CONTIGUOUS BAND MULTIPLEXER

SIMULATION AND OPTIMIZATION

OSA-84-MX-6-T

February 1, 1984

Fourteen channel, 14 variable spacing optimization

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      PROGRAM MXSOS(OUTPUT,TAPE6=OUTPUT)                                    000001
C                                                                           000002
C     THIS PROGRAM IS THE USER DEFINED MAIN SEGMENT OF THE MXSOS 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.                                                       000016
C                                                                           000017
C     THE USER MUST PROVIDE APPROPRIATE DIMENSIONS FOR THE FOLLOWING        000018
C     VARIABLES AFTER STUDYING THE COMMENTS PLACED THROUGHOUT THE MAIN       000019
C     SEGMENT MXSOS. CORRESPONDING DIMENSIONS MUST BE DECLARED IN ALL       000020
C     SUBROUTINES EXCEPT FOR THE MMLC PACKAGE.                              000021
C                                                                           000022
      REAL X(14),W(2000),B(1),C(1,1),T(3),DISP(16),QO(16)                   000023
      REAL OMEGA(25),SURL(25),SLRL(25),WURL(25),WLRL(25),                   000024
     1     SU(20,16),SL(20,16),WU(20,16),WL(20,16)                          000025
      INTEGER RLSCODE(25),SPCODE(20,16),CHBCODE(16,2)                       000026
      REAL WO(16),BW(16),CM(16,8,8),PN1(16),PN2(16),SPN1(16),SPN2(16),      000027
     1          GL(16),WGL(16),DIA(16)                                      000028
      INTEGER CEL(16,8,8)                                                   000029
      REAL FCNST(16),LAMRES(16),LAMDEL(16)                                  000030
      REAL DRL(100),FIL(16),DIL(16,100)                                     000031
      REAL ANGLE1(16),ANGLE2(16),GRDEL(16)                                  000032
      INTEGER IR(16),IRT(16),LC(16,36),KC(16,36)                            000033
      EXTERNAL FDF                                                          000034
      COMMON /BLK1/WO,BW,PN1,PN2,GL,VS,RS,PI2,WIDTH,NP1                     000035
      COMMON /BLK2/CM,WGL                                                   000036
      COMMON /BLK3/OMEGA,SURL,SLRL,WURL,WLRL,SU,SL,WU,WL,                   000037
     1           RLSCODE,SPCODE,NCOUNT,MODE,NCH,MO,NFREQ,NFRL,              000038
     2        CHBCODE,IFLAGJS,IFLAGDP,IDISPER                               000039
      COMMON /BLK4/CBR,FCUT                                                 000040
      COMMON /BLK5/DISP                                                     000041
      COMMON/BLK6/FCNST,LAMRES,LAMDEL                                       000042
      COMMON/BLK7/CEL                                                       000043
      COMMON/BLK8/IR,IRT,LC,KC                                              000044
      DATA T/10HMULTIPLEXE,10HR PROBLEM ,10HMXTST5     /                    000045
C                                                                           000046
C     THE MXSOS PACKAGE CAN OPERATE IN THREE MODES: SIMULATION, SENSITI-    000047
C     VITY ANALYSIS AND OPTIMIZATION. TO SELECT THE REQUIRED FUNCTION OF    000048
C     THE PACKAGE SET LMODE TO                                              000049
C     1 - IF MULTIPLEXER SIMULATION IS REQUIRED,                            000050
C     2 - IF MULTIPLEXER SENSITIVITY ANALYSIS IS REQUIRED,                  000051
C     3 - IF MULTIPLEXER OPTIMIZATION IS REQUIRED.                          000052
C                                                                           000053
C     SELECT MODE OF OPERATION OF THE PACKAGE                               000054
C                                                                           000055
      LMODE=3                                                               000056
C                                                                           000057
C     THIS PART OF THE MAIN SEGMENT IS USED TO DEFINE THE DATA FOR          000058
C     MULTIPLEXER SIMULATION. IT MUST ALWAYS BE DEFINED, REGARDLESS OF      000059
C     THE MODE OF OPERATION OF THE PACKAGE SELECTED.                        000060
C                                                                           000061
C     NCH     - NUMBER OF FILTER CHANNELS INCLUDING DUMMY CHANNELS          000062
C     MO      - ORDER OF FILTERS(THE SAME FOR ALL FILTERS, ODD OR EVEN)     000063
C     WO      - VECTOR OF CENTER FREQUENCIES IN MHZ, ONE PER CHANNEL        000064
C     QO      - VECTOR OF UNLOADED Q FOR THE FILTERS, ONE PER CHANNEL       000065
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C     DIA     - VECTOR OF FILTER DIAMETERS IN INCHES, ONE PER CHANNEL      000066
C     BW      - VECTOR OF CHANNEL BANDWIDTHS IN MHZ, ONE PER CHANNEL       000067
C     SPN1    - VECTOR OF INPUT TRANSFORMER RATIOS(SQUARED), ONE PER       000068
C               CHANNEL                                                    000069
C     SPN2    - VECTOR OF OUTPUT TRANSFORMER RATIOS(SQUARED), ONE PER      000070
C               CHANNEL                                                    000071
C     GL      - VECTOR OF CHANNEL TERMINATING CONDUCTANCES, ONE PER        000072
C               CHANNEL                                                    000073
C     CM      - SYMMETRICAL MATRIX OF COUPLING PARAMETERS(CHANNEL,ROW,     000074
C               COLUMN), INCLUDING NONZERO DIAGONAL ELEMENTS TO MODEL      000075
C               ASYNCHRONOUS DESIGNS                                       000076
C     CEL     - SYMMETRICAL MATRIX FOR TYPE OF COUPLING, +1 FOR SCREW,     000077
C               -1 FOR IRIS, CORRESPONDING TO CM AS ABOVE                  000078
C     WGL     - VECTOR OF WAVEGUIDE SPACINGS FOR EACH CHANNEL, MEASURED    000079
C               IN INCHES ALONG THE MANIFOLD FROM THE ADJACENT CHANNEL     000080
C               (DISTANCE FROM THE SHORT CIRCUIT FOR THE FIRST CHANNEL)    000081
C     VS      - SOURCE VOLTAGE AT THE COMMON PORT                          000082
C     RS      - SOURCE RESISTANCE AT THE COMMON PORT                       000083
C     P12     - CONSTANT EQUAL TO TWICE PI                                 000084
C     WIDTH   - MANIFOLD WIDTH IN INCHES                                   000085
C                                                                          000086
C     DEFINE THE NUMBER OF CHANNELS AND THE ORDER OF THE FILTERS           000087
C                                                                          000088
      NCH=14                                                               000089
      MO=6                                                                 000090
      NP1=NCH+1                                                            000091
C                                                                          000092
C     DEFINE CENTER FREQUENCIES IN MHZ                                     000093
C                                                                          000094
      WO(1)=12220.0                                                        000095
      WO(2)=12180.0                                                        000096
      WO(3)=12140.0                                                        000097
      WO(4)=12100.0                                                        000098
      WO(5)=12060.0                                                        000099
      WO(6)=12020.0                                                        000100
      WO(7)=11980.0                                                        000101
      WO(8)=11940.0                                                        000102
