORHO GOSUB *WAGNER,*HANAI
1430  E(M)=P5: K(M)=-P6/C*F: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1440 *PARAM.8: EA=QEA: KA=QKA: ESO=QEM: KSO=QKM/1000: EIO=QEI: KIO=QKI
1450  ESI=QEMV: KSI=QKMV/1000: EII=QEV: KII=QKV: ESNO=QENO
1460  KSNO=QKNO/1000: ESNI=QENI: KSNI=QKNI/1000: EIN=QENP: KIN=QKNP
1470  ECIST=QECIST: KCIST=QKCIST: RADIUSO=QR: THICKO=QD: RADIUSI=QRV
1480  THICKI=QDV: RADIUSNO=QRN: THICKNO=QDNO
1490  RADIUSNI=QRN-(QDNO+QDCIST)/1000: THICKNI=QDNI: VF=QVF: VFI=QVFI
1500  VFS3=((RADIUSO-THICKO*.001)/RADIUSO)^3
1510  VFS2=((RADIUSI-THICKI*.001)/RADIUSI)^3
1520  VFSNO=((RADIUSNO-THICKNO*.001)/RADIUSNO)^3
1530  VFSNI=((RADIUSNI-THICKNI*.001)/RADIUSNI)^3
1540  VFS4=(RADIUSNO/(RADIUSO-THICKO*.001))^3
1550  VFS5=(RADIUSNI/(RADIUSNO-THICKNO*.001))^3: RETURN
```

[Program Name: CALCA.BAS]

```
1000  ' SAVE "CALCA.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALCA"
1230 *DATA.GET: OPEN "IPMTA.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QNSI,QEA,QKA,QEI,QKI,QRA,QRB,QRC
1250  INPUT #1, QVF: CLOSE #1: GOSUB *FPCAL: RETURN
1260 *CALC: GOSUB *PARAM.A: GOSUB *DPF: GOSUB *XDS1: FOR M=1 TO TNFP+2
1270  F=F(M): IEA#=-KA*C/F: IEI#=-KI*C/F: FOR IH=1 TO 3: EI(IH)=EI
1280  IEI#(IH)=IEI#: NEXT IH: ON WORH GOSUB *AHKD,*AHKC
1290  E(M)=E: K(M)=-IE#*F/C: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1300 *PARAM.A: WORH=QOUTER: NINT=QNSI: EA=QEA: KA=QKA: EI=QEI: KI=QKI
1310  VF=QVF: SA(1)=QRA: SA(2)=QRB: SA(3)=QRC: RETURN
```

[Program Name: CALCB.BAS]

```
1000  ' SAVE "CALCB.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALCB"
1230 *DATA.GET: OPEN "IPMTB.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QNSI,QEA,QKA,QEI,QKI,QEM,QKM,QRA
1250  INPUT #1, QRB,QRC,QD,QVF: CLOSE #1: GOSUB *FPCAL: RETURN
1260 *CALC: GOSUB *PARAM.B: GOSUB *DPF: GOSUB *XDS1: FOR M=1 TO TNFP+2
1270  F=F(M): IEA#=-KA*C/F: IES#=-KS*C/F: IEI#=-KI*C/F
1280  FOR I=1 TO 3: EI(I)=EI: IEI#(I)=IEI#: NEXT: GOSUB *EXYZ
1290  ON WORH GOSUB *AHKD,*AHKC
1300  E(M)=E: K(M)=-IE#*F/C: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1310 *PARAM.B: WORH=QOUTER: NINT=QNSI: EA=QEA: KA=QKA: ES=QEM
1320  KS=QKM/1000: EI=QEI: KI=QKI: VF=QVF: DS=QD: SA(1)=QRA: SA(2)=QRB
1330  SA(3)=QRC: VP=((SA(1)-DS/1000)*(SA(2)-DS/1000)*(SA(3)-DS/1000))
1340  VP=VP/(SA(1)*SA(2)*SA(3)): RETURN
```

[Program Name: CALCC.BAS]

```
1000  ' SAVE "CALCC.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALCC"
1230 *DATA.GET: OPEN "IPMTC.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QINNER,QOUTER,QNSI,QEA,QKA,QEI,QKI,QEM
```

```
1250  INPUT #1, QKM,QRA,QRB,QRC,QD,QVF,QEMV,QKMV,QEV,QKV,QRV,QDV,QVFV
1260  CLOSE #1: GOSUB *FPCAL: RETURN
1270 *CALC: GOSUB *PARAM.C: GOSUB *DPF: GOSUB *XDS1: FOR M=1 TO TNFP+2
1280  F=F(M): IEA#=-KA*C/F: IES#=-KS*C/F: IEIO#=-KIO*C/F
1290  IESI#=-KSI*C/F: IEII#=-KII*C/F: P1=EII: P2=IEII#: P3=ESI
1300  P4=IESI#: P7=VFV1: GOSUB *WAGNER: P1=P5: P2=P6: P3=EIO: P4=IEIO#
1310  P7=VFI: ON WORHI GOSUB *WAGNER,*HANAI
1320  FOR I=1 TO 3: EI(I)=P5: IEI#(I)=P6*F/C: NEXT I: GOSUB *EXYZ
1330  ON WORHO GOSUB *AHKD,*AHKC
1340  E(M)=E: K(M)=-IE#*F/C: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1350 *PARAM.C: WORHO=QOUTER: WORHI=QINNER: NINT=QNSI: EA=QEA: KA=QKA
1360  ES=QEM: KS=QKM/1000: EIO=QEI: KIO=QKI: VF=QVF: DS=QD: ESI=QEMV
1370  KSI=QKMV/1000: EII=QEV: KII=QKV: RADIUSI=QRV: THICKI=QDV
1380  SA(1)=QRA: SA(2)=QRB: SA(3)=QRC: VFI=QVFV
1390  VFV1=((RADIUSI-THICKI*10^-3)/RADIUSI)^3
1400  VP=((SA(1)-DS/1000)*(SA(2)-DS/1000)*(SA(3)-DS/1000))
1410  VP=VP/(SA(1)*SA(2)*SA(3)): RETURN
```

[Program Name: CALCD.BAS]

```
1000  ' SAVE "CALCD.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALCD"
1230 *DATA.GET: OPEN "IPMTD.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,QOUTER,QEA,QKA,QEI,QKI,QEMO,QKMO,QEMI
1250  INPUT #1, QKMI,QRA,QRB,QRC,QDO,QDI,QVF,QNSI: CLOSE #1
1260  GOSUB *FPCAL: RETURN
1270 *CALC: GOSUB *PARAM.D: GOSUB *DPF: GOSUB *XDS1: FOR M=1 TO TNFP+2
1280  F=F(M): IEA#=-KA*C/F: ES=ESI: IES#=-KSI*C/F: VP=VPI
1290  FOR I=1 TO 3: EI(I)=EI: IEI#(I)=-KI*C/F: NEXT I: GOSUB *EXYZ
1300  ES=ESO: IES#=-KSO*C/F: VP=VPO: GOSUB *EXYZ
1310  ON WORH GOSUB *AHKD,*AHKC
1320  E(M)=E: K(M)=-IE#*F/C: GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
1330 *PARAM.D: WORH=QOUTER: NINT=QNSI: EA=QEA: KA=QKA: ESI=QEMI
1340  KSI=QKMI/1000: ESO=QEMO: KSO=QKMO/1000: EI=QEI: KI=QKI: VF=QVF
1350  DSO=QDO: DSI=QDI: SA(1)=QRA: SA(2)=QRB: SA(3)=QRC
1360  VP=((SA(1)-DSO/1000)*(SA(2)-DSO/1000)*(SA(3)-DSO/1000))
1370  VPO=VP/(SA(1)*SA(2)*SA(3)): DSX=DSO+DSI
1380  VP2=((SA(1)-DSX/1000)*(SA(2)-DSX/1000)*(SA(3)-DSX/1000))
1390  VPI=VP2/VP: RETURN
```

[Program Name: CALCE.BAS]

```
1000  ' SAVE "CALCE.BAS",A
1010  CHAIN MERGE "CALC.BAS",1020
1020  PN$="CALCE"
1230 *DATA.GET: OPEN "IPMTE.DAT" FOR INPUT AS #1
1240  INPUT #1, QMIN,QMAX,QPD,NPRM,EH,KL: FOR I=1 TO NPRM
1250  INPUT #1, DE(I),FC(I),B(I): NEXT I: CLOSE #1: GOSUB *FPCAL
1260  RETURN
1270 *CALC: GOSUB *XDS1: FOR M=1 TO TNFP+2: E(M)=EH: K(M)=0
1280  FOR M2=1 TO NPRM: F=F(M)/FC(M2): B=B(M2): DE=DE(M2): GOSUB *CEN
1290  E(M)=E(M)+RE: K(M)=K(M)+IE#: NEXT M2: K(M)=KL-K(M)/C*F(M)
1300  F=F(M): GOSUB *XDS2: NEXT M: GOSUB *XEHKL: RETURN
```

[Program Name: CALC.BAS]

```
1030  ' SAVE "CALC.BAS",A
1040  DEFDBL A-H,K,P-Z
1050  GOSUB *INIT: GOSUB *DEFFUN: GOSUB *CONSTANT
1060  GOSUB *DATA.GET: GOSUB *CALC: GOSUB *DATA.SAVE: RUN "FMENU.BAS"
10140 *INIT: COLOR ,0: WIDTH 80,25: CONSOLE 0,20,0,1
10150  VIEW (0,0)-(639,399): DDATE$="91/08/31": CLS 3
10160  DIM F(201),E(201),K(201),ESH(201),KSH(201),QESH(201),VFSH(201)
10170  DIM VFS(201)
10180  MD$=PN$+"("+DDATE$+")": LINE (635-8*LEN(MD$),0)-(639,17),7,B
10190  ON HELP GOSUB *RECALC: HELP ON
10200  COLOR 6: LOCATE 80-LEN(MD$),0: PRINT MD$: COLOR 7: RETURN
10210 *RECALC: RUN "IAZ.BAS"
10220 *DEFFUN: DEF FNREMUL (D1,E1,D2,E2)=D1*D2-E1*E2
10230  DEF FNIMMUL (D1,E1,D2,E2)=E1*D2+E2*D1
10240  DEF FNREDIV (D1,E1,D2,E2)=(D1*D2+E1*E2)/(D2*D2+E2*E2)
10250  DEF FNIMDIV (D1,E1,D2,E2)=(E1*D2-D1*E2)/(D2*D2+E2*E2): RETURN
10260 *DATA.SAVE: OPEN "IAZTEMP0.DAT" FOR OUTPUT AS #1
10270  PRINT #1,QMIN,QMAX,QPD: FOR IL=1 TO TNFP+2
10280  PRINT #1, F(IL);E(IL);K(IL);: NEXT IL: CLOSE #1
10290  OPEN "CRTDAT.DAT" FOR INPUT AS #1
10300  INPUT #1, NPD,NPT,NPT.MAX,MINF,MAXF: INPUT #1, FILENAME$
10310  CLOSE #1: NPT=NPT+1
10320  OPEN "CRTDAT.DAT" FOR OUTPUT AS #1
10330  PRINT #1, NPD;NPT;NPT.MAX;MINF;MAXF: PRINT #1, FILENAME$
10340  CLOSE #1: RETURN
10350 *CONSTANT: C=1797.510861#: PI=3.141592653589793#: CFE=1/LOG(10)
10360  RETURN
10370 *FPCAL: TNFP=(QMAX-QMIN)*QPD+1: ND=QMAX-QMIN: FSTP=1/QPD: N=1
10380  F(1)=10^(QMIN-6): FOR I=1 TO ND: FOR J=1 TO QPD: N=N+1
10390  F(N)=10^(QMIN+I+FSTP*J-7): NEXT J: NEXT I: F(TNFP+1)=F(1)/1000
10400  F(TNFP+2)=F(TNFP)*1000: RETURN
10410 *XEHKL: CONSOLE 0,25,0: COLOR 7: LINE (350,255)-(600,390),7,B
10420  LINE (351,256)-(599,389),3,BF: HE=(E(1)+E(TNFP))/2
10430  HK=(K(1)+K(TNFP))/2: FOR I=1 TO TNFP: IF E(I)>HE THEN IHE=I
