CONTIGUOUS BAND MULTIPLEXER

SIMULATION AND OPTIMIZATION

OSA-84-MX-10-T

March 2, 1984

This is a printout of MXSOS2 organized to produce a simulation of responses, including group delay and gain slope. The multiplexer considered is the one reported in OSA-84-MX-9-T and the responses are consistent with the optimum.

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      PROGRAM MXSOS2(OUTPUT,TAPE6=OUTPUT)                                    000001
C                                                                            000002
C     THIS PROGRAM IS A USER DEFINED MAIN SEGMENT OF THE MXSOS2 PACKAGE      000003
C     FOR MULTIPLEXER SIMULATION, SENSITIVITY ANALYSIS AND OPTIMIZATION.     000004
C     THE PROGRAM SETS UP ARRAYS, INITIALIZES THE DATA AND EXECUTES SOME     000005
C     SIMPLE STEPS TO ORGANIZE THE PROBLEM AS REQUIRED BY THE PACKAGE.       000006
C     IT CONSISTS OF THREE PARTS. THE FIRST PART INITIALIZES THE DATA        000007
C     REQUIRED FOR SIMULATION, THE SECOND PART INITIALIZES ADDITIONAL        000008
C     DATA REQUIRED FOR SENSITIVITY ANALYSIS AND THE THIRD PART INITIA-      000009
C     LIZES THE DATA REQUIRED FOR THE MULTIPLEXER OPTIMIZATION PROBLEM       000010
C     OF INTEREST INCLUDING SPECIFICATIONS AND WEIGHTING FACTORS AS WELL     000011
C     AS THE DATA REQUIRED BY THE MINIMAX OPTIMIZATION PACKAGE MMLC. AT      000012
C     THIS TIME ONLY COMMON PORT RETURN LOSS AND CHANNEL INSERTION LOSS      000013
C     IN DB ARE HANDLED FOR OPTIMIZATION. IN THE CASE OF SIMULATION          000014
C     GROUP DELAY IS ESTIMATED BY DIFFERENCING THE PHASE AT A PAIR           000015
C     OF FREQUENCIES. GAIN SLOPE IS ESTIMATED BY DIFFERENCING INSERTION      000016
C     LOSS AT A PAIR OF FREQUENCIES.                                         000017
C                                                                            000018
C     THE USER MUST PROVIDE APPROPRIATE DIMENSIONS FOR THE FOLLOWING         000019
C     VARIABLES AFTER STUDYING THE COMMENTS PLACED THROUGHOUT THE MAIN        000020
C     SEGMENT MXSOS2. CORRESPONDING DIMENSIONS MUST BE DECLARED IN ALL       000021
C     SUBROUTINES EXCEPT FOR THE MMLC PACKAGE.                               000022
C                                                                            000023
      REAL X(45),W(20000),B(1),C(1,1),T(3),DISP(16),QO(16)                   000024
      REAL OMEGA(47),SURL(47),SLRL(47),WURL(47),WLRL(47),                    000025
     1     SU(20,16),SL(20,16),WU(20,16),WL(20,16)                           000026
      INTEGER RLSCODE(47),SPCODE(20,16),CHBCODE(16,2)                        000027
      REAL WO(16),BW(16),CM(16,8,8),PN1(16),PN2(16),SPN1(16),SPN2(16),       000028
     1          GL(16),WGL(16),DIA(16)                                       000029
      INTEGER CEL(16,8,8)                                                    000030
      REAL FCNST(16),LAMRES(16),LAMDEL(16)                                   000031
      REAL DRL(100),FIL(16),DIL(16,100)                                      000032
      REAL ANGLE1(16),ANGLE2(16),GRDEL(16),GSLOPE(16),TFIL(16)               000033
      INTEGER IR(16),IRT(16),IPN1(16),IPN2(16),IWG(16)                       000034
      INTEGER LC(16,36),KC(16,36)                                            000035
      EXTERNAL FDF2                                                          000036
      COMMON /BLK1/WO,BW,PN1,PN2,GL,VS,RS,PI2,WIDTH,NP1                      000037
      COMMON /BLK2/CM,WGL                                                    000038
      COMMON /BLK3/OMEGA,SURL,SLRL,WURL,WLRL,SU,SL,WU,WL,                    000039
     1            RLSCODE,SPCODE,NCOUNT,MODE,NCH,MO,NFREQ,NFRL,              000040
     2       CHBCODE,IFLAGJS,IFLAGDP,IDISPER                                 000041
      COMMON /BLK4/CBR,FCUT                                                  000042
      COMMON /BLK5/DISP                                                      000043
      COMMON/BLK6/FCNST,LAMRES,LAMDEL                                        000044
      COMMON/BLK7/CEL                                                        000045
      COMMON/BLK8/IR,IRT,IPN1,IPN2,IWG,LC,KC                                 000046
      DATA T/10HMULTIPLEXE,10HR PROBLEM ,10HMXTST6C    /                     000047
C                                                                            000048
C     THE MXSOS2 PACKAGE CAN OPERATE IN THREE MODES: SIMULATION, SENSITI     000049
C     VITY ANALYSIS AND OPTIMIZATION. TO SELECT THE REQUIRED FUNCTION OF     000050
C     THE PACKAGE SET LMODE TO                                               000051
C     1 - IF MULTIPLEXER SIMULATION IS REQUIRED,                             000052
C     2 - IF MULTIPLEXER SENSITIVITY ANALYSIS IS REQUIRED,                   000053
C     3 - IF MULTIPLEXER OPTIMIZATION IS REQUIRED.                           000054
C                                                                            000055
C     SELECT MODE OF OPERATION OF THE PACKAGE                                000056
C                                                                            000057
      LMODE=1                                                                000058
C                                                                            000059
C     THIS PART OF THE MAIN SEGMENT IS USED TO DEFINE THE DATA FOR           000060
C     MULTIPLEXER SIMULATION. IT MUST ALWAYS BE DEFINED, REGARDLESS OF       000061
C     THE MODE OF OPERATION OF THE PACKAGE SELECTED.                         000062
C                                                                            000063
C     NCH     - NUMBER OF FILTER CHANNELS INCLUDING DUMMY CHANNELS           000064
C     MO      - ORDER OF FILTERS(THE SAME FOR ALL FILTERS, ODD OR EVEN)      000065
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C      WO      - VECTOR OF CENTER FREQUENCIES IN MHZ, ONE PER CHANNEL        000066
C      QO      - VECTOR OF UNLOADED Q FOR THE FILTERS, ONE PER CHANNEL       000067
C      DIA     - VECTOR OF FILTER DIAMETERS IN INCHES, ONE PER CHANNEL       000068
C      BW      - VECTOR OF CHANNEL BANDWIDTHS IN MHZ, ONE PER CHANNEL        000069
C      SPN1    - VECTOR OF INPUT TRANSFORMER RATIOS(SQUARED), ONE PER        000070
C                CHANNEL                                                     000071
C      SPN2    - VECTOR OF OUTPUT TRANSFORMER RATIOS(SQUARED), ONE PER       000072
C                CHANNEL                                                     000073
C      GL      - VECTOR OF CHANNEL TERMINATING CONDUCTANCES, ONE PER         000074
C                CHANNEL                                                     000075
C      CM      - SYMMETRICAL MATRIX OF COUPLING PARAMETERS(CHANNEL,ROW,      000076
C                COLUMN), INCLUDING NONZERO DIAGONAL ELEMENTS TO MODEL       000077
C                ASYNCHRONOUS DESIGNS                                        000078
C      CEL     - SYMMETRICAL MATRIX FOR TYPE OF COUPLING, +1 FOR SCREW,      000079
C                -1 FOR IRIS, CORRESPONDING TO CM AS ABOVE                   000080
C      WGL     - VECTOR OF WAVEGUIDE SPACINGS FOR EACH CHANNEL, MEASURED     000081
C                IN INCHES ALONG THE MANIFOLD FROM THE ADJACENT CHANNEL      000082
C                (DISTANCE FROM THE SHORT CIRCUIT FOR THE FIRST CHANNEL)     000083
C      VS      - SOURCE VOLTAGE AT THE COMMON PORT                           000084
C      RS      - SOURCE RESISTANCE AT THE COMMON PORT                        000085
C      PI2     - CONSTANT EQUAL TO TWICE PI                                  000086
C      WIDTH   - MANIFOLD WIDTH IN INCHES                                    000087
C                                                                            000088
C      DEFINE THE NUMBER OF CHANNELS AND THE ORDER OF THE FILTERS            000089
C                                                                            000090
       NCH=3                                                                 000091
       MO=6                                                                  000092
       NP1=NCH+1                                                             000093
C                                                                            000094
C      DEFINE CENTER FREQUENCIES IN MHZ                                      000095
C                                                                            000096
       WO(1)=12060.0                                                         000097
       WO(2)=12020.0                                                         000098
       WO(3)=11980.0                                                         000099