      WO(9)=11900.0                                                        000103
      WO(10)=11860.0                                                       000104
      WO(11)=11820.0                                                       000105
      WO(12)=11780.0                                                       000106
      WO(13)=11740.0                                                       000107
      WO(14)=11700.0                                                       000108
C                                                                          000109
C     DEFINE UNLOADED Q FACTORS OF THE FILTERS                             000110
C                                                                          000111
      DO 5 I=1,NCH                                                         000112
      QO(I)=12000.0                                                        000113
    5 CONTINUE                                                             000114
C                                                                          000115
C     DEFINE THE DIAMETER OF THE FILTERS IN INCHES                         000116
C                                                                          000117
      DO 70 I=1,NCH                                                        000118
      DIA(I)=1.07                                                          000119
   70 CONTINUE                                                             000120
C                                                                          000121
C     DEFINE BANDWIDTHS, INPUT/OUTPUT TRANSFORMER RATIOS AND OUTPUT        000122
C     CONDUCTANCES                                                         000123
C                                                                          000124
      DO 1 I=1,NCH                                                         000125
      BW(I)=39.0                                                           000126
      SPN1(I)=0.69967                                                      000127
      SPN2(I)=1.09450                                                      000128
      PN1(I)=SQRT(SPN1(I))                                                 000129
      PN2(I)=SQRT(SPN2(I))                                                 000130
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      GL(I)=1.0                                                          000131
    1 CONTINUE                                                           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     DEFINE THE TYPE OF COUPLING IN THE FILTER                          000151
C              +1 >> SCREW COUPLING    -1 >> IRIS COUPLING               000152
C                                                                        000153
      DO 71 I=1,NCH                                                      000154
      DO 71 J=1,MO                                                       000155
      DO 71 KK=1,MO                                                      000156
      CEL(I,J,KK)=0                                                      000157
   71 CONTINUE                                                           000158
C                                                                        000159
      DO 72 I=1,NCH                                                      000160
      CEL(I,1,2)=1                                                       000161
      CEL(I,2,3)=-1                                                      000162
      CEL(I,3,4)=1                                                       000163
      CEL(I,3,6)=-1                                                      000164
      CEL(I,4,5)=-1                                                      000165
      CEL(I,5,6)=1                                                       000166
C                                                                        000167
      DO 72 J=1,MO                                                       000168
      DO 72 KK=1,J                                                       000169
      CEL(I,J,KK)=CEL(I,KK,J)                                            000170
   72 CONTINUE                                                           000171
C                                                                        000172
C     DEFINE THE SECTION LENGTHS(SPACINGS ALONG THE WAVEGUIDE MANIFOLD)  000173
C                                                                        000174
      WGL(1)=0.612                                                       000175
      WGL(2)=0.649                                                       000176
      WGL(3)=0.635                                                       000177
      WGL(4)=0.639                                                       000178
      WGL(5)=0.642                                                       000179
      WGL(6)=0.655                                                       000180
      WGL(7)=0.659                                                       000181
      WGL(8)=0.664                                                       000182
      WGL(9)=0.658                                                       000183
      WGL(10)=0.640                                                      000184
      WGL(11)=0.965                                                      000185
      WGL(12)=0.681                                                      000186
      WGL(13)=0.582                                                      000187
      WGL(14)=0.342                                                      000188
C                                                                        000189
C     DEFINE SOME CONSTANTS, SOURCE VOLTAGE, SOURCE RESISTANCE, TWICE PI 000190
C     MANIFOLD WIDTH                                                     000191
C                                                                        000192
      VS=1.0                                                             000193
      RS=1.0                                                             000194
      PI2=8.0*ATAN(1.0)                                                  000195
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      WIDTH=0.75                                                        000196
                                                                        000197
C                                                                       000198
C     THE MXSOS PACKAGE CAN EXPLOIT THREE PRACTICAL MODELS OF THE       000199
C     MULTIPLEXER AS DETERMINED BY THE PARAMETERS IFLAGJS, IFLAGDP      000200
C     AND IDISPER.                                                      000201
C                                                                       000202
C     IFLAGJS                                                           000203
C     0 - IF JUNCTIONS ARE IDEAL                                        000204
C     1 - IF JUNCTIONS ARE NONIDEAL                                     000205
C                                                                       000206
C     IFLAGDP                                                           000207
C     0 - IF FILTERS ARE LOSSLESS                                       000208
C     1 - IF FILTERS ARE LOSSY                                          000209
C                                                                       000210
C     IDISPER                                                           000211
C     0 - IF FILTERS ARE DISPERSIVE                                     000212
C     1 - IF FILTERS ARE NONDISPERSIVE                                  000213
C                                                                       000214
C     FLAG FOR JUNCTION SUSCEPTANCE (SET TO 0 OR 1)                     000215