10440  IF K(I)<HK THEN IHK=I
10450  NEXT I
10460  IF IHE=0 OR IHK=0 THEN 10540
10470  LFCE=(LOG(F(IHE+1))-LOG(F(IHE)))*(E(IHE)-HE)/(E(IHE)-E(IHE+1))
10480  FCE=EXP(LFCE+LOG(F(IHE)))
10490  LFCK=(LOG(F(IHK+1))-LOG(F(IHK)))*(K(IHK)-HK)/(K(IHK)-K(IHK+1))
10500  FCK=EXP(LFCK+LOG(F(IHK))): LOCATE 46,17
10510  PRINT "Mid-Freq. (E):";: PRINT USING "###.####";FCE;
10520  PRINT " MHz": LOCATE 46,18: PRINT "Mid-Freq. (K):";
10530  PRINT USING "###.####";FCK;: PRINT " MHz"
10540  LOCATE 46,20: PRINT "Eh=";: PRINT USING "#####.####";E(TNFP+2)
10550  LOCATE 62,20: INPUT "OK? ",Q$
10560  IF Q$="" OR Q$="Y" OR Q$="y" THEN 10590
10570  LOCATE 52,20: PRINT SPACE$(15): LOCATE 52,20
10580  INPUT "", E(TNFP+2)
10590  LOCATE 46,22: PRINT "Kl=";: PRINT USING "#####.####";K(TNFP+1)
10600  LOCATE 62,22: INPUT "OK? ",Q$
10610  IF Q$="" OR Q$="Y" OR Q$="y" THEN 10640
10620  LOCATE 52,22: PRINT SPACE$(15): LOCATE 52,22
10630  INPUT "",K(TNFP+1)
10640  RETURN
10650 *XDS1: CONSOLE 1,,0: CLS 1: COLOR 4: LINE (2,10)-(300,390),7,B
10660  LINE (3,11)-(299,389),4,BF: PRINT "   log (f/Hz)        E        ";
10670  PRINT "   K(mS/cm)": COLOR 7: MM=0: MD=6: CC=6: MX=0: RETURN
10680 *XDS2: IF M=TNFP+1 THEN CC=5
10690  IF M>TNFP-2 THEN ELSE 10710
10700  CONSOLE MD+1,,0: GOTO 10770
10710  IF MM=QPD THEN ELSE 10740
10720  MD=MD+1: CONSOLE MD,,0: LOCATE 0,MD: MM=0: CLS
10730  IF CC=7 THEN CC=6: GOTO 10760
10740  IF CC=6 THEN CC=7
10750  IF M=1 THEN CC=6
10760  MM=MM+1
10770  IF M=TNFP THEN CC=6
10780  COLOR CC: CONSOLE MD+1,,0: LF!=LOG(F)/LOG(10)+6
10790  IF M=TNFP THEN CC=6
10800  PRINT USING "#######.###";LF!;
10810  PRINT USING "#########.###";E(M);
10820  PRINT USING "#######.####";K(M): RETURN
10830 *HANAI: R1=P3-P1: R2=P4-P2: R3=R1^3-3*R1*R2^2: R4=3*R1^2*R2-R2^3
10840  R51=R3*P3/(P3^2+P4^2)*(P7-1)^3/3
10850  R52=R4/(P3^2+P4^2)*P4*(P7-1)^3/3
10860  R5=R51+R52: R6=(R4*P3-R3*P4)/(P3^2+P4^2)*(P7-1)^3/3
10870  R7=P1^2-P2^2
10880  R8=2*P1*P2: R9=R7^2+R8^2
10890  R101=R5/R9*R7*4/9: R102=R6*R8/R9*4/9: R10=R101+R102+1
10900  R11=(-R5*R8+R6*R7)/R9*4/9: P11=R10: P12=R11: GOSUB *EXPO
10910  R12=P13: R13=P14: R14=R5*P1-R6*P2: R15=R5*P2+R6*P1
10920  R16=SQR(R12)*COS(R13/2)+1: R17=SQR(R12)*SIN(R13/2)
10930  R18=-3/2*(R14*R16-R15*R17): R19=-3/2*(R14*R17+R15*R16)
10940  P11=R18: P12=R19: GOSUB *EXPO: R20=P13: R21=P14
10950  U(1,1)=R20^(1#/3#)*COS(R21/3): U(1,2)=R20^(1#/3#)*SIN(R21/3)
10960  U(2,1)=-U(1,1)/2-U(1,2)*SQR(3#)/2
10970  U(2,2)=-U(1,2)/2+U(1,1)*SQR(3#)/2
10980  U(3,1)=-U(2,1)/2-U(2,2)*SQR(3#)/2
10990  U(3,2)=-U(2,2)/2+U(2,1)*SQR(3#)/2: R22=U(1,1)^2+U(1,2)^2
11000  V(1,1)=-(R5*U(1,1)+R6*U(1,2))/R22
11010  V(1,2)=-(-R5*U(1,2)+R6*U(1,1))/R22
11020  V(2,1)=-V(1,1)/2+V(1,2)*SQR(3#)/2
11030  V(2,2)=-V(1,2)/2-V(1,1)*SQR(3#)/2
11040  V(3,1)=-V(2,1)/2+V(2,2)*SQR(3#)/2
11050  V(3,2)=-V(2,2)/2-V(2,1)*SQR(3#)/2: FOR I=1 TO 3
11060  R23=P1+U(I,1)+V(I,1): R24=P2+U(I,2)+V(I,2): R25=P3^2+P4^2
11070  R26=(R23*P3+R24*P4)/R25: R27=(-R23*P4+R24*P3)/R25: P11=R26
11080  P12=R27: GOSUB *EXPO: R28=P13: R29=P14
11090  R30=R28^(1#/3#)*COS(R29/3): R31=R28^(1#/3#)*SIN(R29/3)
11100  R32=(1-P7)*(R1*R30-R2*R31): R33=(1-P7)*(R1*R31+R2*R30)
11110  R34=U(I,1)+V(I,1): R35=U(I,2)+V(I,2): R36=R34^2+R35^2
11120  R37=(R32*R34+R33*R35)/R36: R38=(R33*R34-R32*R35)/R36: P11=R37
11130  P12=R38: GOSUB *EXPO: R39=P13: R40=P14
11140  IF ABS(R40)>.01 THEN 11170
11150  IF R23<0 OR R24>0 THEN 11170
11160  P5=R23: P6=R24
11170  NEXT I: RETURN
11180 *WAGNER: P11=2*P3+P1-2*P7*(P3-P1): P12=2*P4+P2-2*P7*(P4-P2)
11190  P13=2*P3+P1+P7*(P3-P1): P14=2*P4+P2+P7*(P4-P2)
11200  P15=(P11*P13+P12*P14)/(P13^2+P14^2)
11210  P16=(P12*P13-P11*P14)/(P13^2+P14^2): P5=P3*P15-P4*P16
11220  P6=P4*P15+P3*P16: RETURN
11230 *EXPO: PI=3.141592653#
11240  IF ABS(P11)<10^18 AND ABS(P12)<10^18 THEN 11260
11250  P13=10^18*SQR((P11/10^18)^2+(P12/10^18)^2): GOTO 11270
11260  P13=SQR(P11^2+P12^2)
11270  IF P11<0 THEN 11290
11280  P14=ATN(P12/P11): GOTO 11300
11290  IF P12<0 THEN P14=ATN(P12/P11)-PI ELSE P14=ATN(P12/P11)+PI
11300  RETURN
11310 *DPF: IF SA(1)=SA(2) THEN GOSUB *SPHEROID: GOTO 11440
11320  IF SA(2)=SA(3) OR SA(3)=SA(1) THEN GOSUB *SPHEROID: GOTO 11440
11330  AX=0: CX=10^12: FOR I=1 TO 3: IF SA(I)>AX THEN AX=SA(I)
11340  IF SA(I)<CX THEN CX=SA(I)
11350  NEXT I: FOR I= 1 TO 3: IF SA(I)<>CX AND SA(I)<>AX THEN BX=SA(I)
11360  NEXT I: RBAX=BX/AX: RCAX=CX/AX: PH=ATN(SQR(1#-RCAX^2#)/RCAX)
11370  KX0=SQR((1#-RBAX^2#)/(1#-RCAX^2#)): P1=PH: P2=KX0: GOSUB *ELIN
11380  FX0=P3:GX0=P4
11390  AA=RBAX*RCAX/(SQR(1#-RCAX^2#)*(1#-RBAX^2#))*(FX0-GX0)
11400  DPF(1)=AA: KX2=KX0^2#: KX1=1#-KX2: AB11=(GX0-KX1*FX0)/(KX1*KX2)
11410  AB1=AB11-SIN(2#*PH)/(2#*KX1*SQR(1#-KX2*(SIN(PH))^2#))
11420  AB=AX*BX*CX/(AX^2-CX^2)^1.5#*AB1:DPF(2)=AB
11430  AC=1#-AA-AB: DPF(3)=AC
11440  RETURN
11450 *ELIN: P6=P1: P5=1: P3=P1: P4=P1: P7=1: FOR I=1 TO 100
11460  P6=-(SIN(P1))^(2*I-1)*COS(P1)/(2*I)+(2*I-1)/(2*I)*P6
11470  P5=(2*I-1)/(2*I)*P5
11480  IF I=1 THEN P7=.5 ELSE P7=(2*I-3)/(2*I)*P7
11490  P3=P3+P5*P2^(2*I)*P6: P4=P4-P7*P2^(2*I)*P6: NEXT I: RETURN
11500 *SPHEROID
11510  IF SA(1)=SA(2) AND SA(2)=SA(3) AND SA(3)=SA(1) THEN 11560
11520  IF SA(1)=SA(2) THEN BX=SA(1): AX=SA(3): GOTO 11550
11530  IF SA(2)=SA(3) THEN BX=SA(2): AX=SA(1): GOTO 11550
11540  IF SA(3)=SA(1) THEN BX=SA(3): AX=SA(2)
11550  IF AX>BX THEN *PROLATE ELSE *OBLATE
11560  AA=1/3: GOTO *ABCAL
11570  *PROLATE: RAB=AX/BX
11580  AA=-1/(RAB^2-1)+RAB/(RAB^2-1)^1.5*LOG(RAB+SQR(RAB^2-1))
11590  GOTO *ABCAL
11600  *OBLATE: RAB=AX/BX
11610  AA=1/(1-RAB^2)-RAB*ATN(SQR(1-RAB^2)/RAB)/(1-RAB^2)^1.5
11620  *ABCAL: AB=(1-AA)/2:AC=AB:DPF(1)=AA:DPF(2)=AB:DPF(3)=AC
11630  RETURN
11640 *AHKC: VF1=0: DVF=VF/NINT: EH=EA:IEH#=IEA#: FOR I=1 TO NINT
11650  GOSUB *EPI: EHD=FNREMUL (EH,IEH#,EPT,IEPT#)/3*DVF/(1-VF1)
11660  IEHD#=FNIMMUL (EH,IEH#,EPT,IEPT#)/3*DVF/(1-VF1): EH=EH+EHD
11670  IEH#=IEH#+IEHD#:VF1=VF1+DVF: NEXT I: E=EH: IE#=IEH#: RETURN
11680 *EPI: EPT=0: IEPT#=0: FOR J=1 TO 3: EPI1=EI(J)-EH
11690  IEPI1#=IEI#(J)-IEH#: EPI2=EH+(EI(J)-EH)*DPF(J)
11700  IEPI2#=IEH#+(IEI#(J)-IEH#)*DPF(J)
11710  EPT=EPT+FNREDIV (EPI1,IEPI1#,EPI2,IEPI2#)
11720  IEPT#=IEPT#+FNIMDIV (EPI1,IEPI1#,EPI2,IEPI2#): NEXT J: RETURN
11730 *AHKD: EH=EA: IEH#=IEA#: GOSUB *EPI
11740  EHD=FNREDIV (2*VF/9*EPT+1,2*VF/9*IEPT#,1-VF/9*EPT,-VF/9*IEPT#)
11750  IEHD#=FNIMDIV (2*VF/9*EPT+1,2*VF/9*IEPT#,1-VF/9*EPT,-VF/9*IEPT#)
11760  E=FNREMUL (EHD,IEHD#,EA,IEA#): IE#=FNIMMUL (EHD,IEHD#,EA,IEA#)
11770  RETURN
11780 *EXYZ: EX1=ES+(EI(1)-ES)*AA+VP*(EI(1)-ES)*(1-AA)
11790  IEX1#=IES#+(IEI#(1)-IES#)*AA+VP*(IEI#(1)-IES#)*(1-AA)
11800  EY1=ES+(EI(2)-ES)*AB+VP*(EI(2)-ES)*(1-AB)
11810  IEY1#=IES#+(IEI#(2)-IES#)*AB+VP*(IEI#(2)-IES#)*(1-AB)
11820  EZ1=ES+(EI(3)-ES)*AC+VP*(EI(3)-ES)*(1-AC)
11830  IEZ1#=IES#+(IEI#(3)-IES#)*AC+VP*(IEI#(3)-IES#)*(1-AC)
11840  EX2=ES+(EI(1)-ES)*AA-VP*(EI(1)-ES)*AA
11850  IEX2#=IES#+(IEI#(1)-IES#)*AA-VP*(IEI#(1)-IES#)*AA
11860  EY2=ES+(EI(2)-ES)*AB-VP*(EI(2)-ES)*AB