C                                                                            000100
C      DEFINE UNLOADED Q FACTORS OF THE FILTERS                              000101
C                                                                            000102
       DO 5 I=1,NCH                                                          000103
       QO(I)=12000.0                                                         000104
     5 CONTINUE                                                              000105
C                                                                            000106
C      DEFINE THE DIAMETER OF THE FILTERS IN INCHES                          000107
C                                                                            000108
       DO 70 I=1,NCH                                                         000109
       DIA(I)=1.07                                                           000110
    70 CONTINUE                                                              000111
C                                                                            000112
C      DEFINE BANDWIDTHS, INPUT/OUTPUT TRANSFORMER RATIOS AND OUTPUT         000113
C      CONDUCTANCES                                                          000114
C                                                                            000115
       DO 1 I=1,NCH                                                          000116
       BW(I)=39.5                                                            000117
       GL(I)=1.0                                                             000118
       SPN1(I)=0.69967                                                       000119
       SPN2(I)=1.09450                                                       000120
       PN1(I)=SQRT(SPN1(I))                                                  000121
       PN2(I)=SQRT(SPN2(I))                                                  000122
     1 CONTINUE                                                              000123
C                                                                            000124
C      FOR THE OPTIMUM VALUES TO BE USED IN A SIMULATION:                    000125
C                                                                            000126
       PN1(1)=1.099062965387                                                 000127
       PN2(1)=1.082354644330                                                 000128
       PN1(2)=0.9161514328102                                                000129
       PN2(2)=1.111196296523                                                 000130
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      PN1(3)=0.8768413389939                                                    000131
      PN2(3)=1.101422627599                                                     000132
C                                                                               000133
C     DEFINE THE SYMMETRICAL COUPLING MATRIX. ONLY THE UPPER PART OF THE        000134
C     CM MATRIX HAS TO BE DEFINED.                                              000135
C                                                                               000136
      DO 30 I=1,NCH                                                             000137
      DO 30 J=1,MO                                                              000138
      DO 30 KK=1,MO                                                             000139
      CM(I,J,KK)=0.0                                                            000140
   30 CONTINUE                                                                  000141
      DO 2 I=1,NCH                                                              000142
      CM(I,1,2)=0.59395                                                         000143
      CM(I,2,3)=0.53514                                                         000144
      CM(I,3,4)=0.42471                                                         000145
      CM(I,3,6)=-0.39967                                                        000146
      CM(I,4,5)=0.83371                                                         000147
      CM(I,5,6)=0.76313                                                         000148
    2 CONTINUE                                                                  000149
C                                                                               000150
C     FOR THE OPTIMUM VALUES TO BE USED IN A SIMULATION:                        000151
C                                                                               000152
      CM(1,1,1)=-6.044027292422E-02                                             000153
      CM(1,1,2)=7.325746553578E-01                                              000154
      CM(1,2,2)=-6.939183412333E-02                                             000155
      CM(1,2,3)=5.598321723712E-01                                              000156
      CM(1,3,3)=1.283843451561E-02                                              000157
      CM(1,3,4)=4.124508825067E-01                                              000158
      CM(1,3,6)=-4.717569036358E-01                                             000159
      CM(1,4,4)=4.182049301334E-02                                              000160
      CM(1,4,5)=8.863784882748E-01                                              000161
      CM(1,5,5)=5.792510733123E-02                                              000162
      CM(1,5,6)=7.824970565547E-01                                              000163
      CM(1,6,6)=1.346337934973E-02                                              000164
      CM(2,1,1)=1.244478609904E-01                                              000165
      CM(2,1,2)=6.360872160508E-01                                              000166
      CM(2,2,2)=2.427646151828E-03                                              000167
      CM(2,2,3)=5.573920279614E-01                                              000168
      CM(2,3,3)=-4.178151147506E-03                                             000169
      CM(2,3,4)=3.962409124580E-01                                              000170
      CM(2,3,6)=-5.640839269006E-01                                             000171
      CM(2,4,4)=-8.155794850229E-03                                             000172
      CM(2,4,5)=9.544758710356E-01                                              000173
      CM(2,5,5)=2.981639393973E-02                                              000174
      CM(2,5,6)=7.639824046422E-01                                              000175
      CM(2,6,6)=-3.907219043917E-03                                             000176
      CM(3,1,1)=1.944047789431E-01                                              000177
      CM(3,1,2)=6.707241120483E-01                                              000178
      CM(3,2,2)=4.771501445755E-02                                              000179
      CM(3,2,3)=5.597795068260E-01                                              000180
      CM(3,3,3)=-3.131345747253E-02                                             000181
      CM(3,3,4)=3.990367533710E-01                                              000182
      CM(3,3,6)=-5.117829489607E-01                                             000183
      CM(3,4,4)=-6.068193434428E-02                                             000184
      CM(3,4,5)=8.945300524320E-01                                              000185
      CM(3,5,5)=-3.206380870620E-02                                             000186
      CM(3,5,6)=7.650458312043E-01                                              000187
      CM(3,6,6)=-2.231361222110E-02                                             000188
C                                                                               000189
C     DEFINE THE TYPE OF COUPLING IN THE FILTER                                 000190
C             +1 >> SCREW COUPLING    -1 >> IRIS COUPLING                       000191
C                                                                               000192
      DO 71 I=1,NCH                                                             000193
      DO 71 J=1,MO                                                              000194
      DO 71 KK=1,MO                                                             000195
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      CEL(I,J,KK)=0                                                    000196
   71 CONTINUE                                                         000197
C                                                                      000198
      DO 72 I=1,NCH                                                    000199
      CEL(I,1,2)=1                                                     000200
      CEL(I,2,3)=-1                                                    000201