C                                                                       000216
      IFLAGJS=1                                                         000217
      IF(IFLAGJS.NE.1)GO TO 42                                          000218
C                                                                       000219
      CALL CONST1(WIDTH)                                                000220
C                                                                       000221
   42 CONTINUE                                                          000222
C                                                                       000223
C     FLAG FOR FILTER DISSIPATION (SET TO 0 OR 1)                       000224
C                                                                       000225
      IFLAGDP=1                                                         000226
      IF(IFLAGDP.NE.1)GO TO 43                                          000227
C                                                                       000228
      CALL DISPAT(NCH,WO,BW,QO)                                         000229
C                                                                       000230
   43 CONTINUE                                                          000231
C                                                                       000232
C     FLAG FOR DISPERSIVE EFFECTS IN THE COUPLED CAVITY FILTERS         000233
C     (SET TO 0 OR 1)                                                   000234
C                                                                       000235
      IDISPER=1                                                         000236
      IF(IDISPER.NE.1)GO TO 44                                          000237
C                                                                       000238
      CALL DISPER(NCH,WO,BW,DIA)                                        000239
C                                                                       000240
   44 CONTINUE                                                          000241
C                                                                       000242
C     CHECK WHETHER THE SIMULATION MODE IS REQUIRED                     000243
C                                                                       000244
      IF(LMODE.NE.1)GO TO 16                                            000245
C                                                                       000246
C     SIMULATION, CORRESPONDING TO LMODE=1                              000247
C                                                                       000248
C     THIS PART OF THE MAIN SEGMENT IS USED TO GENERATE FREQUENCIES AT  000249
C     WHICH SIMULATION IS TO BE PERFORMED. A FREQUENCY STEP OF 1 MHZ IS 000250
C     ASSUMED. NONE OF THE GENERATED FREQUENCIES MUST BE SET EQUAL TO   000251
C     ANY OF THE CENTER FREQUENCIES. SUBROUTINE "SIMUL" IS CALLED AT    000252
C     EACH GENERATED FREQUENCY. IF A DIFFERENT FREQUENCY STEP IS REQUI- 000253
C     RED THE FREQUENCY POINTS FOR SIMULATION HAVE TO BE GENERATED IN A 000254
C     DIFFERENT WAY.                                                    000255
C                                                                       000256
C     FREQST - START FREQUENCY FOR SIMULATION                           000257
C     FREQ   - ACTUAL FREQUENCY AT WHICH "SIMUL" IS CALLED              000258
C     NFRSIM - NUMBER OF FREQUENCY POINTS FOR SIMULATION                000259
C                                                                       000260
      PRINT(6,199)
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  199 FORMAT(1H1)                                                        000261
      PRINT(6,205)                                                       000262
  205 FORMAT(6X,"FREQUENCY",5X,"RETURN LOSS",5X,"INSERTION LOSS",        000263
     1       8X,"FREQUENCY FOR",7X,"GROUP DELAY")                        000264
      PRINT(6,206)                                                       000265
  206 FORMAT(8X,"MHZ",9X,"COMMON PORT",9X,"DB",17X,"GROUP DELAY",        000266
     1       9X,"NANO SECS")                                             000267
C                                                                        000268
C                                                                        000269
C     THE FOLLOWING TWO PARAMETERS MUST BE DEFINED                       000270
C                                                                        000271
      FREQST=11678.0                                                     000272
      NFRSIM=280                                                         000273
C                                                                        000274
      NCHAN=NCH                                                          000275
      MORDER=MO                                                          000276
      IREL=NCH+1                                                         000277
      DO 200 ICOUNT=1,NFRSIM                                             000278
      FREQ=FREQST+FLOAT(ICOUNT)*2.0                                      000279
      ITEST=INT(FREQ)                                                    000280
C                                                                        000281
C     THE FOLLOWING STATEMENT PRINTS DASHED LINE EVERY 20 MHZ            000282
C                                                                        000283
      IF(MOD(ITEST,20).EQ.0)PRINT(6,208)                                 000284
  208 FORMAT(90("-"))                                                    000285
      DO 210 I=1,NCH                                                     000286
      IF(ABS(FREQ-WO(I)).LT.1.E-10)FREQ=FREQ+0.001                       000287
  210 CONTINUE                                                           000288
C                                                                        000289
C     GROUP DELAY IS ESTIMATED FROM THE PHASE DIFFERENCE AT TWO          000290
C     FREQUENCIES, NAMELY, THE SELECTED FREQUENCY AND THE SELECTED       000291
C     FREQUENCY MINUS 0.5 MHZ. CONSEQUENTLY, THE EVALUATION IS A         000292
C     TRUE QUADRATIC APPROXIMATION AT THE SELECTED FREQUENCY MINUS       000293
C     0.25 MHZ. THUS, A SEPARATE COLUMN OF FREQUENCIES AND GROUP         000294
C     DELAYS IS GENERATED AND PRINTED OUT.                               000295
C                                                                        000296
C     SUBTRACT 0.5 MHZ FROM FREQ                                         000297
C                                                                        000298
      FREQ=FREQ-0.5                                                      000299
C                                                                        000300
      CALL SIMUL(FREQ,NCHAN,MORDER,ICOUNT,IFLAGJS,IFLAGDP,IDISPER,       000301
     1           FRL,FIL,ANGLE1)                                         000302
C                                                                        000303
C     RESET FREQ BY ADDING 0.5 MHZ                                       000304
C                                                                        000305
      FREQ=FREQ+0.5                                                      000306
C                                                                        000307
      CALL SIMUL(FREQ,NCHAN,MORDER,ICOUNT,IFLAGJS,IFLAGDP,IDISPER,       000308
     1           FRL,FIL,ANGLE2)                                         000309
C                                                                        000310
      DO 300 I=1,NCH                                                     000311
