OSA

CONTIGUOUS BAND MULTIPLEXER SIMULATION AND OPTIMIZATION

OSA-84-MX-2-T

January 31, 1984

Optimization Systems Associates

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Five channel, 5 variable spacing optimization

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      PROGRAM MXSOS(OUTPUT,TAPE6=OUTPUT)                                    000001
                                                                            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(5),W(4000),B(1),C(1,1),T(3),DISP(8),QO(8)                      000023
      REAL OMEGA(47),SURL(47),SLRL(47),WURL(47),WLRL(47),                   000024
     1     SU(100,8),SL(100,8),WU(100,8),WL(100,8)                         000025
      INTEGER RLSCODE(47),SPCODE(100,8),CHBCODE(8,2)                        000026
      REAL WO(8),BW(8),CM(8,8,8),PN1(8),PN2(8),SPN1(8),SPN2(8),             000027
     1          GL(8),WGL(8),DIA(8)                                         000028
      INTEGER CEL(8,8,8)                                                    000029
      REAL FCNST(8),LAMRES(8),LAMDEL(8)                                     000030
      REAL DRL(296),FIL(8),DIL(8,296)                                       000031
      REAL ANGLE1(8),ANGLE2(8),GRDEL(8)                                     000032
      INTEGER IR(8),IRT(8),LC(8,36),KC(8,36)                                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 ,10HMXTST3A   /                     000045
                                                                            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
                                                                            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      PI2     - 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=5                                                               000089
       MO=6                                                                000090
       NP1=NCH+1                                                           000091
C                                                                          000092
C      DEFINE CENTER FREQUENCIES IN MHZ                                     000093
C                                                                          000094
       WO(1)=12100.0                                                       000095
       WO(2)=12060.0                                                       000096
       WO(3)=12020.0                                                       000097
       WO(4)=11980.0                                                       000098
       WO(5)=11940.0                                                       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
       SPN1(I)=0.69967                                                     000118
       SPN2(I)=1.09450                                                     000119
       PN1(I)=SQRT(SPN1(I))                                                000120
       PN2(I)=SQRT(SPN2(I))                                                000121
       GL(I)=1.0                                                           000122
     1 CONTINUE                                                            000123
C                                                                          000124
C      DEFINE THE SYMMETRICAL COUPLING MATRIX. ONLY THE UPPER PART OF THE   000125
C      CM MATRIX HAS TO BE DEFINED.                                        000126
C                                                                          000127
       DO 30 I=1,NCH                                                       000128
       DO 30 J=1,MO                                                        000129
       DO 30 KK=1,MO                                                       000130
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      CM(I,J,KK)=0.0                                                    000131
   80 CONTINUE                                                          000132
      DO 2 I=1,NCH                                                      000133
      CM(I,1,2)=0.59395                                                 000134
      CM(I,2,3)=0.53514                                                 000135
      CM(I,3,4)=0.42471                                                 000136
      CM(I,3,6)=-0.39967                                                000137
      CM(I,4,5)=0.83371                                                 000138
      CM(I,5,6)=0.76313                                                 000139
    2 CONTINUE                                                          000140
C                                                                       000141
C     DEFINE THE TYPE OF COUPLING IN THE FILTER                         000142
C             +1 >> SCREW COUPLING    -1 >> IRIS COUPLING               000143
C                                                                       000144
      DO 71 I=1,NCH                                                     000145
      DO 71 J=1,MO                                                      000146
      DO 71 KK=1,MO                                                     000147
      CEL(I,J,KK)=0                                                     000148
   71 CONTINUE                                                          000149
C                                                                       000150