      CEL(I,3,4)=1                                                     000202
      CEL(I,3,6)=-1                                                    000203
      CEL(I,4,5)=-1                                                    000204
      CEL(I,5,6)=1                                                     000205
C                                                                      000206
      DO 72 J=1,MO                                                     000207
      DO 72 KK=1,J                                                     000208
      CEL(I,J,KK)=CEL(I,KK,J)                                          000209
   72 CONTINUE                                                         000210
C                                                                      000211
C     DEFINE THE SECTION LENGTHS (SPACINGS ALONG THE WAVEGUIDE MANIFOLD) 000212
C                                                                      000213
      WGL(1)=6.736038935441E-01                                        000214
      WGL(2)=5.954929663106E-01                                        000215
      WGL(3)=5.914808559808E-01                                        000216
C                                                                      000217
C     DEFINE SOME CONSTANTS, SOURCE VOLTAGE, SOURCE RESISTANCE, TWICE PI 000218
C     MANIFOLD WIDTH                                                   000219
C                                                                      000220
      VS=1.0                                                           000221
      RS=1.0                                                           000222
      PI2=8.0*ATAN(1.0)                                                000223
      WIDTH=0.75                                                       000224
C                                                                      000225
C     THE MXSOS2 PACKAGE CAN EXPLOIT THREE PRACTICAL MODELS OF THE     000226
C     MULTIPLEXER AS DETERMINED BY THE PARAMETERS IFLAGJS, IFLAGDP     000227
C     AND IDISPER.                                                     000228
C                                                                      000229
C     IFLAGJS                                                          000230
C     0 - IF JUNCTIONS ARE IDEAL                                       000231
C     1 - IF JUNCTIONS ARE NONIDEAL                                    000232
C                                                                      000233
C     IFLAGDP                                                          000234
C     0 - IF FILTERS ARE LOSSLESS                                      000235
C     1 - IF FILTERS ARE LOSSY                                         000236
C                                                                      000237
C     IDISPER                                                          000238
C     0 - IF FILTERS ARE DISPERSIVE                                    000239
C     1 - IF FILTERS ARE NONDISPERSIVE                                 000240
C                                                                      000241
C     FLAG FOR JUNCTION SUSCEPTANCE (SET TO 0 OR 1)                    000242
C                                                                      000243
      IFLAGJS=1                                                        000244
      IF(IFLAGJS.NE.1)GO TO 42                                         000245
C                                                                      000246
      CALL CONST1(WIDTH)                                               000247
C                                                                      000248
   42 CONTINUE                                                         000249
C                                                                      000250
C     FLAG FOR FILTER DISSIPATION (SET TO 0 OR 1)                      000251
C                                                                      000252
      IFLAGDP=1                                                        000253
      IF(IFLAGDP.NE.1)GO TO 43                                         000254
C                                                                      000255
      CALL DISPAT(NCH,WO,BW,QO)                                        000256
C                                                                      000257
   43 CONTINUE                                                         000258
C                                                                      000259
C     FLAG FOR DISPERSIVE EFFECTS IN THE COUPLED CAVITY FILTERS        000260
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C      (SET TO 0 OR 1)                                                  000261
C                                                                       000262
       IDISPER=1                                                        000263
       IF(IDISPER.NE.1)GO TO 44                                         000264
C                                                                       000265
       CALL DISPER(NCH,WO,BW,DIA)                                       000266
C                                                                       000267
    44 CONTINUE                                                         000268
C                                                                       000269
C      CHECK WHETHER THE SIMULATION MODE IS REQUIRED                    000270
C                                                                       000271
       IF(LMODE.NE.1)GO TO 16                                           000272
C                                                                       000273
C      SIMULATION, CORRESPONDING TO LMODE=1                             000274
C                                                                       000275
C      THIS PART OF THE MAIN SEGMENT IS USED TO GENERATE FREQUENCIES AT  000276
C      WHICH SIMULATION IS TO BE PERFORMED. A FREQUENCY STEP OF 1 MHZ IS 000277
C      ASSUMED. NONE OF THE GENERATED FREQUENCIES MUST BE SET EQUAL TO   000278
C      ANY OF THE CENTER FREQUENCIES. SUBROUTINE "SIMUL" IS CALLED AT    000279
C      EACH GENERATED FREQUENCY. IF A DIFFERENT FREQUENCY STEP IS REQUI- 000280
C      RED THE FREQUENCY POINTS FOR SIMULATION HAVE TO BE GENERATED IN A 000281
C      DIFFERENT WAY.                                                   000282
C                                                                       000283
C      FREQST - START FREQUENCY FOR SIMULATION                          000284
C      FREQ   - ACTUAL FREQUENCY AT WHICH "SIMUL" IS CALLED             000285
C      NFRSIM - NUMBER OF FREQUENCY POINTS FOR SIMULATION               000286
C                                                                       000287
       PRINT(6,199)                                                     000288
   199 FORMAT(1H1)                                                      000289
       PRINT(6,205)                                                     000290
   205 FORMAT(6X,"FREQUENCY",5X,"RETURN LOSS",5X,"INSERTION LOSS",      000291
      1         8X,"FREQUENCY FOR",7X,"GROUP DELAY",7X,"GAIN SLOPE")    000292
       PRINT(6,206)                                                     000293
   206 FORMAT(8X,"MHZ",9X,"COMMON PORT",9X,"DB",16X,"DELAY & SLOPE",    000294
      1        8X,"NANO SECS",10X,"DB/MHZ")                             000295
C                                                                       000296
C                                                                       000297
C      THE FOLLOWING TWO PARAMETERS MUST BE DEFINED                     000298
C                                                                       000299
       FREQST=11959.0                                                   000300
       NFRSIM=120                                                       000301
C                                                                       000302
       NCHAN=NCH                                                        000303
       MORDER=MO                                                        000304
       IREL=NCH+1                                                       000305
       DO 200 ICOUNT=1,NFRSIM                                           000306
       FREQ=FREQST+FLOAT(ICOUNT)                                        000307
       ITEST=INT(FREQ)                                                  000308
C                                                                       000309
C      THE FOLLOWING STATEMENT PRINTS A DASHED LINE EVERY 20 MHZ        000310
C                                                                       000311
       IF(MOD(ITEST,20).EQ.0)PRINT(6,208)                               000312