      DELANG=ANGLE2(I)-ANGLE1(I)                                         000312
      PI=PI2/2.0                                                         000313
      IF(DELANG.GT.PI)DELANG=DELANG-PI2                                  000314
      GRDEL(I)=-2000.0*DELANG/PI2                                        000315
  300 CONTINUE                                                           000316
C                                                                        000317
C     THE FOLLOWING STATEMENT CAUSES THE PRINTING OF INSERTION LOSS      000318
C     FUNCTION VALUES ONLY FOR THE BAND OF INTEREST.                     000319
C                                                                        000320
      IF(MOD(ITEST,40).EQ.0)IREL=IREL-1                                  000321
C                                                                        000322
C     GROUP DELAY IS ESTIMATED AT FREQ MINUS 0.25 MHZ                    000323
C                                                                        000324
      FRGROUP=FREQ-0.25                                                  000325
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      PRINT(6,207)FREQ,FRL,FIL(IREL),FRGROUP,GRDEL(IREL)                    000326
  207 FORMAT(6X,F7.1,9X,F5.2,12X,F5.2,17X,F8.2,10X,F8.2)                    000327
  200 CONTINUE                                                              000328
      GO TO 900                                                             000329
C                                                                           000330
C     SENSITIVITY ANALYSIS, CORRESPONDING TO LMODE=2                        000331
C                                                                           000332
C     THIS PART OF THE MAIN PROGRAM IS USED TO DEFINE CODES FOR MULTI-      000333
C     PLEXER PARAMETERS W.R.T. WHICH WE WANT TO FIND THE SENSITIVITIES.     000334
C     SECTION LENGTHS(SPACINGS) ARE ASSUMED TO BE SUCH PARAMETERS AL-       000335
C     WAYS, SO NO CODES ARE REQUIRED FOR THEM. THE PARAMETER IR=0 SIG-      000336
C     NIFIES THAT SPACINGS ARE THE ONLY VARIABLES. SUBROUTINE "SIMGRD"      000337
C     IS CALLED AT EACH FREQUENCY DEFINED IN THE VECTOR OMEGA(I).           000338
C                                                                           000339
C     IR      - VECTOR CONTAINING THE NUMBER OF COUPLING PARAMETERS BE-     000340
C               ING VARIABLES FOR EACH CHANNEL                              000341
C     LC      - MATRIX CONTAINING THE ROW INDICES OF COUPLING PARAMETERS    000342
C               BEING VARIABLES FOR EACH CHANNEL                            000343
C     KC      - MATRIX CONTAINING THE COLUMN INDICES OF COUPLING PARAME-    000344
C               TERS BEING VARIABLES FOR EACH CHANNEL                       000345
C     OMEGA   - VECTOR OF ARBITRARY FREQUENCIES (EXCEPT CENTER FREQUEN-     000346
C               CIES) AT WHICH THE SENSITIVITY ANALYSIS IS TO BE PERFOR-     000347
C               MED.                                                        000348
C     FRSNS   - ACTUAL FREQUENCY AT WHICH THE SUBROUTINE "SIMGRD" IS        000349
C               CALLED                                                      000350
C     NV      - TOTAL NUMBER OF VARIABLES W.R.T. WHICH THE SENSITIVITIES    000351
C               ARE REQUIRED                                                000352
C     FRL     - VALUE OF THE COMMON PORT RETURN LOSS IN DB AT THE FREQU-    000353
C               ENCY FRSNS                                                  000354
C     DRL     - SENSITIVITIES OF THE COMMON PORT RETURN LOSS W.R.T. ALL     000355
C               VARIABLES                                                   000356
C     FIL     - VECTOR OF THE INSERTION LOSS FUNCTION IN DB FOR EACH        000357
C               CHANNEL AT THE FREQUENCY FRSNS                              000358
C     DIL     - MATRIX OF SENSITIVITIES OF THE INSERTION LOSS FUNCTION      000359
C               FOR EACH CHANNEL W.R.T. ALL VARIABLES                       000360
C                                                                           000361
C     DEFINE THE NUMBER OF COUPLING VARIABLES PER CHANNEL                   000362
C                                                                           000363
   16 DO 55 I=1,NCH                                                         000364
      IR(I)=0                                                               000365
   55 CONTINUE                                                              000366
C                                                                           000367
C     EVALUATE THE TOTAL NUMBER OF VARIABLES ACCUMULATED AFTER              000368
C     EACH SECTION                                                          000369
C                                                                           000370
      CALL TOTAL(NCH,IR,IRT)                                                000371
C                                                                           000372
C     DEFINE CODES FOR THE VARIABLES                                        000373
C                                                                           000374
C                                                                           000375
C     CHECK WHETHER THE SIMULATION AND SENSITIVITY ANALYSIS MODE            000376
C     IS REQUIRED                                                           000377
C                                                                           000378
      IF(LMODE.NE.2) GO TO 17                                               000379
C                                                                           000380
C     GENERATE FREQUENCY POINTS IN MHZ                                      000381
C                                                                           000382
      NFREQ=1                                                               000383
      OMEGA(1)=11899.0                                                      000384
      NCHAN=NCH                                                             000385
      MORDER=MO                                                             000386
      DO 18 ICOUNT=1,NFREQ                                                  000387
      FRSNS=OMEGA(ICOUNT)                                                   000388
C                                                                           000389
      CALL SIMGRD(FRSNS,FRL,DRL,FIL,DIL,NCHAN,MORDER,ICOUNT,IFLAGJS,        000390
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     1            IFLAGDP, IDISPER)                                          000391
C                                                                            000392
   18 CONTINUE                                                               000393
      GO TO 900                                                              000394
C                                                                            000395
C     OPTIMIZATION, CORRESPONDING TO LMODE=3                                 000396
C                                                                            000397
C     THIS PART OF THE MAIN SEGMENT IS USED TO DEFINE ALL VARIABLES AND      000398
C     ARRAYS FOR MULTIPLEXER OPTIMIZATION. TO SELECT THE MULTIPLEXER PA-     000399
C     RAMETERS WHICH ARE THE OPTIMIZATION VARIABLES THE MATRICES LC AND      000400
C     KC HAVE TO BE USED AS DESCRIBED IN THE SENSITIVITY ANALYSIS PART.      000401
C     SECTION LENGTHS ARE ALWAYS ASSUMED TO BE OPTIMIZATION VARIABLES,       000402
C     SO NO CODES ARE REQUIRED FOR THEM. THREE MODES OF OPTIMIZATION ARE     000403