11870  IEY2#=IES#+(IEI#(2)-IES#)*AB-VP*(IEI#(2)-IES#)*AB
11880  EZ2=ES+(EI(3)-ES)*AC-VP*(EI(3)-ES)*AC
11890  IEZ2#=IES#+(IEI#(3)-IES#)*AC-VP*(IEI#(3)-IES#)*AC
11900  EX3=FNREDIV (EX1,IEX1#,EX2,IEX2#)
11910  IEX3#=FNIMDIV (EX1,IEX1#,EX2,IEX2#)
11920  EY3=FNREDIV (EY1,IEY1#,EY2,IEY2#)
11930  IEY3#=FNIMDIV (EY1,IEY1#,EY2,IEY2#)
11940  EZ3=FNREDIV (EZ1,IEZ1#,EZ2,IEZ2#)
11950  IEZ3#=FNIMDIV (EZ1,IEZ1#,EZ2,IEZ2#)
11960  EX=FNREMUL (ES,IES#,EX3,IEX3#):EI(1)=EX
11970  IEX#=FNIMMUL (ES,IES#,EX3,IEX3#):IEI#(1)=IEX#
11980  EY=FNREMUL (ES,IES#,EY3,IEY3#):EI(2)=EY
11990  IEY#=FNIMMUL (ES,IES#,EY3,IEY3#):IEI#(2)=IEY#
12000  EZ=FNREMUL (ES,IES#,EZ3,IEZ3#):EI(3)=EZ
12010  IEZ#=FNIMMUL (ES,IES#,EZ3,IEZ3#):IEI#(3)=IEZ#: RETURN
12020 *CEN: DCEN=1+2*F^B*COS(PI*B/2)+F^(2*B)
12030  RE=DE*(1+F^B*COS(PI*B/2))/DCEN: IE#=-DE*F^B*SIN(PI*B/2)/DCEN
12040  RETURN
```

[Program Name: FMENU.BAS]

```
1000  ' SAVE "FMENU.BAS",A
1010  DT$="1991/08/31": GOSUB *INIT: GOSUB *DEFFUN: GOSUB *CONSTANT
1020  GOSUB *DATAREAD: GOSUB *GETDATA.TEMP: GOSUB *GETDATA.LATEST
1030  GOSUB *PLOT: GOTO 1030
1040 *INIT: DEFDBL A-H,K,Q-Z
1050  DIM QMINT(10),QMAXT(10),PDT(10),FT(8,201),ET(8,201),KT(8,201)
1060  DIM PRM(30),F(201),E(201),K(201),FD(201),ED(201),KD(201),PX(30)
1070  DIM PY(30),XP(201),YP(201),PYL(201),PYR(201),PF(201)
1080  COLOR ,0: VIEW (0,0)-(639,399): CLS 3: CONSOLE 0,25,0,1
1090  WIDTH 80,20: CC(1)=12: CC(2)=13: CC(3)=14: CC(4)=6: CC(5)=5
1100  CC(6)=8 :CC(7)=3 :CC(8)=2 :CC(9)= 2
1110 *DEFFUN: DEF FNREMUL (R1,X1,R2,X2)=R1*R2-X1*X2
1120  DEF FNREMUL (R1,X1,R2,X2)=R1*R2-X1*X2
1130  DEF FNIMMUL (R1,X1,R2,X2)=X1*R2+X2*R1
1140  DEF FNREDIV (R1,X1,R2,X2)=(R1*R2+X1*X2)/(R2*R2+X2*X2)
1150  DEF FNIMDIV (R1,X1,R2,X2)=(X1*R2-R1*X2)/(R2*R2+X2*X2): RETURN
1160 *DATAREAD
```

```
1180  OPEN "DGET.DAT" FOR INPUT AS #1: INPUT #1, M1$: CLOSE #1
1190  OPEN "IAZ.DAT" FOR INPUT AS #1: INPUT #1, PN,CLN
1200  CLOSE #1: OPEN "PLOT.DAT" FOR INPUT AS #1
1210  INPUT #1, YLAX,YMAXL,YMINL,YTSL,TINTE,YRAX,YMAXR,YMINR,YTSR
1220  INPUT #1, TINTK,YTAX,YMAXT,YMINT,YTST,TINTT,RCMAX,RCMIN,RCTS
1230  INPUT #1, TINTCE,RKMAX,RKMIN,RKTS,TINTCK,MAXF,MINF,MARK.MHZ
1240  INPUT #1, NUPLOT,PU.R,PU.L,NORM,VS: CLOSE #1
1250  OPEN "CRTDAT.DAT" FOR INPUT AS #1: INPUT #1, NPD
1260  INPUT #1, NPT,NPT.MAX,MINF,MAXF: INPUT #1, FILENAME$
1270  IF NPT>=NPT.MAX THEN NPT=NPT.MAX
1280  CLOSE #1: OPEN "LTLF.DAT" FOR INPUT AS #1
1290  INPUT #1, LTLF,LTAX,LMAXT,LMINT,LTST,TINTL: CLOSE #1: RETURN
1300 *DATASAVE: OPEN "PLOT.DAT" FOR OUTPUT AS #1
1310  PRINT #1, YLAX,YMAXL,YMINL,YTSL,TINTE,YRAX,YMAXR,YMINR,YTSR
1320  PRINT #1, TINTK,YTAX,YMAXT,YMINT,YTST,TINTT,RCMAX,RCMIN,RCTS
1330  PRINT #1, TINTCE,RKMAX,RKMIN,RKTS,TINTCK,MAXF,MINF,MARK.MHZ
1340  PRINT #1, NUPLOT,PU.R,PU.L,NORM,VS: CLOSE #1
1350  OPEN "CRTDAT.DAT" FOR OUTPUT AS #1
1360  PRINT #1, NPD;NPT;NPT.MAX;MINF;MAXF: PRINT #1, FILENAME$
1370  CLOSE #1: OPEN "LTLF.DAT" FOR OUTPUT AS #1
1380  PRINT #1, LTLF,LTAX,LMAXT,LMINT,LTST,TINTL: CLOSE #1: RETURN
1390 *ACL: PNN=0: OPEN "IAZ.DAT" FOR OUTPUT AS #1
1400  PRINT #1, PNN;CLN: CLOSE #1: GOSUB *DATASAVE
1410  GOSUB *SAVEDATA.TEMP: NPT=0: NPD=0
1420  OPEN "CRTDAT.DAT" FOR OUTPUT AS #1
1430  PRINT #1,NPD;NPT;NPT.MAX;MINF;MAXF: PRINT #1,FILENAME$
1440  CLOSE #1: CLEAR 0,32,1000,0: RUN "IAZ.BAS"
1450 *RECAL: IF PN=26 THEN GOTO *ACL
1460  OPEN "IAZ.DAT" FOR OUTPUT AS #1: PRINT #1, PN,CLN
1470  CLOSE #1: GOSUB *DATASAVE: GOSUB *SAVEDATA.TEMP0
1480  GOSUB *SAVEDATA.TEMP: CLEAR 0,32,1000,0: RUN "IAZ.BAS"
1490 *CONSTANT: C=1797.510861#: PI=3.141592653589793#: CFE=1/LOG(10)
1500  RETURN
1510 *PLOT: WIDTH 80,20: LOCATE 0,2: COLOR 7
1520  LINE (20,12)-(620,128),2,B: LINE (21,13)-(619,127),2,B
1530  LINE (22,14)-(618,126),6,BF
1540  ON KEY GOSUB *PEKF,*PK,*PE,*LT,*LF,*GETD,,*RECAL,*ACL
1550  LOCATE 5,1: PRINT "f%1  E, K vs. log f": LOCATE 5,2
1560  PRINT "f%2  COLE-COLE (E)": LOCATE 5,3: PRINT "f%3  COLE-COLE ";
1570  PRINT "(K)": LOCATE  5,4: PRINT "f%4  LOSS TANGENT"
1580  LOCATE 5,5: PRINT "f%5  LOSS FACTOR": LOCATE 40,1: PRINT "f%6 ";
1590  PRINT "  EXPERIMENTAL DATA": LOCATE 40,3: PRINT "f%8   RECALCU";
1600  PRINT "LATION": LOCATE 40,4: PRINT "F%9   RESTART (ALL CLEAR)"
1610  LINE (33,21)-(69,39),5,B :LINE (34,22)-(68,38),1,BF
1620  LINE (33,41)-(69,59),5,B: LINE (34,42)-(68,58),1,BF
1630  LINE (33,61)-(69,79),5,B: LINE (34,62)-(68,78),1,BF
1640  LINE (33,81)-(69,99),5,B: LINE (34,82)-(68,98),1,BF
1650  LINE (33,101)-(69,119),5,B: LINE (34,102)-(68,118),1,BF
1660  LINE (313,21)-(349,39),5,B: LINE (314,22)-(348,38),1,BF
1670  LINE (313,61)-(349,79),5,B: LINE (314,62)-(348,78),1,BF
1680  LINE (313,81)-(349,99),5,B: LINE (314,82)-(348,98),1,BF
1690  KEY (1) ON:KEY (2) ON:KEY (3) ON:KEY (4) ON:KEY (5) ON
1700  KEY (6) ON:KEY (8) ON:KEY (9) ON
1710  GOSUB *MAXMIN: GOSUB *SETPRM: RETURN
1720 *SETPRM: LOCATE 68,0: PRINT DT$: LINE (538,0)-(628,21),2,BF
1730  LINE (540,2)-(626,19),9,BF: LINE (20,200)-(620,382),2,B
1740  LINE (21,201)-(619,381),2,B: LINE (22,202)-(618,380),6,BF
1750  LINE (308,138)-(577,181),2,BF: LINE (310,140)-(575,179),0,BF
1760  LOCATE 41,7: COLOR 7: PRINT "NUMBER OF TRIALS: ": LOCATE 41,8
1770  COLOR 7: PRINT "RESIDUAL CALCULATION [R]: ";: COLOR 6
1780  IF RC=0 THEN PRINT "OFF  "
1790  IF RC=1 THEN PRINT "E    "
1800  IF RC=2 THEN PRINT "K    "
1810  IF RC=3 THEN PRINT "E, K "
1820  COLOR 7: LOCATE 63,7: PRINT "MAX:": LOCATE 5,10: COLOR 6
1830  PRINT "E, K vs. F" : COLOR 5: LOCATE 7,11: PRINT "E-Axis"
1840  LOCATE 7,12: PRINT "  Max:": LOCATE 7,13: PRINT "  Min:"
1850  LOCATE 7,14: PRINT " Step:": LOCATE 7,15: PRINT "K-Axis"
1860  LOCATE 7,16: PRINT "  Max:": LOCATE 7,17: PRINT "  Min:"
1870  LOCATE 7,18: PRINT " Step:": LOCATE 30,10: COLOR 6
1880  PRINT "Cole-Cole (E)" : COLOR 5: LOCATE 32,11: PRINT "R-Axis  ";
1890  PRINT "Max:": LOCATE 32,12: PRINT "        Min:": LOCATE 32,13
1900  PRINT "       Step:": LOCATE 30,14: COLOR 6: PRINT "Cole-Cole ";
1910  PRINT "(K)" : COLOR 5: LOCATE 32,15: PRINT "R-Axis  Max:"
1920  LOCATE 32,16: PRINT "        Min:": LOCATE 32,17
1930  PRINT "       Step:": LOCATE 30,18: COLOR 6: PRINT "log f     ";
1940  PRINT "Min:              Max:": LOCATE 58,10: COLOR 6
1950  PRINT "Loss Tangent": COLOR 5: LOCATE 61,11: PRINT " Max:"
1960  LOCATE 61,12: PRINT " Min:": LOCATE 61,13: PRINT "Step:"
1970  LOCATE 58,14: COLOR 6: PRINT "Loss Factor" : COLOR 5
1980  LOCATE 61,15: PRINT " Max:": LOCATE 61,16: PRINT " Min:"
1990  LOCATE 61,17: PRINT "Step:": LOCATE 0,0: COLOR 7: PRM(1)=YLAX
2000  PRM(2)=YMAXL: PRM(3)=YMINL: PRM(4)=YTSL: PRM(5)=YRAX
2010  PRM(6)=YMAXR: PRM(7)=YMINR: PRM(8)=YTSR: PRM(9)=RCMAX
2020  PRM(10)=RCMIN: PRM(11)=RCTS: PRM(12)=RKMAX: PRM(13)=RKMIN
2030  PRM(14)=RKTS: PRM(15)=MINF: PRM(16)=MAXF: PRM(17)=YMAXT
2040  PRM(18)=YMINT: PRM(19)=YTST: PRM(20)=LMAXT: PRM(21)=LMINT
2050  PRM(22)=LTST: FOR I=1 TO 8: PX(I)=14: NEXT I: FOR I=9 TO 15
2060  PX(I)=44: NEXT I: PX(16)=59: FOR I=17 TO 22: PX(I)=66: NEXT I