   208 FORMAT(110("-"))                                                 000313
       DO 210 I=1,NCH                                                   000314
       IF(ABS(FREQ-WO(I)).LT.1.E-10)FREQ=FREQ+0.001                     000315
   210 CONTINUE                                                         000316
C                                                                       000317
C      GROUP DELAY IS ESTIMATED FROM THE PHASE DIFFERENCE AT TWO        000318
C      FREQUENCIES, NAMELY, THE SELECTED FREQUENCY AND THE SELECTED     000319
C      FREQUENCY MINUS 0.5 MHZ. CONSEQUENTLY, THE EVALUATION IS A       000320
C      TRUE QUADRATIC APPROXIMATION AT THE SELECTED FREQUENCY MINUS     000321
C      0.25 MHZ. THUS, A SEPARATE COLUMN OF FREQUENCIES AND GROUP       000322
C      DELAYS IS GENERATED AND PRINTED OUT.                             000323
C                                                                       000324
C      GAIN SLOPE IS ESTIMATED FROM THE DIFFERENCE IN INSERTION LOSS    000325
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C      AT TWO FREQUENCIES; THE SELECTED FREQUENCY AND THE SELECTED          000326
C      FREQUENCY MINUS 0.5 MHZ. SIMILAR TO GROUP DELAY, IT IS A TRUE        000327
C      QUADRATIC APPROXIMATION AT THE SELECTED FREQUENCY MINUS              000328
C      0.25 MHZ.                                                            000329
C                                                                           000330
C      SUBTRACT 0.5 MHZ FROM FREQ                                           000331
C                                                                           000332
       FREQ=FREQ-0.5                                                        000333
C                                                                           000334
       CALL SIMUL(FREQ,NCHAN,MORDER,ICOUNT,IFLAGJS,IFLAGDP,IDISPER,         000335
      1           FRL,FIL,ANGLE1)                                           000336
C                                                                           000337
       DO 290 I=1,NCH                                                       000338
       TFIL(I)=FIL(I)                                                       000339
  290  CONTINUE                                                             000340
C                                                                           000341
C      RESET FREQ BY ADDING 0.5 MHZ                                         000342
C                                                                           000343
       FREQ=FREQ+0.5                                                        000344
C                                                                           000345
       CALL SIMUL(FREQ,NCHAN,MORDER,ICOUNT,IFLAGJS,IFLAGDP,IDISPER,         000346
      1           FRL,FIL,ANGLE2)                                           000347
C                                                                           000348
       DO 300 I=1,NCH                                                       000349
       DELANG=ANGLE2(I)-ANGLE1(I)                                           000350
       PI=PI2/2.0                                                           000351
       IF(DELANG.GT.PI)DELANG=DELANG-PI2                                    000352
       GRDEL(I)=-2000.0*DELANG/PI2                                          000353
       GSLOPE(I)=-2.0*(FIL(I)-TFIL(I))                                      000354
  300  CONTINUE                                                             000355
C                                                                           000356
C      THE FOLLOWING STATEMENT CAUSES THE PRINTING OF INSERTION LOSS        000357
C      FUNCTION VALUES, GROUP DELAY AND GAIN SLOPE ONLY FOR THE BAND OF     000358
C      INTEREST.                                                            000359
C                                                                           000360
       IF(MOD(ITEST,40).EQ.0)IREL=IREL-1                                    000361
C                                                                           000362
C      GROUP DELAY AND GAIN SLOPE ARE ESTIMATED AT FREQ MINUS 0.25 MHZ      000363
C                                                                           000364
       FRGROUP=FREQ-0.25                                                    000365
       PRINT(6,207)FREQ,FRL,FIL(IREL),FRGROUP,GRDEL(IREL),GSLOPE(IREL)      000366
  207  FORMAT(6X,F7.1,9X,F5.2,12X,F5.2,17X,F8.2,10X,F8.2,10X,F7.3)          000367
  200  CONTINUE                                                             000368
       GO TO 900                                                            000369
C                                                                           000370
C      SENSITIVITY ANALYSIS, CORRESPONDING TO LMODE=2                       000371
C                                                                           000372
C      THIS PART OF THE MAIN PROGRAM IS USED TO DEFINE CODES FOR MULTI-     000373
C      PLEXER PARAMETERS W.R.T. WHICH WE WANT TO FIND THE SENSITIVITIES.    000374
C      THE PARAMETER IR(I)=0 SIGNIFIES THAT NO ELEMENTS OF THE FILTER       000375
C      COUPLING MATRICES ARE OPTIMIZATION VARIABLES. SUBROUTINE             000376
C      "SIMGRD2" IS CALLED AT EACH FREQUENCY DEFINED IN THE VECTOR          000377
C      OMEGA(I).                                                            000378
C                                                                           000379
C      IR      - VECTOR CONTAINING THE NUMBER OF COUPLING PARAMETERS BE-    000380
C                ING VARIABLES FOR EACH CHANNEL                             000381
C      LC      - MATRIX CONTAINING THE ROW INDICES OF COUPLING PARAMETERS   000382
C                BEING VARIABLES FOR EACH CHANNEL                           000383
C      KC      - MATRIX CONTAINING THE COLUMN INDICES OF COUPLING PARAME-   000384
C                TERS BEING VARIABLES FOR EACH CHANNEL                      000385
C      IPN1    - INTEGER ARRAY OF DIMENSION AT LEAST NCH INDICATING         000386
C                WHETHER THE INPUT TRANSFORMER RATIO IS AN OPTIMIZATION     000387
C                VARIABLE (IPN1(I)=1) OR NOT (IPN1(I)=0).                   000388
C      IPN2    - INTEGER ARRAY OF DIMENSION AT LEAST NCH INDICATING         000389
C                WHETHER THE OUTPUT TRANSFORMER RATIO IS AN OPTIMIZA-       000390
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C                TION VARIABLE (IPN2(I)=1) OR NOT (IPN2(I)=0).                  000391
C       IWG    - INTEGER ARRAY OF DIMENSION AT LEAST NCH INDICATING             000392
C                WHETHER THE WAVEGUIDE SECTION LENGTH IS AN OPTIMIZA-           000393
C                TION VARIABLE (IWG(I)=1) OR NOT (IWG(I)=0).                    000394
C       OMEGA  - VECTOR OF ARBITRARY FREQUENCIES (EXCEPT CENTER FREQUEN-       000395
C                CIES) AT WHICH THE SENSITIVITY ANALYSIS IS TO BE PERFOR-       000396
C                MED.                                                           000397
C       FRSNS  - ACTUAL FREQUENCY AT WHICH THE SUBROUTINE "SIMGRD" IS          000398
C                CALLED                                                         000399
C       NV     - TOTAL NUMBER OF VARIABLES W.R.T. WHICH THE SENSITIVITIES      000400
C                ARE REQUIRED                                                   000401
C       FRL    - VALUE OF THE COMMON PORT RETURN LOSS IN DB AT THE FREQU-      000402
C                ENCY FRSNS                                                     000403
C       DRL    - SENSITIVITIES OF THE COMMON PORT RETURN LOSS W.R.T. ALL       000404
C                VARIABLES                                                      000405
C       FIL    - VECTOR OF THE INSERTION LOSS FUNCTION IN DB FOR EACH          000406
C                CHANNEL AT THE FREQUENCY FRSNS                                 000407
C       DIL    - MATRIX OF SENSITIVITIES OF THE INSERTION LOSS FUNCTION        000408
C                FOR EACH CHANNEL W.R.T. ALL VARIABLES                          000409
C                                                                               000410
C       DEFINE THE NUMBER OF COUPLING VARIABLES PER CHANNEL                     000411
C                                                                               000412
   16   CONTINUE                                                                000413
        IR(1)=12                                                                000414
        IR(2)=12                                                                000415
        IR(3)=12                                                                000416