C     ALLOWED. TO SELECT THE DESIRED MODE OF OPTIMIZATION SET PARAMETER      000404
C     MODE TO                                                                000405
C     0 - IF ONLY COMMON PORT RETURN LOSS OPTIMIZATION IS REQUIRED           000406
C     1 - IF ONLY INSERTION LOSS OPTIMIZATION IS REQUIRED                    000407
C     2 - IF BOTH RETURN LOSS AND INSERTION LOSS OPTIMIZATION ARE            000408
C         REQUIRED.                                                          000409
C     IN EACH CASE A DIFFERENT HEADER FOR THE PRINTOUT OF OPTIMIZATION       000410
C     RESULTS CAN BE OBTAINED BY CALLING THE SUBROUTINE "MMXHDR" FOR         000411
C     WHICH THE ARGUMENT T CAN BE DEFINED USING THE DATA STATEMENT. VA-      000412
C     LUES OF OPTIMIZATION VARIABLES AT THE STARTING POINT MUST BE SUP-      000413
C     PLIED BY DEFINING THE X VECTOR USING EITHER THE DATA STATEMENT OR      000414
C     EXPLICITLY. THE MINIMAX FUNCTIONS ARE CREATED AT THE FREQUENCIES       000415
C     DEFINED IN THE VECTOR OMEGA(I), WHICH IS A REAL ARRAY OF LENGTH        000416
C     AT LEAST NFREQ.                                                        000417
C                                                                            000418
C     NFREQ  - NUMBER OF FREQUENCY POINTS AT WHICH THE MINIMAX FUNCTI-       000419
C              ONS ARE TO BE CREATED                                         000420
C     OMEGA  - VECTOR OF ARBITRARY FREQUENCY POINTS (EXCEPT CENTER FRE-      000421
C              QUENCIES) IN MHZ AT WHICH THE MINIMAX FUNCTIONS ARE TO        000422
C              BE CREATED                                                    000423
C     NFRL   - NUMBER OF MINIMAX FUNCTIONS CREATED DUE TO RETURN LOSS        000424
C              SPECIFICATIONS                                                000425
C                                                                            000426
C     ARRAYS AND CODES FOR COMMON PORT RETURN LOSS OPTIMIZATION              000427
C                                                                            000428
C     RLSCODE- INTEGER ARRAY OF LENGTH AT LEAST NFREQ. EACH ELEMENT MUST     000429
C              BE SET TO THE FOLLOWING SPECIFICATION CODE VALUE AT EACH      000430
C              FREQUENCY :                                                   000431
C              0 - NO SPECIFICATION REQUIRED                                 000432
C             -1 - ONLY LOWER SPECIFICATION REQUIRED                         000433
C              1 - ONLY UPPER SPECIFICATION REQUIRED                         000434
C              2 - BOTH UPPER AND LOWER SPECIFICATIONS REQUIRED               000435
C     SURL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE      000436
C              UPPER SPECIFICATIONS APPLICABLE AT EACH FREQUENCY              000437
C     SLRL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE      000438
C              LOWER SPECIFICATIONS APPLICABLE AT EACH FREQUENCY              000439
C     WURL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE      000440
C              WEIGHTING FACTORS CORRESPONDING TO UPPER SPECIFICATIONS        000441
C     WLRL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE      000442
C              WEIGHTING FACTORS CORRESPONDING TO LOWER SPECIFICATIONS        000443
C                                                                            000444
C     ARRAYS AND CODES FOR INSERTION LOSS OPTIMIZATION                       000445
C                                                                            000446
C     CHBCODE- INTEGER ARRAY OF DIMENSIONS AT LEAST NCH BY 2. EACH ROW       000447
C              MUST CONTAIN THE RANGE OF FREQUENCIES OVER WHICH SPECI-       000448
C              FICATIONS FOR THE CORRESPONDING CHANNEL ARE GIVEN. THE        000449
C              FIRST ELEMENT OF A ROW INDICATES THE LOWER FREQUENCY          000450
C              EDGE OF INTEREST, THE SECOND THE UPPER FREQUENCY EDGE.        000451
C     SPCODE - INTEGER ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH.           000452
C              NSPMAX IS THE MAXIMUM NUMBER OF FREQUENCY POINTS CONSI-       000453
C              DERED FOR ANY OF THE CHANNELS.                                000454
C              EACH COLUMN MUST CONTAIN THE SPECIFICATION CODE AT EACH       000455
```

```
C                FREQUENCY FOR THE CORRESPONDING CHANNEL. EACH ELEMENT      000456
C                OF A COLUMN MUST BE SET TO ONE OF THE FOLLOWING VALUES:    000457
C                0 - NO SPECIFICATION REQUIRED                              000458
C               -1 - ONLY LOWER SPECIFICATION REQUIRED                      000459
C                1 - ONLY UPPER SPECIFICATION REQUIRED                      000460
C                2 - BOTH UPPER AND LOWER SPECIFICATIONS REQUIRED           000461
C      SU      - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000462
C                MUST CONTAIN THE UPPER SPECIFICATIONS FOR EACH CHANNEL     000463
C                ORDERED CONSECUTIVELY W.R.T. FREQUENCY INDEX IMPLIED       000464
C                BY THE CHBCODE MATRIX IN THE FORM (FREQUENCY INDEX,        000465
C                CHANNEL).                                                  000466
C      SL      - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000467
C                MUST CONTAIN THE LOWER SPECIFICATIONS FOR EACH CHANNEL     000468
C                ORDERED CONSECUTIVELY W.R.T. FREQUENCY INDEX IMPLIED       000469
C                BY THE CHBCODE MATRIX IN THE FORM (FREQUENCY INDEX,        000470
C                CHANNEL).                                                  000471
C      WU      - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000472
C                MUST CONTAIN THE WEIGHTING FACTORS FOR UPPER SPECIFI-      000473
C                CATIONS. IT IS ARRANGED TO CORRESPOND TO SU.               000474
C      WL      - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT       000475
C                MUST CONTAIN THE WEIGHTING FACTORS FOR LOWER SPECIFI-      000476
C                CATIONS. IT IS ARRANGED TO CORRESPOND TO SL.               000477
C                                                                           000478
C                                                                           000479
   17 CALL MMXHDR(3,T)                                                      000480
C                                                                           000481
C     SELECT THE DESIRED MODE OF OPTIMIZATION                               000482
C                                                                           000483
      MODE=0                                                                000484
C                                                                           000485
C     THE STARTING POINT MUST BE INITIALIZED BY SETTING CONSECUTIVELY       000486
C     NUMBERED X VALUES                                                     000487
C                                                                           000488
      DO 7 I=1,NCH                                                          000489
      X(I)=WGL(I)                                                           000490
    7 CONTINUE                                                              000491
C                                                                           000492
C     GENERATE FREQUENCY POINTS IN MHZ                                      000493
C                                                                           000494
      NFREQ=23                                                              000495
      NFREQ1=NFREQ-1                                                        000496