      DO 72 I=1,NCH                                                     000151
      CEL(I,1,2)=1                                                      000152
      CEL(I,2,3)=-1                                                     000153
      CEL(I,3,4)=1                                                      000154
      CEL(I,3,6)=-1                                                     000155
      CEL(I,4,5)=-1                                                     000156
      CEL(I,5,6)=1                                                      000157
C                                                                       000158
      DO 72 J=1,MO                                                      000159
      DO 72 KK=1,J                                                      000160
      CEL(I,J,KK)=CEL(I,KK,J)                                           000161
   72 CONTINUE                                                          000162
C                                                                       000163
C     DEFINE THE SECTION LENGTHS(SPACINGS ALONG THE WAVEGUIDE MANIFOLD) 000164
C                                                                       000165
      WGL(1)=0.657                                                      000166
      WGL(2)=0.641                                                      000167
      WGL(3)=0.631                                                      000168
      WGL(4)=0.633                                                      000169
      WGL(5)=0.633                                                      000170
C                                                                       000171
C     DEFINE SOME CONSTANTS, SOURCE VOLTAGE, SOURCE RESISTANCE, TWICE PI000172
C     MANIFOLD WIDTH                                                    000173
C                                                                       000174
      VS=1.0                                                            000175
      RS=1.0                                                            000176
      PI2=8.0*ATAN(1.0)                                                 000177
      WIDTH=0.75                                                        000178
C                                                                       000179
C     THE MXSOS PACKAGE CAN EXPLOIT THREE PRACTICAL MODELS OF THE       000180
C     MULTIPLEXER AS DETERMINED BY THE PARAMETERS IFLAGJS, IFLAGDP      000181
C     AND IDISPER.                                                      000182
C                                                                       000183
C     IFLAGJS                                                           000184
C     0 - IF JUNCTIONS ARE IDEAL                                        000185
C     1 - IF JUNCTIONS ARE NONIDEAL                                     000186
C                                                                       000187
C     IFLAGDP                                                           000188
C     0 - IF FILTERS ARE LOSSLESS                                       000189
C     1 - IF FILTERS ARE LOSSY                                          000190
C                                                                       000191
C     IDISPER                                                           000192
C     0 - IF FILTERS ARE DISPERSIVE                                     000193
C     1 - IF FILTERS ARE NONDISPERSIVE                                  000194
C                                                                       000195
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C      FLAG FOR JUNCTION SUSCEPTANCE (SET TO 0 OR 1)                    000196
C                                                                       000197
       IFLAGJS=1                                                        000198
       IF(IFLAGJS.NE.1)GO TO 42                                         000199
C                                                                       000200
       CALL CONST1(WIDTH)                                               000201
C                                                                       000202
   42  CONTINUE                                                         000203
C                                                                       000204
C      FLAG FOR FILTER DISSIPATION (SET TO 0 OR 1)                      000205
C                                                                       000206
       IFLAGDP=1                                                        000207
       IF(IFLAGDP.NE.1)GO TO 43                                         000208
C                                                                       000209
       CALL DISPAT(NCH,WO,BW,QO)                                        000210
C                                                                       000211
   43  CONTINUE                                                         000212
C                                                                       000213
C      FLAG FOR DISPERSIVE EFFECTS IN THE COUPLED CAVITY FILTERS        000214
C      (SET TO 0 OR 1)                                                  000215
C                                                                       000216
       IDISPER=1                                                        000217
       IF(IDISPER.NE.1)GO TO 44                                         000218
C                                                                       000219