C                                                                               000417
C       DEFINE CODES TO IDENTIFY VARIABLES FOR INPUT-OUTPUT TRANSFORMER         000418
C       RATIOS AND WAVEGUIDE SPACINGS                                           000419
C                                                                               000420
        DO 55 I=1,NCH                                                           000421
        IWG(I)=1                                                                000422
        IPN1(I)=1                                                               000423
        IPN2(I)=1                                                               000424
   55   CONTINUE                                                                000425
C                                                                               000426
C       EVALUATE THE TOTAL NUMBER OF VARIABLES ACCUMULATED AFTER                000427
C       EACH SECTION                                                            000428
C                                                                               000429
        CALL TOTAL2(NCH,IR,IRT,IPN1,IPN2,IWG)                                   000430
C                                                                               000431
C       DEFINE CODES FOR THE VARIABLES CONTAINED IN THE COUPLING MATRICES       000432
C                                                                               000433
        DO 127 I=1,3                                                            000434
        LC(I,1)=1                                                               000435
        LC(I,2)=1                                                               000436
        LC(I,3)=2                                                               000437
        LC(I,4)=2                                                               000438
        LC(I,5)=3                                                               000439
        LC(I,6)=3                                                               000440
        LC(I,7)=3                                                               000441
        LC(I,8)=4                                                               000442
        LC(I,9)=4                                                               000443
        LC(I,10)=5                                                              000444
        LC(I,11)=5                                                              000445
        LC(I,12)=6                                                              000446
        KC(I,1)=1                                                               000447
        KC(I,2)=2                                                               000448
        KC(I,3)=2                                                               000449
        KC(I,4)=3                                                               000450
        KC(I,5)=3                                                               000451
        KC(I,6)=4                                                               000452
        KC(I,7)=6                                                               000453
        KC(I,8)=4                                                               000454
        KC(I,9)=5                                                               000455
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      KC(I,10)=5                                                        000456
      KC(I,11)=6                                                        000457
      KC(I,12)=6                                                        000458
  127 CONTINUE                                                          000459
C                                                                       000460
C     CHECK WHETHER THE SIMULATION AND SENSITIVITY ANALYSIS MODE        000461
C     IS REQUIRED                                                       000462
C                                                                       000463
      IF(LMODE.NE.2) GO TO 17                                           000464
C                                                                       000465
C     GENERATE FREQUENCY POINTS IN MHZ                                  000466
C                                                                       000467
      NFREQ=1                                                           000468
      OMEGA(1)=12062.0                                                  000469
      NCHAN=NCH                                                         000470
      MORDER=MO                                                         000471
      DO 18 ICOUNT=1,NFREQ                                              000472
      FRSNS=OMEGA(ICOUNT)                                               000473
C                                                                       000474
      CALL SIMGRD2(FRSNS,FRL,DRL,FIL,DIL,NCHAN,MORDER,ICOUNT,IFLAGJS,   000475
     1             IFLAGDP,IDISPER)                                     000476
C                                                                       000477
   18 CONTINUE                                                          000478
      GO TO 900                                                         000479
C                                                                       000480
C     OPTIMIZATION, CORRESPONDING TO LMODE=3                            000481
C                                                                       000482
C     THIS PART OF THE MAIN SEGMENT IS USED TO DEFINE ALL VARIABLES AND 000483
C     ARRAYS FOR MULTIPLEXER OPTIMIZATION. TO SELECT THE MULTIPLEXER PA-000484
C     RAMETERS WHICH ARE THE OPTIMIZATION VARIABLES THE MATRICES LC AND 000485
C     KC HAVE TO BE USED AS DESCRIBED IN THE SENSITIVITY ANALYSIS PART. 000486
C     THREE MODES OF OPTIMIZATION ARE ALLOWED. TO SELECT THE DESIRED    000487
C     MODE OF OPTIMIZATION SET PARAMETER MODE TO                        000488
C     0 - IF ONLY COMMON PORT RETURN LOSS OPTIMIZATION IS REQUIRED      000489
C     1 - IF ONLY INSERTION LOSS OPTIMIZATION IS REQUIRED               000490
C     2 - IF BOTH RETURN LOSS AND INSERTION LOSS OPTIMIZATION ARE       000491
C         REQUIRED.                                                     000492
C     IN EACH CASE A DIFFERENT HEADER FOR THE PRINTOUT OF OPTIMIZATION  000493
C     RESULTS CAN BE OBTAINED BY CALLING THE SUBROUTINE "MMXHDR" FOR    000494
C     WHICH THE ARGUMENT T CAN BE DEFINED USING THE DATA STATEMENT. VA- 000495
C     LUES OF OPTIMIZATION VARIABLES AT THE STARTING POINT MUST BE SUP- 000496
C     PLIED BY DEFINING THE X VECTOR USING EITHER THE DATA STATEMENT OR 000497
C     EXPLICITLY. THE MINIMAX FUNCTIONS ARE CREATED AT THE FREQUENCIES  000498
C     DEFINED IN THE VECTOR OMEGA(I), WHICH IS A REAL ARRAY OF LENGTH   000499
C     AT LEAST NFREQ.                                                   000500
C                                                                       000501
C     NFREQ  - NUMBER OF FREQUENCY POINTS AT WHICH THE MINIMAX FUNCTI-  000502
C              ONS ARE TO BE CREATED                                    000503
C     OMEGA  - VECTOR OF ARBITRARY FREQUENCY POINTS (EXCEPT CENTER FRE- 000504
C              QUENCIES) IN MHZ AT WHICH THE MINIMAX FUNCTIONS ARE TO   000505
C              BE CREATED                                               000506
C     NFRL   - NUMBER OF MINIMAX FUNCTIONS CREATED DUE TO RETURN LOSS   000507
C              SPECIFICATIONS                                           000508
C                                                                       000509
C     ARRAYS AND CODES FOR COMMON PORT RETURN LOSS OPTIMIZATION         000510
C                                                                       000511
C     RLSCODE- INTEGER ARRAY OF LENGTH AT LEAST NFREQ. EACH ELEMENT MUST000512
C              BE SET TO THE FOLLOWING SPECIFICATION CODE VALUE AT EACH 000513
C              FREQUENCY :                                              000514
C              0 - NO SPECIFICATION REQUIRED                            000515
C             -1 - ONLY LOWER SPECIFICATION REQUIRED                    000516
C              1 - ONLY UPPER SPECIFICATION REQUIRED                    000517
C              2 - BOTH UPPER AND LOWER SPECIFICATIONS REQUIRED          000518
C     SURL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE 000519
C              UPPER SPECIFICATIONS APPLICABLE AT EACH FREQUENCY         000520
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C      SLRL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE   000521
C               LOWER SPECIFICATIONS APPLICABLE AT EACH FREQUENCY          000522