      OMEGA(1)=11740.0001                                                   000497
      DO 10 I=1,NFREQ1                                                      000498
      I1=I+1                                                                000499
      OMEGA(I1)=OMEGA(I)+20.0                                               000500
   10 CONTINUE                                                              000501
C                                                                           000502
C     DEFINE THE NUMBER OF MINIMAX FUNCTIONS RESULTING FROM THE             000503
C     SPECIFICATIONS ON RETURN LOSS                                         000504
C                                                                           000505
      NFRL=23                                                               000506
C                                                                           000507
C     DEFINE CODES AND ARRAYS REQUIRED FOR RETURN LOSS OPTIMIZATION         000508
C                                                                           000509
      DO 150 I=1,23                                                         000510
      RLSCODE(I)=-1                                                         000511
      SLRL(I)=20.0                                                          000512
      WLRL(I)=1.0                                                           000513
  150 CONTINUE                                                              000514
C                                                                           000515
C     DEFINE CHANNEL BAND CODE (CHANNEL, FREQUENCY EDGE INDEX), WHERE       000516
C     THE FIRST CHANNEL IS CLOSEST TO THE SHORT CIRCUIT AND CORRESPONDS     000517
C     TO THE HIGHEST CENTER FREQUENCY, AND THE FREQUENCY EDGES ARE 1        000518
C     FOR LOWER EDGE AND 2 FOR UPPER EDGE. THE VALUE OF CHBCODE CORRES-     000519
C     PONDS TO THE FREQUENCY POINT INDEX USED AS ARGUMENT OF OMEGA(I).      000520
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C     IF THERE IS NO SPECIFICATION FOR A PARTICULAR CHANNEL, THE VALUE      000521
C     OF CHBCODE MUST BE SET TO 0.                                          000522
C                                                                           000523
C                                                                           000524
C     DEFINE THE SPECIFICATION CODE FOR INSERTION LOSS OPTIMIZATION         000525
C     (FREQUENCY INDEX, CHANNEL)                                            000526
C                                                                           000527
C                                                                           000528
C     DEFINE VALUES FOR THE SPECIFICATIONS (FREQUENCY INDEX, CHANNEL)       000529
C                                                                           000530
C                                                                           000531
C     DEFINE WEIGHTING FACTORS CORRESPONDING TO THE SPECIFICATIONS          000532
C                                                                           000533
C                                                                           000534
C     ARGUMENTS OF THE MINIMAX OPTIMIZATION(MMLC) CALL STATEMENT            000535
C                                                                           000536
C     FDF    - NAME OF A SUBROUTINE CALCULATING MINIMAX FUNCTIONS AND       000537
C              THEIR DERIVATIVES AT THE POINT DEFINED BY THE X VECTOR.      000538
C              THE NAME FDF IS ARBITRARY AND MUST APPEAR IN THE EXTER-      000539
C              NAL STATEMENT IN THE SEGMENT CALLING MMLC1A.                 000540
C     NV     - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF OP-      000541
C              TIMIZATION VARIABLES. ITS VALUE MUST BE POSITIVE AND IS      000542
C              NOT CHANGED BY THE PACKAGE.                                  000543
C     MF     - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF RE-      000544
C              SIDUAL FUNCTIONS DEFINING THE MINIMAX OBJECTIVE FUNCTION.    000545
C              ITS VALUE MUST BE POSITIVE AND IS NOT CHANGED BY THE PA-     000546
C              CKAGE.                                                       000547
C     L      - INTEGER ARGUMENT WHICH MUST BE SET TO THE TOTAL NUMBER       000548
C              OF EQUALITY AND INEQUALITY CONSTRAINTS. ITS VALUE MUST       000549
C              BE POSITIVE OR ZERO AND IT IS NOT CHANGED BY THE PACKA-      000550
C              GE.                                                          000551
C     LEQ    - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF EQ-      000552
C              UALITY CONSTRAINTS. ITS VALUE MUST BE POSITIVE OR ZERO       000553
C              AND NOT GREATER THAN NV, AND NOT GREATER THAN L. ITS         000554
C              VALUE IS NOT CHANGED BY THE PACKAGE.                         000555
C     B      - REAL ARRAY OF LENGTH IIC > L. THE ELEMENTS OF B MUST BE      000556
C              SET TO THE CONSTANT TERMS IN THE LINEAR CONSTRAINTS.         000557
C              THE CONTENTS OF B ARE NOT CHANGED BY THE PACKAGE.            000558
C     C      - REAL MATRIX OF DIMENSIONS (IIC,NV). THE FIRST L ROWS OF      000559
C              C MUST BE SET TO THE COEFFICIENTS OF X IN THE LINEAR         000560
C              CONSTRAINTS.                                                 000561
C     IIC    - INTEGER ARGUMENT WHICH MUST BE SET TO THE LENGTH OF THE      000562
C              ARRAY B AND TO NUMBER OF ROWS OF THE MATRIX C. ITS VA-       000563
C              LUE MUST NOT BE LESS THAN L, AND IT IS NOT CHANGED BY        000564
C              THE PACKAGE.                                                 000565
C     X      - REAL ARRAY OF LENGTH AT LEAST NV WHICH, ON ENTRY, MUST       000566
C              BE SET TO THE INITIAL APPROXIMATION OF THE SOLUTION.         000567
C              ON EXIT X CONTAINS THE BEST SOLUTION FOUND BY THE PACK-      000568
C              AGE.                                                         000569
C     DX     - REAL VARIABLE WHICH CONTROLS THE STEP LENGTH OF THE ITER-    000570
C              ATIVE ALGORITHM. ON ENTRY IT MUST BE SET TO AN INITIAL       000571
C              VALUE APPROXIMATELY EQUAL TO 0.1* X. THE VALUE OF DX         000572
C              MUST BE POSITIVE. ON EXIT DX CONTAINS THE LAST VALUE OF      000573
C              THE STEPSIZE. FOR EXTENSIVE DETAILS PLEASE REFER TO          000574
C              REPORT SOS-82-5-U2, AUGUST 1983.                             000575
C     EPS    - REAL VARIABLE WHICH ON ENTRY MUST BE SET TO THE REQUIRED     000576
C              ACCURACY OF THE SOLUTION. ON EXIT EPS CONTAINS THE LENGTH    000577
C              OF THE LAST STEP TAKEN IN THE ITERATION.                     000578
C     MAXF   - INTEGER VARIABLE WHICH MUST BE SET TO AN UPPER BOUND ON      000579
C              THE NUMBER OF CALLS OF FDF. ON EXIT MAXF CONTAINS THE        000580
C              NUMBER OF CALLS OF FDF THAT HAVE BEEN PERFORMED BY THE       000581
C              PACKAGE.                                                     000582
C     KEQS   - INTEGER VARIABLE WHICH MUST BE SET TO THE NUMBER OF SUC=     000583
C              CESSIVE ITERATIONS WITH IDENTICAL SETS OF ACTIVE RESIDUAL    000584
C              FUNCTIONS AND ACTIVE CONSTRAINTS THAT IS REQUIRED BEFORE     000585
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C                A SWITCH TO STAGE 2 IS MADE. ON EXIT KEQS CONTAINS THE      000586
C                NUMBER OF SWITCHES TO STAGE 2 THAT HAVE TAKEN PLACE.        000587