       CALL DISPER(NCH,WO,BW,DIA)                                       000220
C                                                                       000221
   44  CONTINUE                                                         000222
C                                                                       000223
C      CHECK WHETHER THE SIMULATION MODE IS REQUIRED                    000224
C                                                                       000225
       IF(LMODE.NE.1)GO TO 16                                           000226
C                                                                       000227
C      SIMULATION, CORRESPONDING TO LMODE=1                             000228
C                                                                       000229
C      THIS PART OF THE MAIN SEGMENT IS USED TO GENERATE FREQUENCIES AT 000230
C      WHICH SIMULATION IS TO BE PERFORMED. A FREQUENCY STEP OF 1 MHZ IS000231
C      ASSUMED. NONE OF THE GENERATED FREQUENCIES MUST BE SET EQUAL TO  000232
C      ANY OF THE CENTER FREQUENCIES. SUBROUTINE "SIMUL" IS CALLED AT   000233
C      EACH GENERATED FREQUENCY. IF A DIFFERENT FREQUENCY STEP IS REQUI-000234
C      RED THE FREQUENCY POINTS FOR SIMULATION HAVE TO BE GENERATED IN A000235
C      DIFFERENT WAY.                                                   000236
C                                                                       000237
C      FREQST - START FREQUENCY FOR SIMULATION                          000238
C      FREQ   - ACTUAL FREQUENCY AT WHICH "SIMUL" IS CALLED             000239
C      NFRSIM - NUMBER OF FREQUENCY POINTS FOR SIMULATION               000240
C                                                                       000241
       PRINT(6,199)                                                     000242
  199  FORMAT(1H1)                                                      000243
       PRINT(6,205)                                                     000244
  205  FORMAT(6X,"FREQUENCY",5X,"RETURN LOSS",5X,"INSERTION LOSS",      000245
     1         8X,"FREQUENCY FOR",7X,"GROUP DELAY")                     000246
       PRINT(6,206)                                                     000247
  206  FORMAT(8X,"MHZ",9X,"COMMON PORT",9X,"DB",17X,"GROUP DELAY",      000248
     1        9X,"NANO SECS")                                           000249
C                                                                       000250
C                                                                       000251
C      THE FOLLOWING TWO PARAMETERS MUST BE DEFINED                     000252
C                                                                       000253
       FREQST=11919.0                                                   000254
       NFRSIM=200                                                       000255
C                                                                       000256
       NCHAN=NCH                                                        000257
       MORDER=MO                                                        000258
       IREL=NCH+1                                                       000259
       DO 200 ICOUNT=1,NFRSIM                                           000260
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      FREQ=FREQST+FLOAT(ICOUNT)                                          000261
      ITEST=INT(FREQ)                                                    000262
C                                                                        000263
C     THE FOLLOWING STATEMENT PRINTS DASHED LINE EVERY 20 MHZ            000264
C                                                                        000265
      IF(MOD(ITEST,20).EQ.0)PRINT(6,208)                                 000266
  208 FORMAT(90("-"))                                                    000267
      DO 210 I=1,NCH                                                     000268
      IF(ABS(FREQ-WO(I)).LT.1.E-10)FREQ=FREQ+0.001                       000269
  210 CONTINUE                                                           000270
C                                                                        000271
C     GROUP DELAY IS ESTIMATED FROM THE PHASE DIFFERENCE AT TWO          000272
C     FREQUENCIES, NAMELY, THE SELECTED FREQUENCY AND THE SELECTED       000273
C     FREQUENCY MINUS 0.5 MHZ. CONSEQUENTLY, THE EVALUATION IS A         000274
C     TRUE QUADRATIC APPROXIMATION AT THE SELECTED FREQUENCY MINUS       000275
C     0.25 MHZ. THUS, A SEPARATE COLUMN OF FREQUENCIES AND GROUP         000276
C     DELAYS IS GENERATED AND PRINTED OUT.                               000277
C                                                                        000278
C     SUBTRACT 0.5 MHZ FROM FREQ                                         000279
C                                                                        000280
      FREQ=FREQ-0.5                                                      000281
C                                                                        000282
      CALL SIMUL(FREQ,NCHAN,MORDER,ICOUNT,IFLAGJS,IFLAGDP,IDISPER,       000283
     1           FRL,FIL,ANGLE1)                                         000284
C                                                                        000285
C     RESET FREQ BY ADDING 0.5 MHZ                                       000286
C                                                                        000287