C      WURL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE   000523
C               WEIGHTING FACTORS CORRESPONDING TO UPPER SPECIFICATIONS    000524
C      WLRL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE   000525
C               WEIGHTING FACTORS CORRESPONDING TO LOWER SPECIFICATIONS    000526
C                                                                          000527
C      ARRAYS AND CODES FOR INSERTION LOSS OPTIMIZATION                    000528
C                                                                          000529
C      CHBCODE- INTEGER ARRAY OF DIMENSIONS AT LEAST NCH BY 2. EACH ROW    000530
C               MUST CONTAIN THE RANGE OF FREQUENCIES OVER WHICH SPECI-    000531
C               FICATIONS FOR THE CORRESPONDING CHANNEL ARE GIVEN. THE     000532
C               FIRST ELEMENT OF A ROW INDICATES THE LOWER FREQUENCY       000533
C               EDGE OF INTEREST, THE SECOND THE UPPER FREQUENCY EDGE.     000534
C      SPCODE - INTEGER ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH.        000535
C               NSPMAX IS THE MAXIMUM NUMBER OF FREQUENCY POINTS CONSI-    000536
C               DERED FOR ANY OF THE CHANNELS.                             000537
C               EACH COLUMN MUST CONTAIN THE SPECIFICATION CODE AT EACH    000538
C               FREQUENCY FOR THE CORRESPONDING CHANNEL. EACH ELEMENT      000539
C               OF A COLUMN MUST BE SET TO ONE OF THE FOLLOWING VALUES:    000540
C               0 - NO SPECIFICATION REQUIRED                              000541
C              -1 - ONLY LOWER SPECIFICATION REQUIRED                      000542
C               1 - ONLY UPPER SPECIFICATION REQUIRED                      000543
C               2 - BOTH UPPER AND LOWER SPECIFICATIONS REQUIRED           000544
C      SU     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000545
C               MUST CONTAIN THE UPPER SPECIFICATIONS FOR EACH CHANNEL     000546
C               ORDERED CONSECUTIVELY W.R.T. FREQUENCY INDEX IMPLIED       000547
C               BY THE CHBCODE MATRIX IN THE FORM (FREQUENCY INDEX,        000548
C               CHANNEL).                                                  000549
C      SL     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000550
C               MUST CONTAIN THE LOWER SPECIFICATIONS FOR EACH CHANNEL     000551
C               ORDERED CONSECUTIVELY W.R.T. FREQUENCY INDEX IMPLIED       000552
C               BY THE CHBCODE MATRIX IN THE FORM (FREQUENCY INDEX,        000553
C               CHANNEL).                                                  000554
C      WU     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000555
C               MUST CONTAIN THE WEIGHTING FACTORS FOR UPPER SPECIFI-      000556
C               CATIONS. IT IS ARRANGED TO CORRESPOND TO SU.               000557
C      WL     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000558
C               MUST CONTAIN THE WEIGHTING FACTORS FOR LOWER SPECIFI-      000559
C               CATIONS. IT IS ARRANGED TO CORRESPOND TO SL.               000560
C                                                                          000561
C                                                                          000562
   17 CALL MMXHDR(3,T)                                                     000563
C                                                                          000564
C      SELECT THE DESIRED MODE OF OPTIMIZATION                             000565
C                                                                          000566
      MODE=2                                                               000567
C                                                                          000568
C      THE STARTING POINT FOR OPTIMIZATION MUST BE INITIALIZED BY          000569
C      SETTING CONSECUTIVELY NUMBERED X VALUES. IT IS IMPERATIVE THAT      000570
C      THE OPTIMIZATION VARIABLES FOR EACH CHANNEL ARE DEFINED CON-        000571
C      SECUTIVELY AS FOLLOWS: VARIABLE FILTER COUPLINGS COME FIRST,        000572
C      FOLLOWED BY VARIABLE INPUT, THEN OUTPUT, TRANSFORMER RATIOS,        000573
C      THE SECTION LENGTH BEING THE LAST VARIABLE IN THE SET OF OPTI-      000574
C      MIZATION VARIABLES FOR A PARTICULAR CHANNEL.                        000575
C                                                                          000576
      X(1)=CM(1,1,1)                                                       000577
      X(2)=CM(1,1,2)                                                       000578
      X(3)=CM(1,2,2)                                                       000579
      X(4)=CM(1,2,3)                                                       000580
      X(5)=CM(1,3,3)                                                       000581
      X(6)=CM(1,3,4)                                                       000582
      X(7)=CM(1,3,6)                                                       000583
      X(8)=CM(1,4,4)                                                       000584
      X(9)=CM(1,4,5)                                                       000585
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      X(10)=CM(1,5,5)                                                   000586
      X(11)=CM(1,5,6)                                                   000587
      X(12)=CM(1,6,6)                                                   000588
      X(13)=PN1(1)                                                      000589
      X(14)=PN2(1)                                                      000590
      X(15)=WGL(1)                                                      000591
      X(30)=WGL(2)                                                      000592
      X(45)=WGL(3)                                                      000593
      DO 128 I=1,14                                                     000594
      II=I+15                                                           000595
      X(II)=X(I)                                                        000596
      III=I+30                                                          000597
      X(III)=X(I)                                                       000598
  128 CONTINUE                                                          000599
C                                                                       000600
C     GENERATE FREQUENCY POINTS IN MHZ                                  000601
C                                                                       000602
      NFREQ=47                                                          000603
      OMEGA(1)=11962.0                                                  000604
      OMEGA(2)=11964.0                                                  000605
      OMEGA(3)=11966.0                                                  000606
      OMEGA(4)=11968.0                                                  000607
      OMEGA(5)=11970.0                                                  000608
      OMEGA(6)=11972.0                                                  000609
      OMEGA(7)=11976.0                                                  000610
      OMEGA(8)=11980.0001                                               000611
      OMEGA(9)=11984.0                                                  000612
      OMEGA(10)=11988.0                                                 000613
      OMEGA(11)=11990.0                                                 000614
      OMEGA(12)=11992.0                                                 000615
      OMEGA(13)=11994.0                                                 000616
      OMEGA(14)=11996.0                                                 000617
      OMEGA(15)=11998.0                                                 000618
      DO 10 I=16,45                                                     000619
      OMEGA(I)=OMEGA(I-15)+40.0                                         000620
   10 CONTINUE                                                          000621
      OMEGA(46)=12000.0                                                 000622
      OMEGA(47)=12040.0                                                 000623
C                                                                       000624
C     DEFINE THE NUMBER OF MINIMAX FUNCTIONS RESULTING FROM THE         000625
C     SPECIFICATIONS ON RETURN LOSS                                     000626
C                                                                       000627
      NFRL=47                                                           000628
C                                                                       000629
C     DEFINE CODES AND ARRAYS REQUIRED FOR RETURN LOSS OPTIMIZATION     000630
C                                                                       000631