C      W       - REAL ARRAY WHICH IS USED FOR WORKING SPACE. ITS LENGTH      000588
C                IS GIVEN BY IW. ON EXIT THE FIRST MF ELEMENTS OF W CON-     000589
C                TAIN THE RESIDUAL FUNCTION VALUES AT THE SOLUTION.          000590
C      IW      - INTEGER ARGUMENT WHICH MUST BE SET TO THE LENGTH OF W.      000591
C                ITS VALUE MUST BE AT LEAST                                  000592
C                                                                            000593
C                     IWR=2*MF*NV+5*NV*NV+4*MF+8*NV+4*IIC+3                  000594
C                                                                            000595
C      ICH     - INTEGER ARGUMENT WHICH MUST BE SET TO THE UNIT NUMBER       000596
C                THAT IS TO BE USED FOR THE PRINTED OUTPUT GENERATED BY      000597
C                THE PACKAGE. IF ICH IS LESS THAN OR EQUAL TO ZERO, NO       000598
C                PRINTED OUTPUT WILL BE GENERATED BY THE PACKAGE.            000599
C      IPR     - INTEGER ARGUMENT WHICH CONTROLS THE PRINTED OUTPUT GE-      000600
C                NERATED BY THE PACKAGE. FOR EXTENSIVE DETAILS PLEASE        000601
C                REFER TO REPORT SOS-82-5-U2, AUGUST 1983.                   000602
C      IFALL   - INTEGER VARIABLE WHICH ON EXIT CONTAINS INFORMATION        000603
C                ABOUT THE SOLUTION:                                         000604
C                IFALL=-2 FEASIBLE REGION IS EMPTY,                          000605
C                IFALL=-1 INCORRECT INPUT DATA,                              000606
C                IFALL= 0 REGULAR SOLUTION; REQUIRED ACCURACY OBTAINED,      000607
C                IFALL= 1 SINGULAR SOLUTION; REQUIRED ACCURACY OBTAINED,     000608
C                IFALL= 2 MACHINE ACCURACY REACHED,                          000609
C                IFALL= 3 MAXIMUM NUMBER OF FUNCTION EVALUATIONS REACHED,    000610
C                IFALL= 4 ITERATION TERMINATED BY THE USER.                  000611
C                                                                            000612
C      DEFINE PARAMETERS FOR THE MMLC PACKAGE                                000613
C                                                                            000614
       NV=14                                                                 000615
       MF=23                                                                 000616
       L=0                                                                   000617
       LEQ=0                                                                 000618
       IIC=1                                                                 000619
       DX=0.05                                                               000620
       EPS=1.E-6                                                             000621
       MAXF=50                                                               000622
       KEQS=3                                                                000623
       IW=2000                                                               000624
       ICH=6                                                                 000625
       IPR=10                                                                000626
       NCOUNT=1                                                              000627
C                                                                            000628
       CALL MMLC1A(FDF,NV,MF,L,LEQ,B,C,IIC,X,DX,EPS,MAXF,KEQS,W,IW,ICH,      000629
      1            IPR,IFALL)                                               000630
C                                                                            000631
  900  STOP                                                                  000632
       END                                                                   000633
C                                                                            000634
```

```
C                                                                       000635
      SUBROUTINE FDF(NV,MF,X,DF,F)                                      000636
      REAL X(NV),F(MF),DF(MF,NV)                                        000637
      REAL OMEGA(25),SURL(25),SLRL(25),WURL(25),WLRL(25),               000638
     1     SU(20,16),SL(20,16),WU(20,16),WL(20,16)                      000639
      INTEGER RLSCODE(25),SPCODE(20,16),CHBCODE(16,2)                   000640
      REAL CM(16,8,8),WGL(16),DRL(100),FIL(16),DIL(16,100)              000641
      INTEGER IR(16),IRT(16),LC(16,36),KC(16,36)                        000642
      COMMON /BLK2/CM,WGL                                               000643
      COMMON /BLK3/OMEGA,SURL,SLRL,WURL,WLRL,SU,SL,WU,WL,               000644
     1             RLSCODE,SPCODE,NCOUNT,MODE,NCH,MO,                   000645
     2             NFREQ,NFRL,CHBCODE,IFLAGJS,IFLAGDP,IDISPER           000646
      COMMON/BLK8/IR,IRT,LC,KC                                          000647
C                                                                       000648
C     UPDATE OPTIMIZATION VARIABLES                                     000649
C                                                                       000650
      IF(IR(1).EQ.0)GO TO 20                                            000651
      IR1=IR(1)                                                         000652
      DO 10 IV=1,IR1                                                    000653
      CM(1,LC(1,IV),KC(1,IV))=X(IV)                                     000654
   10 CONTINUE                                                          000655
   20 DO 40 I=2,NCH                                                     000656
      IX=IRT(I-1)                                                       000657
      IF(IR(I).EQ.0) GO TO 40                                           000658
      IRI=IR(I)                                                         000659
      DO 30 IP=1,IRI                                                    000660
      IXX=IX+IP                                                         000661
      CM(I,LC(I,IP),KC(I,IP))=X(IXX)                                    000662
   30 CONTINUE                                                          000663
   40 CONTINUE                                                          000664
      DO 50 I=1,NCH                                                     000665
      WGL(I)=X(IRT(I))                                                  000666
   50 CONTINUE                                                          000667
C                                                                       000668
C     DEFINE MINIMAX FUNCTIONS AND THEIR GRADIENTS                      000669
C                                                                       000670
      NCHAN=NCH                                                         000671
      MORDER=MO                                                         000672
      KFRL=0                                                            000673
      KFUN=NFRL                                                         000674
      DO 100 I=1,NFREQ                                                  000675
      FREQ=OMEGA(I)                                                     000676
C                                                                       000677
      CALL SIMGRD(FREQ,FRL,DRL,FIL,DIL,NCHAN,MORDER,I,IFLAGJS,          000678
     1            IFLAGDP,IDISPER)                                      000679
C                                                                       000680
      IF(MODE.EQ.1)GO TO 199                                            000681
      IF(RLSCODE(I).EQ.0)GO TO 199                                      000682