      FREQ=FREQ+0.5                                                      000288
C                                                                        000289
      CALL SIMUL(FREQ,NCHAN,MORDER,ICOUNT,IFLAGJS,IFLAGDP,IDISPER,       000290
     1           FRL,FIL,ANGLE2)                                         000291
C                                                                        000292
      DO 300 I=1,NCH                                                     000293
      DELANG=ANGLE2(I)-ANGLE1(I)                                         000294
      PI=PI2/2.0                                                         000295
      IF(DELANG.GT.PI)DELANG=DELANG-PI2                                  000296
      GRDEL(I)=-2000.0*DELANG/PI2                                        000297
  300 CONTINUE                                                           000298
C                                                                        000299
C     THE FOLLOWING STATEMENT CAUSES THE PRINTING OF INSERTION LOSS      000300
C     FUNCTION VALUES ONLY FOR THE BAND OF INTEREST.                     000301
C                                                                        000302
      IF(MOD(ITEST,40).EQ.0)IREL=IREL-1                                  000303
C                                                                        000304
C     GROUP DELAY IS ESTIMATED AT FREQ MINUS 0.25 MHZ                    000305
C                                                                        000306
      FRGROUP=FREQ-0.25                                                  000307
      PRINT(6,207)FREQ,FRL,FIL(IREL),FRGROUP,GRDEL(IREL)                 000308
  207 FORMAT(6X,F7.1,9X,F5.2,12X,F5.2,17X,F8.2,10X,F8.2)                 000309
  200 CONTINUE                                                           000310
      GO TO 900                                                          000311
C                                                                        000312
C     SENSITIVITY ANALYSIS, CORRESPONDING TO LMODE=2                     000313
C                                                                        000314
C     THIS PART OF THE MAIN PROGRAM IS USED TO DEFINE CODES FOR MULTI-   000315
C     PLEXER PARAMETERS W.R.T. WHICH WE WANT TO FIND THE SENSITIVITIES.  000316
C     SECTION LENGTHS(SPACINGS) ARE ASSUMED TO BE SUCH PARAMETERS AL-    000317
C     WAYS, SO NO CODES ARE REQUIRED FOR THEM. THE PARAMETER IR=0 SIG-   000318
C     NIFIES THAT SPACINGS ARE THE ONLY VARIABLES. SUBROUTINE "SIMGRD"   000319
C     IS CALLED AT EACH FREQUENCY DEFINED IN THE VECTOR OMEGA(I).        000320
C                                                                        000321
C     IR      - VECTOR CONTAINING THE NUMBER OF COUPLING PARAMETERS BE-  000322
C               ING VARIABLES FOR EACH CHANNEL                           000323
C     LC      - MATRIX CONTAINING THE ROW INDICES OF COUPLING PARAMETERS 000324
C               BEING VARIABLES FOR EACH CHANNEL                         000325
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C      KC      - MATRIX CONTAINING THE COLUMN INDICES OF COUPLING PARAME-    000326
C                TERS BEING VARIABLES FOR EACH CHANNEL                       000327
C      OMEGA   - VECTOR OF ARBITRARY FREQUENCIES (EXCEPT CENTER FREQUEN-    000328
C                CIES) AT WHICH THE SENSITIVITY ANALYSIS IS TO BE PERFOR-    000329
C                MED.                                                       000330
C      FRSNS   - ACTUAL FREQUENCY AT WHICH THE SUBROUTINE "SIMGRD" IS       000331
C                CALLED                                                     000332
C      NV      - TOTAL NUMBER OF VARIABLES W.R.T. WHICH THE SENSITIVITIES   000333
C                ARE REQUIRED                                               000334
C      FRL     - VALUE OF THE COMMON PORT RETURN LOSS IN DB AT THE FREQU-   000335
C                ENCY FRSNS                                                 000336
C      DRL     - SENSITIVITIES OF THE COMMON PORT RETURN LOSS W.R.T. ALL    000337
C                VARIABLES                                                  000338
C      FIL     - VECTOR OF THE INSERTION LOSS FUNCTION IN DB FOR EACH       000339
C                CHANNEL AT THE FREQUENCY FRSNS                             000340
C      DIL     - MATRIX OF SENSITIVITIES OF THE INSERTION LOSS FUNCTION     000341
C                FOR EACH CHANNEL W.R.T. ALL VARIABLES                      000342
C                                                                           000343
C      DEFINE THE NUMBER OF COUPLING VARIABLES PER CHANNEL                  000344
C                                                                           000345
   16  DO 55 I=1,NCH                                                       000346
       IR(I)=0                                                             000347
   55  CONTINUE                                                            000348
C                                                                          000349
C      EVALUATE THE TOTAL NUMBER OF VARIABLES ACCUMULATED AFTER             000350
C      EACH SECTION                                                        000351
C                                                                          000352
       CALL TOTAL(NCH,IR,IRT)                                              000353
C                                                                          000354