      DO 150 I=1,47                                                     000632
      RLSCODE(I)=-1                                                     000633
      SLRL(I)=20.0                                                      000634
      WLRL(I)=1.0                                                       000635
  150 CONTINUE                                                          000636
C                                                                       000637
C     DEFINE CHANNEL BAND CODE (CHANNEL, FREQUENCY EDGE INDEX), WHERE   000638
C     THE FIRST CHANNEL IS CLOSEST TO THE SHORT CIRCUIT AND CORRESPONDS 000639
C     TO THE HIGHEST CENTER FREQUENCY, AND THE FREQUENCY EDGES ARE 1    000640
C     FOR LOWER EDGE AND 2 FOR UPPER EDGE. THE VALUE OF CHBCODE CORRES- 000641
C     PONDS TO THE FREQUENCY POINT INDEX USED AS ARGUMENT OF OMEGA(I).  000642
C     IF THERE IS NO SPECIFICATION FOR A PARTICULAR CHANNEL, THE VALUE  000643
C     OF CHBCODE MUST BE SET TO 0.                                      000644
C                                                                       000645
      CHBCODE(1,1)=31                                                   000646
      CHBCODE(1,2)=45                                                   000647
      CHBCODE(2,1)=16                                                   000648
      CHBCODE(2,2)=30                                                   000649
      CHBCODE(3,1)=1                                                    000650
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      CHBCODE(3,2)=15                                                    000651
C                                                                        000652
C     DEFINE THE SPECIFICATION CODE FOR INSERTION LOSS OPTIMIZATION      000653
C     (FREQUENCY INDEX, CHANNEL)                                         000654
C                                                                        000655
      DO 20 I=1,15                                                       000656
      DO 20 J=1,3                                                        000657
      SPCODE(I,J)=1                                                      000658
   20 CONTINUE                                                           000659
C                                                                        000660
C     DEFINE VALUES FOR THE SPECIFICATIONS (FREQUENCY INDEX, CHANNEL)    000661
C                                                                        000662
      DO 25 I=1,3                                                        000663
      SU(1,I)=2.79                                                       000664
      SU(2,I)=1.77                                                       000665
      SU(3,I)=1.41                                                       000666
      SU(4,I)=1.24                                                       000667
      DO 33 J=5,11                                                       000668
      SU(J,I)=1.12                                                       000669
   33 CONTINUE                                                           000670
      SU(12,I)=1.24                                                      000671
      SU(13,I)=1.41                                                      000672
      SU(14,I)=1.77                                                      000673
      SU(15,I)=2.79                                                      000674
   25 CONTINUE                                                           000675
C                                                                        000676
C     DEFINE WEIGHTING FACTORS CORRESPONDING TO THE SPECIFICATIONS       000677
C                                                                        000678
      DO 35 I=1,15                                                       000679
      DO 35 J=1,3                                                        000680
      WU(I,J)=1.0                                                        000681
   35 CONTINUE                                                           000682
C                                                                        000683
C     ARGUMENTS OF THE MINIMAX OPTIMIZATION(MMLC) CALL STATEMENT         000684
C                                                                        000685
C     FDF2    - NAME OF A SUBROUTINE CALCULATING MINIMAX FUNCTIONS AND   000686
C               THEIR DERIVATIVES AT THE POINT DEFINED BY THE X VECTOR.  000687
C               THE NAME FDF2 IS ARBITRARY AND MUST APPEAR IN THE EXTER- 000688
C               NAL STATEMENT IN THE SEGMENT CALLING MMLC1A.             000689
C     NV      - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF OP-   000690
C               TIMIZATION VARIABLES. ITS VALUE MUST BE POSITIVE AND IS  000691
C               NOT CHANGED BY THE PACKAGE.                              000692
C     MF      - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF RE-   000693
C               SIDUAL FUNCTIONS DEFINING THE MINIMAX OBJECTIVE FUNCTION. 000694
C               ITS VALUE MUST BE POSITIVE AND IS NOT CHANGED BY THE PA- 000695
C               CKAGE.                                                   000696
C     L       - INTEGER ARGUMENT WHICH MUST BE SET TO THE TOTAL NUMBER    000697
C               OF EQUALITY AND INEQUALITY CONSTRAINTS. ITS VALUE MUST   000698
C               BE POSITIVE OR ZERO AND IT IS NOT CHANGED BY THE PACKA-  000699
C               GE.                                                      000700
C     LEQ     - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF EQ-   000701
C               UALITY CONSTRAINTS. ITS VALUE MUST BE POSITIVE OR ZERO   000702
C               AND NOT GREATER THAN NV, AND NOT GREATER THAN L. ITS     000703
C               VALUE IS NOT CHANGED BY THE PACKAGE.                     000704
C     B       - REAL ARRAY OF LENGTH IIC > L. THE ELEMENTS OF B MUST BE  000705
C               SET TO THE CONSTANT TERMS IN THE LINEAR CONSTRAINTS.     000706
C               THE CONTENTS OF B ARE NOT CHANGED BY THE PACKAGE.        000707
C     C       - REAL MATRIX OF DIMENSIONS (IIC,NV). THE FIRST L ROWS OF  000708
C               C MUST BE SET TO THE COEFFICIENTS OF X IN THE LINEAR     000709
C               CONSTRAINTS.                                             000710
C     IIC     - INTEGER ARGUMENT WHICH MUST BE SET TO THE LENGTH OF THE  000711
C               ARRAY B AND TO NUMBER OF ROWS OF THE MATRIX C. ITS VA-   000712
C               LUE MUST NOT BE LESS THAN L, AND IT IS NOT CHANGED BY    000713
C               THE PACKAGE.                                             000714
C     X       - REAL ARRAY OF LENGTH AT LEAST NV WHICH, ON ENTRY, MUST   000715
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C                BE SET TO THE INITIAL APPROXIMATION OF THE SOLUTION.          000716
C                ON EXIT X CONTAINS THE BEST SOLUTION FOUND BY THE PACK-       000717
C                AGE.                                                          000718
C      DX      - REAL VARIABLE WHICH CONTROLS THE STEP LENGTH OF THE ITER-     000719
C                ATIVE ALGORITHM. ON ENTRY IT MUST BE SET TO AN INITIAL        000720
C                VALUE APPROXIMATELY EQUAL TO 0.1* X. THE VALUE OF DX          000721
C                MUST BE POSITIVE. ON EXIT DX CONTAINS THE LAST VALUE OF       000722
C                THE STEPSIZE. FOR EXTENSIVE DETAILS PLEASE REFER TO           000723
C                REPORT SOS-82-5-U2, AUGUST 1983.                              000724
C      EPS     - REAL VARIABLE WHICH ON ENTRY MUST BE SET TO THE REQUIRED      000725
C                ACCURACY OF THE SOLUTION. ON EXIT EPS CONTAINS THE LENGTH     000726
C                OF THE LAST STEP TAKEN IN THE ITERATION.                      000727
C      MAXF    - INTEGER VARIABLE WHICH MUST BE SET TO AN UPPER BOUND ON       000728
C                THE NUMBER OF CALLS OF FDF2. ON EXIT MAXF CONTAINS THE        000729
C                NUMBER OF CALLS OF FDF THAT HAVE BEEN PERFORMED BY THE        000730
C                PACKAGE.                                                      000731
C      KEQS    - INTEGER VARIABLE WHICH MUST BE SET TO THE NUMBER OF SUC=      000732
C                CESSIVE ITERATIONS WITH IDENTICAL SETS OF ACTIVE RESIDUAL     000733
C                FUNCTIONS AND ACTIVE CONSTRAINTS THAT IS REQUIRED BEFORE      000734
C                A SWITCH TO STAGE 2 IS MADE. ON EXIT KEQS CONTAINS THE        000735
C                NUMBER OF SWITCHES TO STAGE 2 THAT HAVE TAKEN PLACE.          000736
C      W       - REAL ARRAY WHICH IS USED FOR WORKING SPACE. ITS LENGTH        000737
C                IS GIVEN BY IW. ON EXIT THE FIRST MF ELEMENTS OF W CON-       000738