      IF(RLSCODE(I).EQ.-1)GO TO 70                                      000683
      IF(RLSCODE(I).EQ.1)GO TO 75                                       000684
      KFRL=KFRL+1                                                       000685
      F(KFRL)=WURL(I)*(FRL-SURL(I))                                     000686
      DO 80 K1=1,NV                                                     000687
      DF(KFRL,K1)=WURL(I)*DRL(K1)                                       000688
   80 CONTINUE                                                          000689
      KFRL=KFRL+1                                                       000690
      F(KFRL)=-WLRL(I)*(FRL-SLRL(I))                                    000691
      DO 85 K2=1,NV                                                     000692
      DF(KFRL,K2)=-WLRL(I)*DRL(K2)                                      000693
   85 CONTINUE                                                          000694
      GO TO 199                                                         000695
   70 KFRL=KFRL+1                                                       000696
      F(KFRL)=-WLRL(I)*(FRL-SLRL(I))                                    000697
      DO 90 K3=1,NV                                                     000698
      DF(KFRL,K3)=-WLRL(I)*DRL(K3)                                      000699
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 90 CONTINUE                                                                    000700
    GO TO 199                                                                   000701
 75 KFRL=KFRL+1                                                                 000702
    F(KFRL)=WURL(I)*(FRL-SURL(I))                                               000703
    DO 95 K4=1,NV                                                               000704
    DF(KFRL,K4)=WURL(I)*DRL(K4)                                                 000705
 95 CONTINUE                                                                    000706
199 CONTINUE                                                                    000707
    IF(MODE.EQ.0)GO TO 100                                                      000708
    DO 105 J=1,NCH                                                              000709
    NCHECK=0                                                                    000710
    IF(I.GE.CHBCODE(J,1).AND.I.LE.CHBCODE(J,2))NCHECK=1                         000711
    IF(NCHECK.EQ.0)GO TO 105                                                    000712
    K=I-CHBCODE(J,1)+1                                                          000713
    IF(SPCODE(K,J).EQ.0)GO TO 105                                               000714
    IF(SPCODE(K,J).EQ.-1)GO TO 110                                              000715
    IF(SPCODE(K,J).EQ.1)GO TO 115                                               000716
    KFUN=KFUN+1                                                                 000717
    F(KFUN)=WU(K,J)*(FIL(J)-SU(K,J))                                            000718
    DO 120 I1=1,NV                                                              000719
    DF(KFUN,I1)=WU(K,J)*DIL(J,I1)                                               000720
120 CONTINUE                                                                    000721
    KFUN=KFUN+1                                                                 000722
    F(KFUN)=-WL(K,J)*(FIL(J)-SL(K,J))                                           000723
    DO 125 I2=1,NV                                                              000724
    DF(KFUN,I2)=-WL(K,J)*DIL(J,I2)                                              000725
125 CONTINUE                                                                    000726
    GO TO 105                                                                   000727
110 KFUN=KFUN+1                                                                 000728
    F(KFUN)=-WL(K,J)*(FIL(J)-SL(K,J))                                           000729
    DO 130 I3=1,NV                                                              000730
    DF(KFUN,I3)=-WL(K,J)*DIL(J,I3)                                              000731
130 CONTINUE                                                                    000732
    GO TO 105                                                                   000733
115 KFUN=KFUN+1                                                                 000734
    F(KFUN)=WU(K,J)*(FIL(J)-SU(K,J))                                            000735
    DO 135 I4=1,NV                                                              000736
    DF(KFUN,I4)=WU(K,J)*DIL(J,I4)                                               000737
135 CONTINUE                                                                    000738
105 CONTINUE                                                                    000739
100 CONTINUE                                                                    000740
    NCOUNT=NCOUNT+1                                                             000741
    RETURN                                                                      000742
    END                                                                         000743
```

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LINEARLY CONSTRAINED MINIMAX OPTIMIZATION (MMLC PACKAGE) (V:82.04)

MULTIPLEXER PROBLEM MXTST5

INPUT DATA

NUMBER OF VARIABLES (N)	14
NUMBER OF FUNCTIONS (M)	23
TOTAL NUMBER OF LINEAR CONSTRAINTS (L)	0
NUMBER OF EQUALITY CONSTRAINTS (LEQ)	0
STEP LENGTH (DX)	5.000E-02
ACCURACY (EPS)	1.000E-06
MAX NUMBER OF FUNCTION EVALUATIONS (MAXF)	50
NUMBER OF SUCCESSIVE ITERATIONS (KEQS)	3
WORKING SPACE (IW)	2000
PRINTOUT CONTROL (IPR)	10

STARTING POINT :

	VARIABLES		FUNCTION VALUES
1	6.120000000000E-01	1	8.541161677208E+00
2	6.490000000000E-01	2	1.263209543037E+01
3	6.350000000000E-01	3	-1.798869126660E+00
4	6.390000000000E-01	4	-2.465549851873E+00
5	6.420000000000E-01	5	-9.424023791436E+00
6	6.550000000000E-01	6	1.608221853995E+01
7	6.590000000000E-01	7	3.542946897279E+00
8	6.640000000000E-01	8	5.022901175288E+00
9	6.580000000000E-01	9	-3.880235261511E+01
10	6.400000000000E-01	10	-5.258273641275E-01
11	9.650000000000E-01	11	-7.784509841135E+00
12	6.810000000000E-01	12	-8.695288891806E+00
13	5.820000000000E-01	13	-6.451396243270E+00
14	3.420000000000E-01	14	-7.507301664909E+00
		15	-5.429470068086E+00
		16	-7.459300495708E+00
		17	-6.338927924887E+00
		18	-2.211925012621E-01
		19	-3.734114505165E+00
		20	-1.062637849436E+00
		21	-4.353682407357E+00
		22	-9.432690656715E-01
		23	-9.839313195642E+00

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LINEARLY CONSTRAINED MINIMAX OPTIMIZATION (MMLC PACKAGE) (V:82.04)

MULTIPLEXER PROBLEM MXTST3

SOLUTION

	VARIABLES		FUNCTION VALUES
1	6.162514713052E-01	1	9.294502749235E+00
2	6.487688257528E-01	2	2.715069026169E+00
3	6.275662662271E-01	3	-1.171671222620E+00
4	6.255317523370E-01	4	-5.159864380883E+00
5	6.263763988010E-01	5	-1.038743920468E+01
6	6.426781451475E-01	6	9.295563982824E+00
7	6.538057153148E-01	7	8.602608824877E+00
8	6.695819607321E-01	8	5.592213998151E+00
9	6.773647361084E-01	9	3.229353569422E+00
10	6.787002040090E-01	10	1.415588625863E+00
11	1.016034279879E+00	11	1.776442700344E-01
12	6.921680661541E-01	12	6.225837915166E-01
13	6.907075707817E-01	13	-1.466889109184E+00
14	3.525038859824E-01	14	3.634119888160E+00
		15	-3.864650025191E+00
		16	4.882076855633E+00
		17	-6.506456264401E+00
		18	6.875974888589E+00
		19	-6.829541072173E+00
		20	4.963369537767E+00
		21	-6.749668583635E+00
		22	2.023295511106E+00
		23	-1.195515418328E+01

TYPE OF SOLUTION (IFALL) 3

NUMBER OF FUNCTION EVALUATIONS 50

NUMBER OF SHIFTS TO STAGE-2 4

EXECUTION TIME (IN SECONDS) 238.938