C      DEFINE CODES FOR THE VARIABLES                                      000355
C                                                                          000356
C                                                                          000357
C      CHECK WHETHER THE SIMULATION AND SENSITIVITY ANALYSIS MODE          000358
C      IS REQUIRED                                                         000359
C                                                                          000360
       IF(LMODE.NE.2) GO TO 17                                             000361
C                                                                          000362
C      GENERATE FREQUENCY POINTS IN MHZ                                    000363
C                                                                          000364
       NFREQ=1                                                             000365
       OMEGA(1)=11899.0                                                    000366
       NCHAN=NCH                                                           000367
       MORDER=MO                                                           000368
       DO 18 ICOUNT=1,NFREQ                                                000369
       FRSNS=OMEGA(ICOUNT)                                                 000370
C                                                                          000371
       CALL SIMGRD(FRSNS,FRL,DRL,FIL,DIL,NCHAN,MORDER,ICOUNT,IFLAGJS,      000372
      1            IFLAGDP,IDISPER)                                        000373
C                                                                          000374
   18  CONTINUE                                                            000375
       GO TO 900                                                           000376
C                                                                          000377
C      OPTIMIZATION, CORRESPONDING TO LMODE=3                              000378
C                                                                          000379
C      THIS PART OF THE MAIN SEGMENT IS USED TO DEFINE ALL VARIABLES AND   000380
C      ARRAYS FOR MULTIPLEXER OPTIMIZATION. TO SELECT THE MULTIPLEXER PA-  000381
C      RAMETERS WHICH ARE THE OPTIMIZATION VARIABLES THE MATRICES LC AND   000382
C      KC HAVE TO BE USED AS DESCRIBED IN THE SENSITIVITY ANALYSIS PART.   000383
C      SECTION LENGTHS ARE ALWAYS ASSUMED TO BE OPTIMIZATION VARIABLES,    000384
C      SO NO CODES ARE REQUIRED FOR THEM. THREE MODES OF OPTIMIZATION ARE  000385
C      ALLOWED. TO SELECT THE DESIRED MODE OF OPTIMIZATION SET PARAMETER   000386
C      MODE TO                                                             000387
C      0 - IF ONLY COMMON PORT RETURN LOSS OPTIMIZATION IS REQUIRED        000388
C      1 - IF ONLY INSERTION LOSS OPTIMIZATION IS REQUIRED                 000389
C      2 - IF BOTH RETURN LOSS AND INSERTION LOSS OPTIMIZATION ARE         000390
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C          REQUIRED.                                                    000391
C       IN EACH CASE A DIFFERENT HEADER FOR THE PRINTOUT OF OPTIMIZATION 000392
C       RESULTS CAN BE OBTAINED BY CALLING THE SUBROUTINE "MMXHDR" FOR   000393
C       WHICH THE ARGUMENT T CAN BE DEFINED USING THE DATA STATEMENT. VA-000394
C       LUES OF OPTIMIZATION VARIABLES AT THE STARTING POINT MUST BE SUP-000395
C       PLIED BY DEFINING THE X VECTOR USING EITHER THE DATA STATEMENT OR000396
C       EXPLICITLY. THE MINIMAX FUNCTIONS ARE CREATED AT THE FREQUENCIES 000397
C       DEFINED IN THE VECTOR OMEGA(I), WHICH IS A REAL ARRAY OF LENGTH  000398
C       AT LEAST NFREQ.                                                  000399
C                                                                        000400
C       NFREQ  - NUMBER OF FREQUENCY POINTS AT WHICH THE MINIMAX FUNCTI- 000401
C                ONS ARE TO BE CREATED                                   000402
C       OMEGA  - VECTOR OF ARBITRARY FREQUENCY POINTS (EXCEPT CENTER FRE-000403
C                QUENCIES) IN MHZ AT WHICH THE MINIMAX FUNCTIONS ARE TO  000404
C                BE CREATED                                              000405
C       NFRL   - NUMBER OF MINIMAX FUNCTIONS CREATED DUE TO RETURN LOSS  000406
C                SPECIFICATIONS                                          000407
C                                                                        000408
C       ARRAYS AND CODES FOR COMMON PORT RETURN LOSS OPTIMIZATION        000409
C                                                                        000410
C       RLSCODE- INTEGER ARRAY OF LENGTH AT LEAST NFREQ. EACH ELEMENT MUST 000411
C                BE SET TO THE FOLLOWING SPECIFICATION CODE VALUE AT EACH000412
C                FREQUENCY :                                             000413
C                 0 - NO SPECIFICATION REQUIRED                          000414
C                -1 - ONLY LOWER SPECIFICATION REQUIRED                  000415
C                 1 - ONLY UPPER SPECIFICATION REQUIRED                  000416
C                 2 - BOTH UPPER AND LOWER SPECIFICATIONS REQUIRED       000417
C       SURL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE000418
C                UPPER SPECIFICATIONS APPLICABLE AT EACH FREQUENCY        000419
C       SLRL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE000420