C                TAIN THE RESIDUAL FUNCTION VALUES AT THE SOLUTION.            000739
C      IW      - INTEGER ARGUMENT WHICH MUST BE SET TO THE LENGTH OF W.        000740
C                ITS VALUE MUST BE AT LEAST                                    000741
C                                                                              000742
C                     IWR=2*MF*NV+5*NV*NV+4*MF+8*NV+4*IIC+3                    000743
C                                                                              000744
C      ICH     - INTEGER ARGUMENT WHICH MUST BE SET TO THE UNIT NUMBER         000745
C                THAT IS TO BE USED FOR THE PRINTED OUTPUT GENERATED BY        000746
C                THE PACKAGE. IF ICH IS LESS THAN OR EQUAL TO ZERO, NO         000747
C                PRINTED OUTPUT WILL BE GENERATED BY THE PACKAGE.              000748
C      IPR     - INTEGER ARGUMENT WHICH CONTROLS THE PRINTED OUTPUT GE-         000749
C                NERATED BY THE PACKAGE. FOR EXTENSIVE DETAILS PLEASE          000750
C                REFER TO REPORT SOS-82-5-U2, AUGUST 1983.                     000751
C      IFALL   - INTEGER VARIABLE WHICH ON EXIT CONTAINS INFORMATION          000752
C                ABOUT THE SOLUTION:                                           000753
C                IFALL=-2 FEASIBLE REGION IS EMPTY,                            000754
C                IFALL=-1 INCORRECT INPUT DATA,                                000755
C                IFALL= 0 REGULAR SOLUTION; REQUIRED ACCURACY OBTAINED,        000756
C                IFALL= 1 SINGULAR SOLUTION; REQUIRED ACCURACY OBTAINED,       000757
C                IFALL= 2 MACHINE ACCURACY REACHED,                            000758
C                IFALL= 3 MAXIMUM NUMBER OF FUNCTION EVALUATIONS REACHED,      000759
C                IFALL= 4 ITERATION TERMINATED BY THE USER.                    000760
C                                                                              000761
C      DEFINE PARAMETERS FOR THE MMLC PACKAGE                                  000762
C                                                                              000763
       NV=45                                                                   000764
       MF=92                                                                   000765
       L=0                                                                     000766
       LEQ=0                                                                   000767
       IIC=1                                                                   000768
       DX=0.05                                                                 000769
       EPS=1.E-6                                                               000770
       MAXF=65                                                                 000771
       KEQS=3                                                                  000772
       IW=20000                                                                000773
       ICH=6                                                                   000774
       IPR=10                                                                  000775
       NCOUNT=1                                                                000776
C                                                                              000777
       CALL MMLC1A(FDF2,NV,MF,L,LEQ,B,C,IIC,X,DX,EPS,MAXF,KEQS,W,IW,ICH,       000778
      1            IPR,IFALL)                                                 000779
C                                                                              000780
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  900 STOP                                                          000781
      END                                                           000782
C                                                                   000783
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FREQUENCY MHZ	RETURN LOSS COMMON PORT	INSERTION LOSS DB	FREQUENCY FOR DELAY & SLOPE	GROUP DELAY NANO SECS	GAIN SLOPE DB/MHZ
11960.0	5.95	6.57	11959.75	90.58	6.906
11961.0	14.19	3.05	11960.75	99.90	2.574
11962.0	22.60	1.96	11961.75	75.33	.784
11963.0	20.48	1.55	11962.75	58.29	.330
11964.0	20.22	1.33	11963.75	49.03	.196
11965.0	20.80	1.18	11964.75	43.46	.131
11966.0	20.99	1.08	11965.75	39.64	.089
11967.0	20.63	1.02	11966.75	36.80	.062
11968.0	20.22	.97	11967.75	34.63	.046
11969.0	20.10	.93	11968.75	32.96	.038
11970.0	20.40	.89	11969.75	31.69	.034
11971.0	21.12	.86	11970.75	30.71	.031
11972.0	22.18	.83	11971.75	29.96	.027
11973.0	23.40	.81	11972.75	29.36	.021
11974.0	24.32	.79	11973.75	28.88	.015
11975.0	24.39	.78	11974.75	28.48	.009
11976.0	23.60	.78	11975.75	28.14	.003
11977.0	22.47	.78	11976.75	27.87	-.001
11978.0	21.43	.78	11977.75	27.67	-.004
11979.0	20.66	.79	11978.75	27.54	-.005
11980.0	20.22	.79	11979.75	27.50	-.005
11981.0	20.10	.80	11980.75	27.56	-.004
11982.0	20.34	.80	11981.75	27.71	-.003
11983.0	20.94	.80	11982.75	27.97	-.002
11984.0	21.97	.81	11983.75	28.32	-.003
11985.0	23.51	.81	11984.75	28.77	-.005
11986.0	25.73	.82	11985.75	29.32	-.008
11987.0	28.99	.83	11986.75	29.96	-.013
11988.0	33.95	.85	11987.75	30.71	-.020
11989.0	39.10	.87	11988.75	31.60	-.027
11990.0	35.19	.90	11989.75	32.65	-.034
11991.0	31.49	.94	11990.75	33.92	-.043
11992.0	29.64	.99	11991.75	35.51	-.052
11993.0	28.97	1.06	11992.75	37.53	-.064
11994.0	28.81	1.13	11993.75	40.16	-.083
11995.0	27.87	1.24	11994.75	43.73	-.116
11996.0	25.26	1.40	11995.75	48.85	-.187
11997.0	22.15	1.73	11996.75	56.47	-.395
11998.0	20.35	2.57	11997.75	63.08	-1.040
11999.0	21.62	3.99	11998.75	55.71	-1.415
12000.0	22.93	5.23	11999.75	81.37	1.315
12001.0	20.95	4.14	12000.75	53.38	1.171
12002.0	20.21	2.57	12001.75	60.15	1.562
12003.0	22.62	1.71	12002.75	60.91	.644

12004.0	25.22	1.39	12003.75	51.97	.254
12005.0	26.06	1.23	12004.75	45.67	.138
12006.0	25.72	1.13	12005.75	41.45	.093
12007.0	25.50	1.05	12006.75	38.45	.070
12008.0	25.90	.99	12007.75	36.22	.056
12009.0	27.06	.94	12008.75	34.50	.046
12010.0	29.06	.90	12009.75	33.15	.038
12011.0	31.56	.87	12010.75	32.06	.030
12012.0	32.23	.85	12011.75	31.16	.023
12013.0	29.64	.83	12012.75	30.41	.016
12014.0	26.66	.82	12013.75	29.78	.010
12015.0	24.33	.81	12014.75	29.24	.005
12016.0	22.65	.81	12015.75	28.80	.002
12017.0	21.47	.81	12016.75	28.45	-.000
12018.0	20.71	.81	12017.75	28.20	-.001
12019.0	20.30	.81	12018.75	28.04	-.001
12020.0	20.22	.81	12019.75	27.98	.000
12021.0	20.45	.81	12020.75	28.01	.001
12022.0	21.00	.81	12021.75	28.14	.001
12023.0	21.91	.81	12022.75	28.36	.001
12024.0	23.24	.81	12023.75	28.67	-.001
12025.0	25.09	.81	12024.75	29.06	-.004
12026.0	27.67	.82	12025.75	29.55	-.008
12027.0	31.39	.83	12026.75	30.13	-.013
12028.0	37.24	.85	12027.75	30.83	-.019
12029.0	43.79	.87	12028.75	31.66	-.026
12030.0	38.13	.90	12029.75	32.67	-.032
12031.0	34.41	.94	12030.75	33.92	-.040
12032.0	32.69	.99	12031.75	35.48	-.049
12033.0	31.84	1.05	12032.75	37.45	-.062
12034.0	30.80	1.12	12033.75	40.03	-.082
12035.0	28.79	1.23	12034.75	43.51	-.116
12036.0	26.13	1.40	12035.75	48.45	-.186
12037.0	23.63	1.71	12036.75	55.60	-.378
12038.0	21.91	2.46	12037.75	62.54	-.908
12039.0	21.38	3.77	12038.75	60.07	-1.381
12040.0	20.41	5.50	12039.75	82.01	1.447
12041.0	18.59	4.33	12040.75	52.66	1.279
12042.0	20.22	2.57	12041.75	63.89	1.710
12043.0	25.66	1.71	12042.75	63.01	.621
12044.0	28.22	1.41	12043.75	52.94	.243
12045.0	26.42	1.25	12044.75	46.29	.138
12046.0	25.23	1.15	12045.75	41.88	.097
12047.0	25.21	1.07	12046.75	38.76	.076
12048.0	26.28	1.00	12047.75	36.43	.062
12049.0	28.54	.95	12048.75	34.62	.051
12050.0	32.08	.90	12049.75	33.18	.041
12051.0	33.93	.87	12050.75	31.99	.031

12052.0	30.15	.85	12051.75	30.98	.023
12053.0	26.39	.83	12052.75	30.11	.015
12054.0	23.76	.82	12053.75	29.36	.009
12055.0	21.97	.81	12054.75	28.72	.005
12056.0	20.78	.81	12055.75	28.19	.004
12057.0	20.06	.80	12056.75	27.76	.004
12058.0	19.74	.80	12057.75	27.45	.005
12059.0	19.80	.79	12058.75	27.24	.007
12060.0	20.22	.79	12059.75	27.14	.008
12061.0	21.00	.78	12060.75	27.14	.008
12062.0	22.17	.77	12061.75	27.22	.007
12063.0	23.64	.77	12062.75	27.37	.004
12064.0	25.10	.77	12063.75	27.58	-.001
12065.0	25.75	.77	12064.75	27.86	-.007
12066.0	25.01	.78	12065.75	28.18	-.014
12067.0	23.48	.80	12066.75	28.58	-.020
12068.0	22.00	.83	12067.75	29.08	-.025
12069.0	20.88	.85	12068.75	29.71	-.029
12070.0	20.22	.88	12069.75	30.53	-.031
12071.0	20.01	.92	12070.75	31.62	-.034
12072.0	20.22	.96	12071.75	33.03	-.040
12073.0	20.69	1.00	12072.75	34.87	-.051
12074.0	21.05	1.07	12073.75	37.23	-.071
12075.0	20.83	1.16	12074.75	40.32	-.103
12076.0	20.22	1.30	12075.75	44.57	-.150
12077.0	20.32	1.51	12076.75	51.05	-.228
12078.0	21.42	1.87	12077.75	62.22	-.425
12079.0	14.49	2.78	12078.75	81.53	-1.148