2070  FOR I=1 TO 8: PY(I)=I+10: NEXT I: FOR I=9 TO 11: PY(I)=I+2
2080  NEXT I: FOR I=12 TO 15: PY(I)=I+3: NEXT I: PY(16)=18
2090  FOR I=17 TO 19: PY(I)=I-6: NEXT I: FOR I=20 TO 22: PY(I)=I-5
2100  NEXT I: NPRM=1
2110  COLOR 6: LOCATE 58,7: PRINT NPT: LOCATE 67,7
2120  PRINT NPT.MAX: COLOR 7: GOSUB *DISPNULL
2130  IF NPRM=1 OR NPRM=5 THEN GOSUB *DISPNL
2140  IF NPRM=6 OR NPRM=7 OR NPRM=8 THEN GOSUB *DISPMS
2150  IF NPRM=12 OR NPRM=13 OR NPRM=14 THEN GOSUB *DISPMS
2160  IF NPRM=15 OR NPRM=16 THEN GOSUB *DISPLH
2170  FOR I=1 TO 22: IF I=NPRM THEN COLOR 4
2180  IF I=1 OR I=5 THEN ELSE 2210
2190  IF PRM(I)=0 THEN LOCATE PX(I)+1,PY(I): PRINT "Normal": GOTO 2220
2200  IF PRM(I)=1 THEN LOCATE PX(I)+1,PY(I): PRINT "log   ": GOTO 2220
2210  LOCATE PX(J),PY(I): PRINT PRM(I);: LOCATE 0,0
2220  COLOR 7: NEXT I
2230  K$=INKEY$: IF K$="" THEN 2230
2240  IF ASC(K$)=8 THEN RUN "IASTART.BAS"
2250  IF K$="R" OR K$="r" THEN GOSUB *SET.RESIDUAL
2260  IF K$="M" OR K$="m" THEN RUN "MEANMW.BAS
2270  IF ASC(K$)=248 THEN NPT.MAX=NPT.MAX+1: GOTO 2550
2280  IF ASC(K$)=249 THEN NPT.MAX=NPT.MAX-1: GOTO 2550
2290  IF ASC(K$)>=48 AND ASC(K$)<=57 THEN GOSUB *DATAX
2300  IF ASC(K$)=46 THEN GOSUB *DATAX
2310  IF ASC(K$)=32 AND (NPRM=1 OR NPRM=5) THEN GOSUB *DATAX
2320  IF ASC(K$)=30 THEN ELSE 2380
2330  IF NPRM=1 THEN NPRM=8: GOTO 2550
2340  IF NPRM=9 THEN NPRM=15: GOTO 2550
2350  IF NPRM=17 THEN NPRM=16: GOTO 2550
2360  IF NPRM=16 THEN NPRM=22: GOTO 2550
2370  NPRM=NPRM-1: GOTO 2550
2380  IF ASC(K$)=31 THEN ELSE 2440
2390  IF NPRM=8 THEN NPRM=1: GOTO 2550
2400  IF NPRM=15 THEN NPRM=9: GOTO 2550
2410  IF NPRM=16 THEN NPRM=17: GOTO 2550
2420  IF NPRM=22 THEN NPRM=16: GOTO 2550
2430  NPRM=NPRM+1: GOTO 2550
2440  IF ASC(K$)=28 THEN ELSE 2500
2450  IF NPRM<=3 THEN NPRM=NPRM+8: GOTO 2550
2460  IF 5<=NPRM AND NPRM<=8 THEN NPRM=NPRM+7: GOTO 2550
2470  IF 9<=NPRM AND NPRM<=14 THEN NPRM=NPRM+8: GOTO 2550
2480  IF NPRM=15 THEN NPRM=16: GOTO 2550
2490  GOTO 2550
2500  IF ASC(K$)=29 THEN ELSE 2550
2510  IF 9<=NPRM AND NPRM<=11 THEN NPRM=NPRM-8: GOTO 2550
2520  IF 12<=NPRM AND NPRM<=15 THEN NPRM=NPRM-7: GOTO 2550
2530  IF NPRM=16 THEN NPRM=15: GOTO 2550
2540  IF 17<=NPRM AND NPRM<=22 THEN NPRM=NPRM-8: GOTO 2550
2550  IF NPT.MAX>8 THEN NPT.MAX=8
2560  IF NPT.MAX<0 THEN NPT.MAX=0
2570  GOTO 2110
2580  RETURN
2590 *SET.RESIDUAL: RC=RC+1: IF RC=4 THEN RC=0
2600  LOCATE 67,8: COLOR 6: IF RC=0 THEN PRINT "OFF  "
2610  IF RC=1 THEN PRINT "E    "
2620  IF RC=2 THEN PRINT "K    "
2630  IF RC=3 THEN PRINT "E, K "
2640  RETURN
2650 *DISPNULL: LOCATE 41,9: PRINT SPACE$(27): RETURN
2660 *DISPNL: COLOR 4: LOCATE 41,9: IF NPT.MAX<0 THEN NPT.MAX=0
2670  PRINT "NORMAL <--- SPACE ---> LOG ": COLOR 7: RETURN
2680 *DISPMS: COLOR 4: LOCATE 41,9: PRINT "           (mS/cm)      "
2690  COLOR 7: RETURN
2700 *DISPLH: COLOR 4: LOCATE 41,9: PRINT "          (Log F/Hz)     "
2710  COLOR 7: RETURN
2720 *DATAX: IF NPRM=1 OR NPRM=5 THEN ELSE 2770
2730  IF ASC(K$)<>32 THEN 2820
2740  LOCATE PX(NPRM)+1,PY(NPRM): PRINT "       ";: LOCATE 0,0
2750  IF PRM(NPRM)=0 THEN PRM(NPRM)=1: GOTO 2810
2760  IF PRM(NPRM)=1 THEN PRM(NPRM)=0: GOTO 2810
2770  LOCATE PX(NPRM)+1,PY(NPRM): PRINT "       ";: LOCATE 0,0
2780  COLOR 6: LOCATE PX(NPRM)+1,PY(NPRM): PRINT K$;:LOCATE 0,0
2790  LOCATE PX(NPRM)+2,PY(NPRM): INPUT "",KDAT$
2800  PRM(NPRM)=VAL(K$+KDAT$)
2810  NPRM=NPRM+1: IF NPRM=23 THEN NPRM=16
2820  YLAX=PRM(1): YMAXL=PRM(2): YMINL=PRM(3): YTSL=PRM(4)
2830  YRAX=PRM(5): YMAXR=PRM(6): YMINR=PRM(7): YTSR=PRM(8)
2840  RCMAX=PRM(9): RCMIN=PRM(10): RCTS=PRM(11)
2850  RKMAX=PRM(12): RKMIN=PRM(13): RKTS=PRM(14)
2860  MINF=PRM(15): MAXF=PRM(16)
2870  YMAXT=PRM(17): YMINT=PRM(18): YTST=PRM(19)
2880  LMAXT=PRM(20): LMINT=PRM(21): LTST=PRM(22): RETURN
2890 *PEKF: IF NPT=0 AND NPD=0 THEN RETURN *PLOT
2900  WIDTH 80,25: CLS 3: NPT.BAK=NPT: LFT$="EK"
2910  IF NPT=0 THEN NPT=NPT.BAK
2920  IF NPT>NPT.MAX THEN NPT=NPT.MAX
2930  GOSUB *PT1: GOSUB *AXEKF: IF NPD=0 THEN 2960
2940  FOR I=1 TO TNFPD: PF(I)=FD(I): PYL(I)=ED(I): PYR(I)=KD(I)
2950  NEXT I: NFP=TNFPD: NKND=0: GOSUB *F.NAME: GOSUB *PLDATAEKF
2960  IF NPT=0 THEN 3040
2970  IF NPT=1 THEN 3020
2980  FOR J=NPT-1 TO 1 STEP -1
2990  FOR I=1 TO TNFPT(J): PF(I)=FT(J,I): PYL(I)=ET(J,I)
3000  PYR(I)=KT(J,I): NEXT I: NFP=TNFPT(J): NKND=J+1: GOSUB *PLDATAEKF
3010  NEXT J
3020  FOR I=1 TO TNFP: PF(I)=F(I): PYL(I)=E(I): PYR(I)=K(I): NEXT I
3030  NFP=TNFP: NKND=1: GOSUB *PLDATAEKF: GOSUB *NUM.LINE
3040  GOSUB *PT2: IF ASC(K$)=13 THEN CLS 3: RETURN *PLOT
3050  LFT$="EK": RETURN *PLOT
3060 *SETKL: VIEW (0,0)-(639,399): WINDOW (0,0)-(639,399)
3070  IF LEFT$(FA$(2),6)="A:\MIX" THEN ELSE 3140
3080  LOCATE 0,0: PRINT "K(1)=";:PRINT USING "##.###";KD(1)
3090  LOCATE 15,0: PRINT "K(11)=";:PRINT USING "##.###";KD(11)
3100  LOCATE 30,0: PRINT "K(21)=";:PRINT USING "##.###";KD(21)
3110  LOCATE 45,0: PRINT "K(31)=";:PRINT USING "##.###";KD(31)
3120  LOCATE 60,0: PRINT "K(41)=";:PRINT USING "##.###";KD(41)
3130  DATAFLAG=1
3140  LOCATE 30,21: PRINT PR$: IF PR$="Eh = " THEN 3160
3150  LOCATE 43,21: PRINT " mS/cm  "
3160  LINE (235,336)-(500,352),5,BF: LOCATE 35,21
3170  PRINT USING "###.####";KLL: CC1=7: CC2=0
3180  IF CC1=7 THEN CC2=0: CG1=3: CG2=4
3190  IF CC1=0 THEN CC2=7: CG1=4: CG2=3
3200  LOCATE 53,21: COLOR CC1: PRINT "YES"
3210  LINE (417,337)-(453,351),CG1,BF
3220  LOCATE 59,21: COLOR CC2: PRINT "NO": COLOR 7
3230  LINE (466,337)-(492,351),CG2,BF
3240  K$=INKEY$: IF K$="" THEN 3240
3250  IF ASC(K$)=13 THEN GOTO 3280
3260  IF CC1=7 THEN CC1=0: GOTO 3180
3270  IF CC1=0 THEN CC1=7: GOTO 3180
3280  IF CC1=7 THEN 3310
3290  LOCATE 35,21: PRINT "          ";: LOCATE 36,21: INPUT "",KLL
3300  CC1=7: GOTO 3180
3310  LINE (400,336)-(500,352),0,BF
3320  LOCATE 53,21: PRINT "               ": VIEW (99,49)-(499,299)
3330  WINDOW (0,-100)-(100,0): RETURN
3340 *LF: IF NPT=0 AND NPD=0 THEN RETURN *PLOT
3350  WIDTH 80,25: CLS 3: LFT$="LF": GOTO 3380
3360 *LT: IF NPT=0 AND NPD=0 THEN RETURN *PLOT
3370  WIDTH 80,25: CLS 3: LFT$="LT"
3380  NPT.BAK=NPT: IF NPT=0 THEN NPT=NPT.BAK
3390  IF NPT>NPT.MAX THEN NPT=NPT.MAX
3400  GOSUB *PT1: GOSUB *AXLOSS: IF HMFM>0 THEN HMFM=0: GOTO 3460
3410  IF NPD=0 THEN 3470
3420  KLL=KL: PR$="Kl = ": GOSUB *SETKL: KL=KLL: FOR I=1 TO TNFPD
3430  IF LFT$="LF" THEN PF(I)=FD(I):PYL(I)=(KD(I)-KLL)*C/FD(I)
3440  IF LFT$="LT" THEN PF(I)=FD(I):PYL(I)=(KD(I)-KLL)*C/FD(I)/ED(I)
3450  NEXT I: NFP=TNFPD: NKND=0
3460  GOSUB *F.NAME: GOSUB *PLDATATF: DATAFLAG=1: IF NPT=0 THEN 3640
3470  IF NPT=1 THEN 3570
3480  LOCATE 0,2: DATAFLAG=0: FOR J=NPT-1 TO 1 STEP -1
3490  IF LEFT$(FA$(2),6)="A:\MIX" THEN ELSE 3510
3500  INPUT "Kl ?",KLL: IF KLL=0  THEN ELSE 3520
3510  KLL=KT(J,TNFPT(J)+1)
3520  FOR I=1 TO TNFPT(J)
3530  IF LFT$="LF" THEN PF(I)=FT(J,I): PYL(I)=(KT(J,I)-KLL)*C/FT(J,I)
3540  IF LFT$="LT" THEN ELSE 3560
3550  PF(I)=FT(J,I): PYL(I)=(KT(J,I)-KLL)*C/FT(J,I)/ET(J,I)
3560  NEXT I: NFP=TNFPT(J): NKND=J+1: GOSUB *PLDATATF: NEXT J
3570  IF LEFT$(FA$(2),6)="A:\MIX" THEN ELSE 3590