C                LOWER SPECIFICATIONS APPLICABLE AT EACH FREQUENCY        000421
C       WURL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE000422
C                WEIGHTING FACTORS CORRESPONDING TO UPPER SPECIFICATIONS  000423
C       WLRL   - REAL ARRAY OF LENGTH AT LEAST NFREQ. IT MUST CONTAIN THE000424
C                WEIGHTING FACTORS CORRESPONDING TO LOWER SPECIFICATIONS  000425
C                                                                        000426
C       ARRAYS AND CODES FOR INSERTION LOSS OPTIMIZATION                 000427
C                                                                        000428
C       CHBCODE- INTEGER ARRAY OF DIMENSIONS AT LEAST NCH BY 2. EACH ROW 000429
C                MUST CONTAIN THE RANGE OF FREQUENCIES OVER WHICH SPECI- 000430
C                FICATIONS FOR THE CORRESPONDING CHANNEL ARE GIVEN. THE  000431
C                FIRST ELEMENT OF A ROW INDICATES THE LOWER FREQUENCY    000432
C                EDGE OF INTEREST, THE SECOND THE UPPER FREQUENCY EDGE.  000433
C       SPCODE - INTEGER ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH.     000434
C                NSPMAX IS THE MAXIMUM NUMBER OF FREQUENCY POINTS CONSI- 000435
C                DERED FOR ANY OF THE CHANNELS.                          000436
C                EACH COLUMN MUST CONTAIN THE SPECIFICATION CODE AT EACH 000437
C                FREQUENCY FOR THE CORRESPONDING CHANNEL. EACH ELEMENT   000438
C                OF A COLUMN MUST BE SET TO ONE OF THE FOLLOWING VALUES: 000439
C                 0 - NO SPECIFICATION REQUIRED                          000440
C                -1 - ONLY LOWER SPECIFICATION REQUIRED                  000441
C                 1 - ONLY UPPER SPECIFICATION REQUIRED                  000442
C                 2 - BOTH UPPER AND LOWER SPECIFICATIONS REQUIRED       000443
C       SU     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT     000444
C                MUST CONTAIN THE UPPER SPECIFICATIONS FOR EACH CHANNEL  000445
C                ORDERED CONSECUTIVELY W.R.T. FREQUENCY INDEX IMPLIED    000446
C                BY THE CHBCODE MATRIX IN THE FORM (FREQUENCY INDEX,     000447
C                CHANNEL).                                               000448
C       SL     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT     000449
C                MUST CONTAIN THE LOWER SPECIFICATIONS FOR EACH CHANNEL  000450
C                ORDERED CONSECUTIVELY W.R.T. FREQUENCY INDEX IMPLIED    000451
C                BY THE CHBCODE MATRIX IN THE FORM (FREQUENCY INDEX,     000452
C                CHANNEL).                                               000453
C       WU     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT     000454
C                MUST CONTAIN THE WEIGHTING FACTORS FOR UPPER SPECIFI-    000455
```

```
C                CATIONS. IT IS ARRANGED TO CORRESPOND TO SU.                  000456
C       WL     - REAL ARRAY OF DIMENSIONS AT LEAST NSPMAX BY NCH. IT           000457
C                MUST CONTAIN THE WEIGHTING FACTORS FOR LOWER SPECIFI-         000458
C                CATIONS. IT IS ARRANGED TO CORRESPOND TO SL.                  000459
C                                                                              000460
C                                                                              000461
   17 CALL MMXHDR(3,T)                                                         000462
C                                                                              000463
C      SELECT THE DESIRED MODE OF OPTIMIZATION                                 000464
C                                                                              000465
       MODE=2                                                                  000466
C                                                                              000467
C      THE STARTING POINT MUST BE INITIALIZED BY SETTING CONSECUTIVELY         000468
C      NUMBERED X VALUES                                                       000469
C                                                                              000470
       DO 7 I=1,5                                                              000471
       X(I)=WGL(I)                                                             000472
    7  CONTINUE                                                                000473
C                                                                              000474
C      GENERATE FREQUENCY POINTS IN MHZ                                        000475
C                                                                              000476
       NFREQ=47                                                                000477
       OMEGA(1)=11962.0                                                        000478
       OMEGA(2)=11964.0                                                        000479
       OMEGA(3)=11966.0                                                        000480
       OMEGA(4)=11968.0                                                        000481
       OMEGA(5)=11970.0                                                        000482
       OMEGA(6)=11972.0                                                        000483
       OMEGA(7)=11976.0                                                        000484
       OMEGA(8)=11980.0001                                                     000485
       OMEGA(9)=11984.0                                                        000486
       OMEGA(10)=11988.0                                                       000487
       OMEGA(11)=11990.0                                                       000488
       OMEGA(12)=11992.0                                                       000489
       OMEGA(13)=11994.0                                                       000490
       OMEGA(14)=11996.0                                                       000491
       OMEGA(15)=11998.0                                                       000492
       DO 10 I=16,45                                                           000493
       OMEGA(I)=OMEGA(I-15)+40.0                                               000494
   10  CONTINUE                                                                000495
       OMEGA(46)=12000.0                                                       000496
       OMEGA(47)=12040.0                                                       000497
C                                                                              000498
C      DEFINE THE NUMBER OF MINIMAX FUNCTIONS RESULTING FROM THE               000499
C      SPECIFICATIONS ON RETURN LOSS                                           000500
C                                                                              000501
       NFRL=2                                                                  000502
C                                                                              000503
C      DEFINE CODES AND ARRAYS REQUIRED FOR RETURN LOSS OPTIMIZATION           000504
C                                                                              000505
       DO 150 I=1,45                                                           000506
       RLSCODE(I)=0                                                            000507
  150  CONTINUE                                                                000508
       RLSCODE(46)=-1                                                          000509
       RLSCODE(47)=-1                                                          000510
       SLRL(46)=20.0                                                           000511
       SLRL(47)=20.0                                                           000512
       WLRL(46)=1.0                                                            000513
       WLRL(47)=1.0                                                            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
```

```
C     IF THERE IS NO SPECIFICATION FOR A PARTICULAR CHANNEL, THE VALUE     000521
C     OF CHBCODE MUST BE SET TO 0.                                         000522
C                                                                          000523
      CHBCODE(1,1)=0                                                       000524
      CHBCODE(1,2)=0                                                       000525
      CHBCODE(2,1)=31                                                      000526
      CHBCODE(2,2)=45                                                      000527
      CHBCODE(3,1)=16                                                      000528
      CHBCODE(3,2)=30                                                      000529
      CHBCODE(4,1)=1                                                       000530
      CHBCODE(4,2)=15                                                      000531
      CHBCODE(5,1)=0                                                       000532
      CHBCODE(5,2)=0                                                       000533
C                                                                          000534
C     DEFINE THE SPECIFICATION CODE FOR INSERTION LOSS OPTIMIZATION        000535
C     (FREQUENCY INDEX, CHANNEL)                                           000536
C                                                                          000537
      DO 15 I=1,15                                                         000538
      SPCODE(I,1)=0                                                        000539
      SPCODE(I,5)=0                                                        000540
   15 CONTINUE                                                             000541
      DO 20 I=1,15                                                         000542
      DO 20 J=2,4                                                          000543
      SPCODE(I,J)=1                                                        000544
   20 CONTINUE                                                             000545
C                                                                          000546
C     DEFINE VALUES FOR THE SPECIFICATIONS (FREQUENCY INDEX, CHANNEL)      000547
C                                                                          000548
      DO 25 I=2,4                                                          000549
      SU(1,I)=2.79                                                         000550
      SU(2,I)=1.77                                                         000551
      SU(3,I)=1.41                                                         000552
      SU(4,I)=1.24                                                         000553
      DO 33 J=5,11                                                         000554
      SU(J,I)=1.12                                                         000555
   33 CONTINUE                                                             000556
      SU(12,I)=1.24                                                        000557