3580  INPUT "Kl ?",KLL: IF KLL=0  THEN ELSE 3600
3590  KLL=K(TNFP+1)
3600  FOR I=1 TO TNFP
3610  IF LFT$="LF" THEN PF(I)=F(I):PYL(I)=(K(I)-KLL)*C/F(I)
3620  IF LFT$="LT" THEN PF(I)=F(I):PYL(I)=(K(I)-KLL)*C/F(I)/E(I)
3630  NEXT I: NFP=TNFP: NKND=1: GOSUB *PLDATATF
3640  GOSUB *PT3: IF ASC(K$)=13 THEN CLS 3: RETURN *PLOT
3650  IF ASC(K$)=13 THEN CLS 3: RETURN *PLOT
3660  LFT$="EK": IF ASC(K$)=70 THEN LFT$="LOSS FACTOR "
3670  IF ASC(K$)=84 THEN LFT$="LOSS TANGENT"
3680  RETURN *PLOT
3690 *F.NAME: LOCATE 15,4: PRINT FD$: RETURN
3700 *NUM.LINE: VIEW (0,0)-(639,399): SCREEN ,,0: FOR I=1 TO NPT
3710  LINE (15,40+15.7*I)-(35,40+15.7*I),CC(I),BF: LOCATE 4,I+2
3720  PRINT I: NEXT I: RETURN
3730 *PE: IF NPT=0 AND NPD=0 THEN RETURN *PLOT
3740  IQD1=IQE1: IQD2=IQE2: IQD3=IQE3: ISTARTD=ISTARTE: IENDD=IENDE
3750  WIDTH 80,25: TITLE$="COLE-COLE (E)": RMAX=RCMAX: RMIN=RCMIN
3760  RTS=RCTS
3770  IF NPT>NPT.MAX THEN NPT=NPT.MAX
3780  GOSUB *CCPLOT: GOSUB *PTCE: IF NPD=0 THEN 3920
3790  KLL=KL: PR$="Kl = ": GOSUB *SETKL: VIEW (99,49)-(499,249)
3800  WINDOW (0,-50)-(100,0): GOTO 3860
3810  LOCATE 10,18: PRINT "Kl = ";: PRINT USING "###.####";KL;
3820  PRINT " mS/cm  ";:INPUT "  OK (Y)";Q$
3830  IF Q$="N" OR Q$="n" THEN ELSE 3870
3840  LOCATE 10,20: PRINT "Kl = ";: PRINT "       "
3850  LOCATE 18,20: INPUT "",KLL
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3860  KL=KLL
3870  SPT=1: FOR I=1 TO TNFPD: PF(I)=FD(I): PYL(I)=ED(I)
3880  PYR(I)=(KD(I)-KLL)*C/FD(I): NEXT I: NFP=TNFPD: NKND=0
3890  XLR=0: IF IQD2<>0 THEN XLR=1
3900  GOSUB *PLDATACC: GOSUB *PLDATACC2: GOSUB *PLDATACC3
3910  GOSUB *F.NAME: IF NPT=0 THEN 4000
3920  IF NPT=1 THEN 3970
3930  FOR J=NPT-1 TO 1 STEP -1: KLL=KT(J,TNFPT(J)+1)
3940  FOR I=1 TO TNFPT(J): PF(I)=FT(J,I): PYL(I)=ET(J,I)
3950  PYR(I)=(KT(J,I)-KLL)*C/FT(J,I): NEXT I: NFP=TNFPT(J): NKND=J+1
3960  MPDT=PDT(J): GOSUB *PLDATACC: NEXT J
3970  KLL=K(TNFP+1): FOR I=1 TO TNFP: PF(I)=F(I): PYL(I)=E(I)
3980  PYR(I)=(K(I)-KLL)*C/F(I): NEXT I: NFP=TNFP: NKND=1: MPDT=PDT
3990  GOSUB *PLDATACC
4000  GOSUB *NUM.LINE
4010  IQE1=IQD1: IQE2=IQD2: IQE3=IQD3: ISTARTE=ISTARTD: IENDE=IENDD
4020  K$=INKEY$: IF K$="" THEN 4020
4030  IF ASC(K$)=8 THEN NPT=NPT-1: GOTO 3770
4040  IF ASC(K$)>=28 AND ASC(K$)<=31 THEN ELSE 4070
4050  GOSUB *P.CHANGE: IQ1=IQD1: IQ2=IQD2: IQ3=IQD3: ISTART=ISTARTD
4060  IEND=IENDD: GOSUB *PLDATACC3: GOTO 4000
4070  CLS 3: RETURN *PLOT
4080 *PK: IF NPT=0 AND NPD=0 THEN RETURN *PLOT
4090  IQD1=IQK1: IQD2=IQK2: IQD3=IQK3: ISTARTD=ISTARTK: IENDD=IENDK
4100  WIDTH 80,25: TITLE$="COLE-COLE (K)": RMAX=RKMAX: RMIN=RKMIN
4110  RTS=RKTS
4120  IF NPT>NPT.MAX THEN NPT=NPT.MAX
4130  GOSUB *CCPLOT: GOSUB *PTCK: IF NPD=0 THEN 4260
4140  EHL=EH: PR$="Eh = ": KLL=EHL: GOSUB *SETKL: EHL=KLL
4150  VIEW (99,49)-(499,249): WINDOW (0,-50)-(100,0): GOTO 4200
4160  LOCATE 11,18: PRINT "Eh = ";: PRINT USING "###.###";EH;
4170  INPUT "  OK (Y)";Q$: IF Q$="N" OR Q$="n" THEN ELSE 4210
4180  LOCATE 11,20: PRINT "Eh = ";: PRINT "       "
4190  LOCATE 18,20: INPUT "",EHL
4200  EH=EHL
4210  SPT=1: FOR I=1 TO TNFPD: PF(I)=FD(I): PYL(I)=KD(I)
4220  PYR(I)=(ED(I)-EHL)/C*FD(I): NEXT I: NFP=TNFPD: NKND=0
4230  XLR=0: IF IQK2<>0 THEN XLR=1
4240  GOSUB *PLDATACC: GOSUB *PLDATACC2: GOSUB *PLDATACC3
4250  GOSUB *F.NAME: IF NPT=0 THEN 4340
4260  IF NPT=1 THEN 4310
4270  FOR J=NPT-1 TO 1 STEP -1: EHL=ET(J,TNFPT(J)+2)
4280  FOR I=1 TO TNFPT(J): PF(I)=FT(J,I): PYL(I)=KT(J,I)
4290  PYR(I)=(ET(J,I)-EHL)/C*FT(J,I): NEXT I: NFP=TNFPT(J): NKND=J+1
4300  MPDT=PDT(J): XLR=0: GOSUB *PLDATACC: NEXT J
4310  EHL=E(TNFP+2): FOR I=1 TO TNFP: PF(I)=F(I): PYL(I)=K(I)
4320  PYR(I)=(E(I)-EHL)/C*F(I): NEXT I: NFP=TNFP: NKND=1: MPDT=PDT
4330  GOSUB *PLDATACC
4340  GOSUB *NUM.LINE: IQK1=IQD1: IQK2=IQD2: IQK3=IQD3
4350  ISTARTK=ISTARTD: IENDK=IENDD
4360  K$=INKEY$: IF K$="" THEN 4360
4370  IF ASC(K$)=8 THEN NPT=NPT-1: GOTO 4120
4380  IF ASC(K$)>=28 AND ASC(K$)<=31 THEN ELSE 4410
4390  GOSUB *P.CHANGE: IQ1=IQD1: IQ2=IQD2: IQ3=IQD3: ISTART=ISTARTD
4400  IEND=IENDD: GOSUB *PLDATACC3: GOTO 4340
4410  CLS 3: RETURN *PLOT
4420 *P.CHANGE: IF ASC(K$)=28 THEN ELSE 4460
4430  IF SPT=1 THEN SPT=3: GOTO 4500
4440  IF SPT=2 THEN SPT=1: GOTO 4500
4450  IF SPT=3 THEN SPT=2: GOTO 4500
4460  IF ASC(K$)=29 THEN ELSE 4500
4470  IF SPT=1 THEN SPT=2: GOTO 4500
4480  IF SPT=2 THEN SPT=3: GOTO 4500
4490  IF SPT=3 THEN SPT=1: GOTO 4500
4500  IF TITLE$="COLE-COLE (K)" THEN ELSE 4790
4510  IF ASC(K$)=30 THEN ELSE 4610
4520  IF SPT=1 THEN ELSE 4550
4530  IF IQD1=>IQD3-1 THEN IQD1=IQD3-1: GOTO 4710
4540  IQD1=IQD1+1: GOTO 4710
4550  IF SPT=2 THEN ELSE 4580
4560  IF IQD2>=IENDD THEN IQD2=IENDD: GOTO 4710
4570  IQD2=IQD2+1: GOTO 4710
4580  IF SPT=3 THEN ELSE 4610
4590  IF IQD3>=IQD2-1 THEN IQD3=IQD2-1: GOTO 4710
4600  IQD3=IQD3+1: GOTO 4710
4610  IF ASC(K$)=31 THEN ELSE 4710
4620  IF SPT=1 THEN ELSE 4650
4630  IF IQD1<=ISTARTD THEN IQD1=ISTARTD: GOTO 4710
4640  IQD1=IQD1-1: GOTO 4710
4650  IF SPT=2 THEN ELSE 4680
4660  IF IQD2=<IQD3+1 THEN IQD2=IQD3+1: GOTO 4710
4670  IQD2=IQD2-1: GOTO 4710
4680  IF SPT=3 THEN ELSE 4710
4690  IF IQD3=<IQD1+1 THEN IQD3=IQD1+1: GOTO 4710
4700  IQD3=IQD3-1
4710  XQ1X=XQ1: XQ2X=XQ2: XQ3X=XQ3: YQ1X=YQ1: YQ2X=YQ2: YQ3X=YQ3
4720  XQ1=(KD(IQD1)-RMIN)*RFACT
4730  YQ1=-((ED(IQD1)-EH)/C*FD(IQD1)-IMIN)*IFACT
4740  XQ2=(KD(IQD2)-RMIN)*RFACT
4750  YQ2=-((ED(IQD2)-EH)/C*FD(IQD2)-IMIN)*IFACT
4760  XQ3=(KD(IQD3)-RMIN)*RFACT
4770  YQ3=-((ED(IQD3)-EH)/C*FD(IQD3)-IMIN)*IFACT
4780  GOTO 5060
4790  IF ASC(K$)=31 THEN ELSE 4890
4800  IF SPT=1 THEN ELSE 4830
4810  IF IQD1=>IENDD THEN IQD1=IENDD: GOTO 4990
4820  IQD1=IQD1+1: GOTO 4990
4830  IF SPT=2 THEN ELSE 4860
4840  IF IQD2>=IQD3-1 THEN IQD2=IQD3-1: GOTO 4990
4850  IQD2=IQD2+1: GOTO 4990
4860  IF SPT=3 THEN ELSE 4890
4870  IF IQD3>=IQD1-1 THEN IQD3=IQD1-1: GOTO 4990
4880  IQD3=IQD3+1: GOTO 4990
4890  IF ASC(K$)=30 THEN ELSE 4990
4900  IF SPT=1 THEN ELSE 4930
4910  IF IQD1<=IQD3+1 THEN IQD1=IQD3+1: GOTO 4990
4920  IQD1=IQD1-1: GOTO 4990
4930  IF SPT=2 THEN ELSE 4960
4940  IF IQD2=<ISTARTD THEN IQD2=ISTARTD: GOTO 4990
4950  IQD2=IQD2-1: GOTO 4990
4960  IF SPT=3 THEN ELSE 4990
4970  IF IQD3=<IQD2+1 THEN IQD3=IQD2+1: GOTO 4990
4980  IQD3=IQD3-1: GOTO 4990
4990  XQ1X=XQ1: XQ2X=XQ2: XQ3X=XQ3: YQ1X=YQ1: YQ2X=YQ2: YQ3X=YQ3
5000  XQ1=(ED(IQD1)-RMIN)*RFACT
5010  YQ1=-((KD(IQD1)-KL)*C/FD(IQD1)-IMIN)*IFACT
5020  XQ2=(ED(IQD2)-RMIN)*RFACT
5030  YQ2=-((KD(IQD2)-KL)*C/FD(IQD2)-IMIN)*IFACT
5040  XQ3=(ED(IQD3)-RMIN)*RFACT
5050  YQ3=-((KD(IQD3)-KL)*C/FD(IQD3)-IMIN)*IFACT
5060  RETURN
5070 *MAXMIN: MAXE=-1D+38:MINE=1D+38:MAXK=-1D+38:MINK=1D+38
5080  FOR I=1 TO TNFP: IF E(I)>MAXE THEN MAXE=E(I)
5090  IF K(I)>MAXK THEN MAXK=K(I)
5100  IF E(I)<MINE THEN MINE=E(I)
5110  IF K(I)<MINK THEN MINK=K(I)
5120  NEXT I
5130  IF MAXE<-10000000000# THEN MAXE=0: MINE=0
5140  IF MAXK<-10000000000# THEN MAXK=0: MINK=0
5150  IF MAXE>1E+08 THEN MAXE=999999!: MINK=0#
5160  LINE (20,140)-(290,204),2,BF: LINE (22,142)-(288,202),1,BF
5170  LOCATE 15, 7: PRINT "E           K(mS/cm)"
5180  LOCATE 5, 8: PRINT "MAX: ";: PRINT USING "########.##";MAXE
5190  LOCATE 25, 8: PRINT USING "####.###";MAXK
5200  LOCATE 5, 9: PRINT "MIN: ";:PRINT USING "########.##";MINE
5210  LOCATE 25, 9: PRINT USING "####.###";MINK: RETURN
5220 *AXLOSS: WINDOW (0,-100)-(100,0): VIEW (99,49)-(499,299): CLS 2
5230  FWID=MAXF-MINF: NTF=FWID: FFACT=100/FWID
5240  IF LFT$="LT" THEN ELSE 5260
5250  YMAX=YMAXT: YMIN=YMINT: YTS=YTST: GOTO 5270
5260  YMAX=LMAXT: YMIN=LMINT: YTS=LTST
5270  YWIDT=YMAX-YMIN: NTYT=INT(YWIDT/YTS+.0001): YFACTT=-100/YWIDT
5280  LINE (0,-100)-(100,0),,B: FOR I=1 TO NTYT-1
5290  LINE (0,YTS*I*YFACTT)-(1,YTS*I*YFACTT)
5300  LINE (99,YTS*I*YFACTT)-(100,YTS*I*YFACTT): NEXT I
5310  FOR I=INT(MINF-.01) TO INT(MAXF+.01)
5320  LINE ((I-MINF)*FFACT,0)-((I-MINF)*FFACT,-2)
5330  LINE ((I-MINF)*FFACT,-100)-((I-MINF)*FFACT,-98): NEXT I: RETURN
5340 *AXEKF: IF YLAX=1 THEN 5360
5350  YLABELL$=LBL1$+":": GOTO 5370
5360  YTSL=1:YLABELL$="LOG("+LBL1$+"):"
5370  IF YRAX=1 THEN 5390
5380  YLABELR$=LBL2$+":": GOTO 5400
5390  YTSR=1:YLABELR$="LOG("+LBL2$+"):"
5400  FTS=1: WINDOW (0,-100)-(100,0): VIEW (99,49)-(499,299): CLS 2
5410  FWID=MAXF-MINF:NTF=FWID:FFACT=100/FWID
5420  YWIDL=YMAXL-YMINL:NTYL=INT(YWIDL/YTSL+.0001):YFACTL=-100/YWIDL
5430  YWIDR=YMAXR-YMINR:NTYR=INT(YWIDR/YTSR+.0001):YFACTR=-100/YWIDR
5440  LINE (0,-100)-(100,0),,B: FOR I=1 TO NTYL-1
5450  LINE (0,YTSL*I*YFACTL)-(1,YTSL*I*YFACTL): NEXT I
5460  FOR I=1 TO NTYR-1: LINE (99,YTSR*I*YFACTR)-(100,YTSR*I*YFACTR)
5470  NEXT I: FOR I=INT(MINF-.01) TO INT(MAXF+.01)
5480  LINE ((I-MINF)*FFACT,0)-((I-MINF)*FFACT,-2)
5490  LINE ((I-MINF)*FFACT,-100)-((I-MINF)*FFACT,-98): NEXT I: RETURN
5500 *PT1: VIEW (0,0)-(639,399): WINDOW (0,0)-(639,399)
5510  FOR I=INT(MINF-.01)+1 TO INT(MAXF+.01)
5520  PUT ( 95+400*(I-MINF)/(MAXF-MINF),305),KANJI(48+I),OR: NEXT I
5530  IF LFT$="EK" THEN ELSE 5550
5540  LOCATE 9,10: PRINT "E ": LOCATE 64,10: PRINT "K ": RETURN
5550  IF LFT$="LT" THEN ELSE 5570
5560  LOCATE 5,10: PRINT "LOSS": LOCATE 5,11: PRINT "TANGENT": RETURN
5570  LOCATE 5,10: PRINT "LOSS": LOCATE 5,11: PRINT "FACTOR ": RETURN
5580 *PT2: VIEW (0,0)-(639,399): WINDOW (0,0)-(639,399)
5590  LOCATE 21,1 : PRINT "TAB  SELECT   BS  RE-PLOT   RETURN  MENU"
5600  LINE (159,14)-(260,34),5,BF: LINE (164,16)-(195,32),3,BF
5610  LINE (270,14)-(372,34),5,BF: LINE (275,16)-(298,32),3,BF
5620  LINE (383,14)-(493,34),5,BF: LINE (388,16)-(442,32),3,BF
5630  CN=1: CNP(1)=3: CNP(2)=1: CNP(3)=4: CNP(4)=4
5640  IF YLAX=1 THEN CNP(1)=1: CNP(2)=1
5650  IF YRAX=1 THEN CNP(3)=1: CNP(4)=1
5660  CNX(1)=168: CNX(2)=168: CNX(3)=503: CNX(4)=503
5670  CNY(1)=338: CNY(2)=354: CNY(3)=338: CNY(4)=354
5680  LOCATE 12,21: PRINT "MAX:";: PRINT USING "#####";YMAXL
5690  LOCATE 12,22: PRINT "MIN:";: PRINT USING "#####";YMINL
5700  LOCATE 53,21: PRINT "MAX:";: PRINT USING "##.###";YMAXR
5710  LOCATE 53,22: PRINT "MIN:";: PRINT USING "##.###";YMINR
5720  LOCATE 18,23: PRINT "E ";: LOCATE 0,0
5730  LOCATE 59,23: PRINT "K ";: LOCATE 0,0
5740  IF CN=1 THEN CC=5 ELSE CC=2
5750  LINE ( 90,336)-(170,352),CC,BF
5760  IF CN=2 THEN CC=5 ELSE CC=2
5770  LINE ( 90,352)-(170,368),CC,BF
5780  IF CN=3 THEN CC=5 ELSE CC=2
5790  LINE (416,336)-(505,352),CC,BF
5800  IF CN=4 THEN CC=5 ELSE CC=2
5810  LINE (416,352)-(505,368),CC,BF: CNXX=CNX(CN)-CNP(CN)*8-2
5820  CNYY=CNY(CN)-1: IF CN=3 OR CN=4 THEN ELSE 5850
5830  IF YRAX=0 AND CNP(CN)>=4 THEN ELSE 5850
5840  CNXX=CNXX-8
5850  LINE (CNXX,CNYY-1)-(CNXX+10,CNYY+14),3,BF
5860  K$=INKEY$: IF K$="" THEN 5860
5870  IF ASC(K$)=13 THEN RETURN
5880  IF ASC(K$)=46 THEN GOSUB *KIN2
5890  IF ASC(K$)>=48 AND ASC(K$)<=57 THEN GOSUB *KIN2: GOTO 5680
5900  IF ASC(K$)=9 THEN CN=CN+1
5910  IF CN=5 THEN CN=1
5920  IF 28<=ASC(K$) AND ASC(K$)<=31 THEN GOSUB *PT2.PRM: GOTO 5680
5930  IF ASC(K$)=8 THEN RETURN *PLOT
5940  GOTO 5740
5950 *PT2.PRM: IF ASC(K$)=28 THEN ELSE 5990
5960  CNP(CN)=CNP(CN)-1: IF CNP(CN)=0 THEN CNP(CN)=1: CN=CN+1
5970  IF CN=5 THEN CN=1
5980  GOTO 6180
5990  IF ASC(K$)=29 THEN ELSE 6030
6000  CNP(CN)=CNP(CN)+1: IF CNP(CN)=6 THEN CNP(CN)=5: CN=CN-1
6010  IF CN=0 THEN CN=4
6020  GOTO 6180
6030  IF ASC(K$)=30 THEN ELSE 6110
6040  IF CN=1 THEN YMAXL=YMAXL+INT(10^(CNP(1)-1)+.1)
6050  IF CN=2 THEN YMINL=YMINL+INT(10^(CNP(2)-1)+.1)
6060  IF CN=3 AND YRAX=0 THEN YMAXR=YMAXR+INT(10^(CNP(3)-1)+.1)/1000
6070  IF CN=3 AND YRAX=1 THEN YMAXR=YMAXR+INT(10^(CNP(3)-1)+.1)
6080  IF CN=4 AND YRAX=0 THEN YMINR=YMINR+INT(10^(CNP(4)-1)+.1)/1000
6090  IF CN=4 AND YRAX=1 THEN YMINR=YMINR+INT(10^(CNP(4)-1)+.1)
6100  GOTO 6180
6110  IF ASC(K$)=31 THEN ELSE 6180
6120  IF CN=1 THEN YMAXL=YMAXL-INT(10^(CNP(1)-1)+.1)
6130  IF CN=2 THEN YMINL=YMINL-INT(10^(CNP(2)-1)+.1)
6140  IF CN=3 AND YRAX=0 THEN YMAXR=YMAXR-INT(10^(CNP(3)-1)+.1)/1000
6150  IF CN=3 AND YRAX=1 THEN YMAXR=YMAXR-INT(10^(CNP(3)-1)+.1)
6160  IF CN=4 AND YRAX=0 THEN YMINR=YMINR-INT(10^(CNP(4)-1)+.1)/1000
6170  IF CN=4 AND YRAX=1 THEN YMINR=YMINR-INT(10^(CNP(4)-1)+.1)
6180  RETURN
6190 *PT3: HMFM=0: VIEW (0,0)-(639,399): WINDOW (0,0)-(639,399)
6200  LOCATE 21,1 : PRINT "                  BS  RE-PLOT   RETURN  MENU"
6210  LINE (270,14)-(372,34),5,BF: LINE (275,16)-(298,32),3,BF
6220  LINE (383,14)-(493,34),5,BF: LINE (388,16)-(442,32),3,BF
6230  CN=1: CNP(1)=4: CNP(2)=2: IF LFT$="LT" THEN CNP(1)=2
6240  CNX(1)=168: CNX(2)=168: CNY(1)=338: CNY(2)=354
6250  LOCATE 12,21: PRINT "MAX:";: PRINT USING "#####.#";YMAX
6260  LOCATE 12,22: PRINT "MIN:";: PRINT USING "#####.#";YMIN
6270  IF CN=1 THEN CC=5 ELSE CC=2
6280  LINE ( 90,336)-(188,352),CC,BF: IF CN=2 THEN CC=5 ELSE CC=2
6290  LINE ( 90,352)-(188,368),CC,BF: CNXX=CNX(CN)-CNP(CN)*8+6
6300  CNYY=CNY(CN)-1: IF CNP(CN)=1 THEN ELSE 6320
6310  CNXX=CNXX+8
6320  LINE (CNXX,CNYY-1)-(CNXX+10,CNYY+14),3,BF
6330  K$=INKEY$: IF K$="" THEN 6330
6340  IF ASC(K$)=13 THEN GOTO 6560
6350  IF ASC(K$)=46 THEN GOSUB *KIN3
6360  IF ASC(K$)>=48 AND ASC(K$)<=57 THEN GOSUB *KIN3: GOTO 6470
6370  IF ASC(K$)=9 THEN CN=CN+1
6380  IF ASC(K$)=1 THEN GOSUB *P1P2 ELSE 6390
6390  IF CN=3 THEN CN=1
6400  IF 28<=ASC(K$) AND ASC(K$)<=31 THEN GOSUB *PT3.PRM: GOTO 6250
6410  IF ASC(K$)=8 THEN GOTO 6560
6420  IF ASC(K$)=83 OR ASC(K$)=115 THEN ELSE 6470
6430  INPUT "INPUT DRIVE FOR DATA SAVE";LTSD$ : LTSD$=LTSD$+":"
6440  INPUT "INPUT FILE NAME";LTFN$
6450  OPEN LTSD$+LTFN$+".LTM" FOR OUTPUT AS #1
6460  FOR I=1 TO TNFPD: PRINT #1, PYL(I): NEXT I: CLOSE #1: CLS
6470  IF ASC(K$)=77 OR ASC(K$)=109 THEN ELSE 6550
6480  INPUT "HOW MANY FILES"; HMFM
6490  INPUT "INPUT DRIVE FOR DATA LOAD";LTSD$ : LTSD$=LTSD$+":"
6500  FOR J=1 TO HMFM: INPUT "INPUT FILE NAME";LTFN$
6510  OPEN LTSD$+LTFN$+".LTM" FOR INPUT AS #1
6520  FOR I=1 TO TNFPD-1: INPUT #1, PYL(I): NEXT I: CLOSE #1
6530  FOR I=1 TO TNFPD-1: PYL(I)=(PYR(I)*(J-1)+PYL(I))/J
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6540  PYR(I)=PYL(I): NEXT I: NEXT J: CLS
6550  GOTO 6270
6560  IF LFT$="LF" THEN LMAXT=YMAX: LMINT=YMIN
6570  IF LFT$="LT" THEN YMAXT=YMAX: YMINT=YMIN
6580  IF ASC(K$)=8 THEN RETURN *PLOT
6590  RETURN
6600 *PT3.PRM: IF ASC(K$)=28 THEN ELSE 6630
6610  CNP(CN)=CNP(CN)-1: IF CNP(CN)=0 THEN CNP(CN)=1
6620  GOTO 6730
6630  IF ASC(K$)=29 THEN ELSE 6660
6640  CNP(CN)=CNP(CN)+1: IF CNP(CN)=7 THEN CNP(CN)=6
6650  GOTO 6730
6660  IF ASC(K$)=30 THEN ELSE 6700
6670  IF CN=1 THEN YMAX=YMAX+INT(10^(CNP(1)-1)+.1)/10
6680  IF CN=2 THEN YMIN=YMIN+INT(10^(CNP(2)-1)+.1)/10
6690  GOTO 6730
6700  IF ASC(K$)=31 THEN ELSE 6730
6710  IF CN=1 THEN YMAX=YMAX-INT(10^(CNP(1)-1)+.1)/10
6720  IF CN=2 THEN YMIN=YMIN-INT(10^(CNP(2)-1)+.1)/10
6730  RETURN
6740 *KIN2: IF CN=1 OR CN=2 THEN LX!=17 ELSE LX!=58
6750  IF CN=1 OR CN=3 THEN LY!=21 ELSE LY!=22
6760  LOCATE LX!,LY!: PRINT K$;"        ": LOCATE LX!+1,LY!
6770  INPUT "",YKI$: YKI$=K$+YKI$: IF CN=1 THEN YMAXL=VAL(YKI$)
6780  IF CN=2 THEN YMINL=VAL(YKI$)
6790  IF CN=3 THEN YMAXR=VAL(YKI$)
6800  IF CN=4 THEN YMINR=VAL(YKI$)
6810  CN=CN+1: IF CN=5 THEN CN=1
6820  RETURN
6830 *KIN3: LX!=17: IF CN=1 THEN LY!=21 ELSE LY!=22
6840  LOCATE LX!,LY!: PRINT K$;"        ": LOCATE LX!+1,LY!
6850  INPUT "",YKI$: YKI$=K$+YKI$: IF CN=1 THEN YMAX=VAL(YKI$)
6860  IF CN=2 THEN YMIN=VAL(YKI$)
6870  CN=CN+1: IF CN=3 THEN CN=1
6880  RETURN
6890 *CCPLOT: CLS 3: WINDOW (0,-50)-(100,0): VIEW (99,49)-(499,249)
6900  RWID=RMAX-RMIN: NTR=INT(RWID/RTS): RFACT=100/RWID
6910  IFACT=-100/RWID: LINE (0,-50)-(100,0),,B: FOR I=1 TO INT(NTR/2)
6920  LINE (0,RTS*I*IFACT)-(1,RTS*I*IFACT)
6930  LINE (99,RTS*I*IFACT)-(100,RTS*I*IFACT): NEXT I
6940  FOR I=1 TO NTR-1: LINE (RTS*I*RFACT,0)-(RTS*I*RFACT,-1)
6950  LINE (RTS*I*RFACT,-50)-(RTS*I*RFACT,-49): NEXT I: RETURN
6960 *PTCK: LOCATE 15,2: PRINT TITLE$: LOCATE 9,16
6970  PRINT USING "###.###";RMIN: LOCATE 57,16
6980  PRINT USING "###.###";RMAX: RETURN
6990 *PTCE: LOCATE 15,2: PRINT TITLE$: LOCATE 8,16
7000  PRINT USING "######";RMIN: LOCATE 54,16
7010  PRINT USING "#########";RMAX: RETURN
7020 *PLDATAEKF: RSDE=0: NRSDE=0: RSDK=0: NRSDK=0: RMINE=10000000#
7030  RMAXE=0: RMINK=10000000#: RMAXK=0: FOR I=1 TO NFP-1
7040  IF 6+LOG(PF(I))*CFE<MINF OR 6+LOG(PF(I))*CFE>MAXF THEN 7220
7050  IF RMINE>PYL(I) THEN RMINE=PYL(I)
7060  IF RMINK>PYR(I) THEN RMINK=PYR(I)
7070  IF RMAXE<PYL(I) THEN RMAXE=PYL(I)
7080  IF RMAXK<PYR(I) THEN RMAXK=PYR(I)
7090  XPT1=(6+CFE*LOG(PF(I))-MINF)*FFACT
7100  XPT2=(6+CFE*LOG(PF(I+1))-MINF)*FFACT: IF YLAX=1 THEN 7140
7110  IF PYL(I)<YMINL OR PYL(I)>YMAXL THEN 7220
7120  YLPT1=(PYL(I)-YMINL)*YFACTL: YLPT2=(PYL(I+1)-YMINL)*YFACTL
7130  GOTO 7190
7140  IF PYL(I)<=0 THEN 7190
7150  IF PYL(I+1)<=0 THEN 7190
7160  IF CFE*LOG(PYL(I))<YMINL OR CFE*LOG(PYL(I))>YMAXL THEN 7220
7170  YLPT1=(CFE*LOG(PYL(I))-YMINL)*YFACTL
7180  YLPT2=(CFE*LOG(PYL(I+1))-YMINL)*YFACTL
7190  PF2=PF(2)*10^6: IF NKND=0 THEN ELSE 7210
7200  GOSUB *RESIDUAL.E: PSET (XPT1,YLPT1): GOTO 7220
7210  LINE (XPT1,YLPT1)-(XPT2,YLPT2),CC(NKND)
7220  NEXT I
7230  IF YLAX=1 THEN ELSE 7260
7240  IF RMAXE=0 OR RMINE=0 GOTO 7260
7250  RMAXE=(6+CFE*LOG(RMAXE)-MINF): RMINE=(6+CFE*LOG(RMINE)-MINF)
7260  IF NKND=0 THEN ELSE 7310
7270  IF RC=1 OR RC=3 THEN ELSE 7310
7280  LOCATE 25,21: PRINT "RESIDUAL (E):";
7290  RESIDUAL.E=(RSDE/NRSDE)/(RMAXE-RMINE)*(YMAXL-YMINL)
7300  PRINT USING "###.####"; RESIDUAL.E;: PRINT "%"
7310  FOR I=1 TO NFP-1
7320  IF 6+CFE*LOG(PF(I))<MINF OR 6+CFE*LOG(PF(I))>MAXF THEN 7470
7330  XPT1=(6+CFE*LOG(PF(I))-MINF)*FFACT
7340  XPT2=(6+CFE*LOG(PF(I+1))-MINF)*FFACT: IF YRAX=1 THEN 7380
7350  IF PYR(I)<YMINR OR PYR(I)>YMAXR THEN 7470
7360  YRPT1=(PYR(I)-YMINR)*YFACTR: YRPT2=(PYR(I+1)-YMINR)*YFACTR
7370  GOTO 7440
7380  IF PYR(I)<=0 THEN 7470
7390  IF CFE*LOG(PYR(I))<YMINR OR CFE*LOG(PYR(I))>YMAXR THEN 7470
7400  YRPT1=(CFE*LOG(PYR(I))-YMINR)*YFACTR
7410  IF I=1 THEN 7440
7420  IF PYR(I-1)<=0 THEN 7470
7430  YRPT2=(CFE*LOG(PYR(I-1))-YMINR)*YFACTR
7440  IF NKND=0 THEN ELSE 7460
7450  GOSUB *RESIDUAL.K: PSET (XPT1,YRPT1): GOTO 7470
7460  LINE (XPT1,YRPT1)-(XPT2,YRPT2),CC(NKND)
7470  NEXT I
7480  IF NKND=0 THEN ELSE 7570
7490  IF RC=2 OR RC=3 THEN ELSE 7570
7500  LOCATE 25,22: PRINT "RESIDUAL (K):";
7510  RESIDUAL.K=(RSDK/NRSDK)/(RMAXK-RMINK)*(YMAXR-YMINR)
7520  PRINT USING "###.####"; RESIDUAL.K;: PRINT "%"
7530  IF RC=3 THEN ELSE 7570
7540  LOCATE 29,23: PRINT "(E and K):";
7550  RON=(RESIDUAL.E*NRSDE+RESIDUAL.K*NRSDK)/(NRSDE+NRSDK)
7560  PRINT USING "###.####"; RON;: PRINT "%"
7570  RETURN
7580 *RESIDUAL.E: IF RC=0 OR RC=2 THEN GOTO 7660
7590  IF FD(I)<10^(MINF-6) OR FD(I)>10^(MAXF-6) THEN GOTO 7660
7600  GOSUB *CALCF: IF FF=0 THEN GOTO 7660
7610  IF YLAX=1 THEN 7630
7620  YLPT3=(FFE-YMINL)*YFACTL: GOTO 7640
7630  YLPT3=(CFE*LOG(FFE)-YMINL)*YFACTL
7640  LINE (XPT1,YLPT1)-(XPT1,YLPT3),5: RSDE=RSDE+(ABS(YLPT3-YLPT1))
7650  NRSDE=NRSDE+1
7660  RETURN
7670 *RESIDUAL.K: IF RC=0 OR RC=1 THEN GOTO 7750
7680  IF FD(I)<10^(MINF-6) OR FD(I)>10^(MAXF-6) THEN GOTO 7750
7690  GOSUB *CALCF: IF FF=0 THEN GOTO 7750
7700  IF YRAX=1 THEN 7720
7710  YRPT3=(FFK-YMINR)*YFACTR: GOTO 7730
7720  YRPT3=(CFE*LOG(FFK)-YMINR)*YFACTR
7730  LINE (XPT1,YRPT1)-(XPT1,YRPT3),3: RSDK=RSDK+(ABS(YRPT3-YRPT1))
7740  NRSDK=NRSDK+1
7750  RETURN
7760 *CALCF: FF=0: FOR IH=1 TO TNFP
7770  IF F(IH)<=FD(I) AND FD(I)<F(IH+1) THEN ELSE 7810
7780  FFR=(LOG(FD(I))-LOG(F(IH)))/(LOG(F(IH+1))-LOG(F(IH)))
7790  FFE=E(IH)+FFR*(E(IH+1)-E(IH)): FFK=K(IH)+FFR*(K(IH+1)-K(IH))
7800  FF=1
7810  NEXT IH: RETURN
7820 *PLDATATF: FOR I=1 TO NFP-1
7830  IF 6+LOG(PF(I))*CFE<MINF OR 6+LOG(PF(I))*CFE>MAXF THEN 7910
7840  XPT1=(6+CFE*LOG(PF(I))-MINF)*FFACT
7850  XPT2=(6+CFE*LOG(PF(I+1))-MINF)*FFACT
7860  IF PYL(I)<YMIN OR PYL(I)>YMAX THEN 7910
7870  YLPT1=(PYL(I)-YMIN)*YFACTT: YLPT2=(PYL(I+1)-YMIN)*YFACTT
7880  IF NKND=0 THEN ELSE 7900
7890  CIRCLE (XPT1,YLPT1),.2: PSET (XPT1,YLPT1): GOTO 7910
7900  LINE (XPT1,YLPT1)-(XPT2,YLPT2),CC(NKND)
7910  NEXT I: RETURN
7920 *PLDATACC: MRKI=1: ISTART=0: XQ2=0: YQ2=0: FOR I=1 TO NFP-1
7930  IF 6+LOG(PF(I))*CFE<MINF OR 6+LOG(PF(I))*CFE>MAXF THEN 8100
7940  IEND=I+1: IF ISTART=0 THEN ISTART=I
7950  XPT1=(PYL(I)-RMIN)*RFACT: XPT2=(PYL(I+1)-RMIN)*RFACT
7960  YPT1=(PYR(I)-IMIN)*IFACT: YPT2=(PYR(I+1)-IMIN)*IFACT
7970  IF PYL(I)<RMIN OR PYL(I)>RMAX THEN 8020
7980  IF NKND=0 THEN ELSE 8010
7990  IF ABS(XPT1)>1000 OR ABS(YPT1)>1000 THEN GOTO 8020
8000  PSET (XPT1,YPT1): CIRCLE (XPT1,YPT1),.2: GOTO 8020
8010  LINE (XPT1,YPT1)-(XPT2,YPT2),CC(NKND)
8020  IF I=NFP-1 THEN ELSE 8040
8030  XP(NFP)=XPT2: YP(NFP)=YPT2
8040  XP(I)=XPT1: YP(I)=YPT1: IF XLR=0 THEN ELSE 8060
8050  IF YQ2>YP(I) THEN YQ2=YP(I): XQ2=XP(I): IQ2=I
8060  XQ2=XP(IQ2): YQ2=YP(IQ2)
8070  IF MRKI=MPDT THEN LINE (XPT2,YPT2+1.5)-(XPT2,YPT2-1.5)
8080  IF MRKI=MPDT THEN MRKI=0
8090  MRKI=MRKI+1
8100  NEXT I: YQ2=-YQ2: RETURN
8110 *PLDATACC2: IF XLR=0 THEN ELSE 8160
8120  XQ1=XP(ISTART): YQ1=-YP(ISTART): IQ1=ISTART
8130  IF TITLE$="COLE-COLE (K)" THEN GOTO 8150
8140  XQ1=XP(IEND): YQ1=-YP(IEND): IQ1=IEND
8150  IQ3=INT((IQ1+IQ2)/2): XQ3=XP(IQ3): YQ3=-YP(IQ3): GOTO 8190
8160  XQ1=XP(IQD1): YQ1=-YP(IQD1): XQ2=XP(IQD2): YQ2=-YP(IQD2)
8170  XQ3=XP(IQD3): YQ3=-YP(IQD3): IQ1=IQD1: IQ2=IQD2: IQ3=IQD3
8180  IQ1=IQD1: IQ2=IQD2: IQ3=IQD3
8190  RETURN
8200 *PLDATACC3: WINDOW (0,-50)-(100,0): VIEW (99,49)-(499,249)
8210  IF ABS(XQ1X)>1000 OR ABS(YQ1X)>1000 THEN GOTO 8230
8220  CIRCLE (XQ1X,-YQ1X),1,0
8230  IF ABS(XQ2X)>1000 OR ABS(YQ2X)>1000 THEN GOTO 8250
8240  CIRCLE (XQ2X,-YQ2X),1,0
8250  IF ABS(XQ3X)>1000 OR ABS(YQ3X)>1000 THEN GOTO 8270
8260  CIRCLE (XQ3X,-YQ3X),1,0
8270  IF SPT=1 THEN CG=7 ELSE CG=5
8280  IF ABS(XQ1)>1000 OR ABS(YQ1)>1000 THEN GOTO 8300
8290  CIRCLE (XQ1,-YQ1),1,CG
8300  IF SPT=2 THEN CG=7 ELSE CG=5
8310  IF ABS(XQ2)>1000 OR ABS(YQ2)>1000 THEN GOTO 8330
8320  CIRCLE (XQ2,-YQ2),1,CG
8330  IF SPT=3 THEN CG=7 ELSE CG=5
8340  IF ABS(XQ3)>1000 OR ABS(YQ3)>1000 THEN GOTO 8360
8350  CIRCLE (XQ3,-YQ3),1,CG
8360  QQ1=XQ1*XQ1+YQ1*YQ1-XQ2*XQ2-YQ2*YQ2
8370  QQ2=XQ1*XQ1+YQ1*YQ1-XQ3*XQ3-YQ3*YQ3
8380  QQ3=(XQ1-XQ3)*QQ1-(XQ1-XQ2)*QQ2
8390  QQ4=(YQ1-YQ3)*QQ1-(YQ1-YQ2)*QQ2
8400  QQ5=2*((YQ1-YQ2)*(XQ1-XQ3)-(YQ1-YQ3)*(XQ1-XQ2))
8410  QQ6=2*((XQ1-XQ2)*(YQ1-YQ3)-(XQ1-XQ3)*(YQ1-YQ2))
8420  BQ=QQ3/QQ5: AQ=QQ4/QQ6: RQ=SQR(ABS((XQ1-AQ)^2+(YQ1-BQ)^2))
8430  AB=SQR(ABS(RQ^2-(YORG-BQ)^2)): XL=AQ-AB: XR=AQ+AB
8440  ALP=ATN((YORG-BQ)/AB): THET=90-(ALP/3.14159)*180: BETA=THET/90
8450  WINDOW (0,-50)-(125,12.5): VIEW (99,49)-(599,299)
8460  LINE (0,.2)-(100,12.5),0,BF: LINE (0,0)-(100,0)
8470  IF ABS(AQ)>1000 OR ABS(BQ)>1000 THEN GOTO 8500
8480  CIRCLE (AQ,-BQ),1,13,,,,F: CIRCLE (AQ,-BQ),.7,0,,,,F
8490  PSET (AQ,-BQ)
8500  IF SPT=1 THEN CG=7 ELSE CG=5
8510  CIRCLE (105,-48),1,CG: PSET (105,-48),7
8520  IF SPT=3 THEN CG=7 ELSE CG=5
8530  CIRCLE (105,-44),1,CG: PSET (105,-44),7
8540  IF SPT=2 THEN CG=7 ELSE CG=5
8550  CIRCLE (105,-40),1,CG: PSET (105,-40),7: LOCATE 66,2
8560  PRINT "No.  log f/Hz": LOCATE 66,3: PRINT USING "###";IQ1
8570  LOCATE 71,3: PRINT USING "###.###";LOG(FD(IQ1))/LOG(10)+6
8580  LOCATE 66,4: PRINT USING "###";IQ3: LOCATE 71,4
8590  PRINT USING "###.###";LOG(FD(IQ3))/LOG(10)+6: LOCATE 66,5
8600  PRINT USING "###";IQ2: LOCATE 71,5
8610  PRINT USING "###.###";LOG(FD(IQ2))/LOG(10)+6: LOCATE 65,8
8620  PRINT "BETA: ";: PRINT USING "####.####";BETA
8630  IF TITLE$="COLE-COLE (K)" THEN ELSE 8670
8640  KL=XL/RFACT+RMIN: KH=XR/RFACT+RMIN: LOCATE 64,9: PRINT "Kl:";
8650  PRINT USING "#####.####";KL: LOCATE 64,10: PRINT "Kh:";
8660  PRINT USING "#####.####";KH: GOTO 8700
8670  EH=XL/RFACT+RMIN: EL=XR/RFACT+RMIN
8680  LOCATE 64,9: PRINT "El:";: PRINT USING "######.###";EL
8690  LOCATE 64,10: PRINT "Eh:";: PRINT USING "######.###";EH
8700  WINDOW (0,-50)-(100,0): VIEW (99,49)-(499,249): IQD1=IQ1
8710  IQD2=IQ2: IQD3=IQ3: ISTARTD=ISTART: IENDD=IEND: RETURN
8720 *GETDATA.TEMP: IF NPT=1 THEN GOTO 8800
8730  FOR I=1 TO NPT-1
8740  OPEN "IAZTEMP"+RIGHT$(STR$(I),1)+".DAT" FOR INPUT AS #1
8760  INPUT #1,QMINT(I),QMAXT(I),PDT(I)
8770  TNFPT(I)=(QMAXT(I)-QMINT(I))*PDT(I)+1: FOR IL=1 TO TNFPT(I)+2
8780  INPUT #1, FT(I,IL): INPUT #1, ET(I,IL): INPUT #1, KT(I,IL)
8790  NEXT IL: CLOSE #1: NEXT I
8800  RETURN
8810 *SAVEDATA.TEMP: FOR I=1 TO NPT-1
8820  OPEN "IAZTEMP"+RIGHT$(STR$(I+1),1)+".DAT" FOR OUTPUT AS #1
8840  PRINT #1,QMINT(I);QMAXT(I);PDT(I)
8850  FOR IL=1 TO TNFPT(I)+2: PRINT #1, FT(I,IL);: PRINT #1, ET(I,IL);
8860  PRINT #1, KT(I,IL): NEXT IL: CLOSE #1: NEXT I: RETURN
8870 *SAVEDATA.TEMP0: OPEN "IAZTEMP1.DAT" FOR OUTPUT AS #1
8880  PRINT #1,QMINT;QMAXT;PDT: TNFP=(QMAXT-QMINT)*PDT+1
8890  FOR IL=1 TO TNFP+2: PRINT #1, F(IL);: PRINT #1, E(IL);
8900  PRINT #1, K(IL): NEXT IL: CLOSE #1: RETURN
8910 *GETDATA.LATEST: OPEN "IAZTEMP0.DAT" FOR INPUT AS #1
8920  *GETDATA2: INPUT #1,QMINT,QMAXT,PDT: TNFP=(QMAXT-QMINT)*PDT+1
8930  IF QMINT=0 AND QMAXT=1 THEN TNFP=PDT
8940  FOR IL=1 TO TNFP: INPUT #1, F(IL): INPUT #1, E(IL)
8950  INPUT #1, K(IL): NEXT IL: IF EOF(1) THEN ELSE 8990
8960  F(TNFP+1)=F(1): E(TNFP+1)=E(1): K(TNFP+1)=K(1)
8970  F(TNFP+2)=F(TNFP): E(TNFP+2)=E(TNFP): K(TNFP+2)=K(TNFP)
8980  GOTO 9070
8990  INPUT #1, F(TNFP+1): INPUT #1, E(TNFP+1): INPUT #1, K(TNFP+1)
9000  INPUT #1, F(TNFP+2): INPUT #1, E(TNFP+2): INPUT #1, K(TNFP+2)
9010  IF EOF(1) THEN 9070
9020  FOR M=1 TO 23: IF EOF(1) THEN 9070
9030  INPUT #1, DTP(1,M): NEXT M: IF EOF(1) THEN 9070
9040  INPUT #1,HMF: IF HMF>10 THEN HMF=10
9050  FOR M=1 TO HMF: IF EOF(1) THEN 9070
9060  INPUT #1, SN$(M): NEXT M
9070  CLOSE #1: NPD=0: RETURN
9080 *GETD: CONSOLE 1,20: CLS 3: FILES "*.FEK"
9090  INPUT "SELECT FILENAME ",AF$
9100  OPEN FA$(2)+"\"+AF$+".FEK" FOR INPUT AS #1
9110  INPUT #1, TNFPD,KL,EH: INPUT #1, FD$,DD$,ZD$,YD$,SD$,CD$
9120  FOR I=1 TO TNFPD: INPUT #1,FD(I),ED(I),KD(I):NEXT I
9130  IF EOF(1) THEN GOTO 9150
9140  INPUT #1, IQK1,IQK2,IQK3,IQE1,IQE2,IQE3
9150  CLOSE #1: NPD=1
9160  IF IQK1=0 THEN ELSE GOTO 9180
9170  IQK2=0:IQK3=0:IQE1=0:IQE2=0:IQE3=0
9180  RETURN *PLOT
```