      SU(13,I)=1.41                                                        000558
      SU(14,I)=1.77                                                        000559
      SU(15,I)=2.79                                                        000560
   25 CONTINUE                                                             000561
C                                                                          000562
C     DEFINE WEIGHTING FACTORS CORRESPONDING TO THE SPECIFICATIONS         000563
C                                                                          000564
      DO 35 I=1,15                                                         000565
      DO 35 J=2,4                                                          000566
      WU(I,J)=1.0                                                          000567
   35 CONTINUE                                                             000568
C                                                                          000569
C     ARGUMENTS OF THE MINIMAX OPTIMIZATION(MMLC) CALL STATEMENT           000570
C                                                                          000571
C     FDF     - NAME OF A SUBROUTINE CALCULATING MINIMAX FUNCTIONS AND     000572
C               THEIR DERIVATIVES AT THE POINT DEFINED BY THE X VECTOR.    000573
C               THE NAME FDF IS ARBITRARY AND MUST APPEAR IN THE EXTER-    000574
C               NAL STATEMENT IN THE SEGMENT CALLING MMLC1A.               000575
C     NV      - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF OP-    000576
C               TIMIZATION VARIABLES. ITS VALUE MUST BE POSITIVE AND IS    000577
C               NOT CHANGED BY THE PACKAGE.                                000578
C     MF      - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF RE-    000579
C               SIDUAL FUNCTIONS DEFINING THE MINIMAX OBJECTIVE FUNCTION.  000580
C               ITS VALUE MUST BE POSITIVE AND IS NOT CHANGED BY THE PA-   000581
C               CKAGE.                                                     000582
C     L       - INTEGER ARGUMENT WHICH MUST BE SET TO THE TOTAL NUMBER     000583
C               OF EQUALITY AND INEQUALITY CONSTRAINTS. ITS VALUE MUST     000584
C               BE POSITIVE OR ZERO AND IT IS NOT CHANGED BY THE PACKA-    000585
```

```
C                GE.                                                    000586
C       LEQ    - INTEGER ARGUMENT WHICH MUST BE SET TO THE NUMBER OF EQ- 000587
C                UALITY CONSTRAINTS. ITS VALUE MUST BE POSITIVE OR ZERO 000588
C                AND NOT GREATER THAN NV, AND NOT GREATER THAN L. ITS   000589
C                VALUE IS NOT CHANGED BY THE PACKAGE.                   000590
C       B      - REAL ARRAY OF LENGTH IIC > L. THE ELEMENTS OF B MUST BE 000591
C                SET TO THE CONSTANT TERMS IN THE LINEAR CONSTRAINTS.   000592
C                THE CONTENTS OF B ARE NOT CHANGED BY THE PACKAGE.      000593
C       C      - REAL MATRIX OF DIMENSIONS (IIC,NV). THE FIRST L ROWS OF 000594
C                C MUST BE SET TO THE COEFFICIENTS OF X IN THE LINEAR   000595
C                CONSTRAINTS.                                           000596
C       IIC    - INTEGER ARGUMENT WHICH MUST BE SET TO THE LENGTH OF THE 000597
C                ARRAY B AND TO NUMBER OF ROWS OF THE MATRIX C. ITS VA- 000598
C                LUE MUST NOT BE LESS THAN L, AND IT IS NOT CHANGED BY  000599
C                THE PACKAGE.                                           000600
C       X      - REAL ARRAY OF LENGTH AT LEAST NV WHICH, ON ENTRY, MUST 000601
C                BE SET TO THE INITIAL APPROXIMATION OF THE SOLUTION.   000602
C                ON EXIT X CONTAINS THE BEST SOLUTION FOUND BY THE PACK- 000603
C                AGE.                                                   000604
C       DX     - REAL VARIABLE WHICH CONTROLS THE STEP LENGTH OF THE ITER- 000605
C                ATIVE ALGORITHM. ON ENTRY IT MUST BE SET TO AN INITIAL 000606
C                VALUE APPROXIMATELY EQUAL TO 0.1* X. THE VALUE OF DX   000607
C                MUST BE POSITIVE. ON EXIT DX CONTAINS THE LAST VALUE OF 000608
C                THE STEPSIZE. FOR EXTENSIVE DETAILS PLEASE REFER TO    000609
C                REPORT SOS-82-5-U2, AUGUST 1983.                       000610
C       EPS    - REAL VARIABLE WHICH ON ENTRY MUST BE SET TO THE REQUIRED 000611
C                ACCURACY OF THE SOLUTION. ON EXIT EPS CONTAINS THE LENGTH 000612
C                OF THE LAST STEP TAKEN IN THE ITERATION.               000613
C       MAXF   - INTEGER VARIABLE WHICH MUST BE SET TO AN UPPER BOUND ON 000614
C                THE NUMBER OF CALLS OF FDF. ON EXIT MAXF CONTAINS THE  000615
C                NUMBER OF CALLS OF FDF THAT HAVE BEEN PERFORMED BY THE 000616
C                PACKAGE.                                               000617
C       KEQS   - INTEGER VARIABLE WHICH MUST BE SET TO THE NUMBER OF SUC= 000618
C                CESSIVE ITERATIONS WITH IDENTICAL SETS OF ACTIVE RESIDUAL 000619
C                FUNCTIONS AND ACTIVE CONSTRAINTS THAT IS REQUIRED BEFORE 000620
C                A SWITCH TO STAGE 2 IS MADE. ON EXIT KEQS CONTAINS THE 000621
C                NUMBER OF SWITCHES TO STAGE 2 THAT HAVE TAKEN PLACE.   000622
C       W      - REAL ARRAY WHICH IS USED FOR WORKING SPACE. ITS LENGTH 000623
C                IS GIVEN BY IW. ON EXIT THE FIRST MF ELEMENTS OF W CON- 000624
C                TAIN THE RESIDUAL FUNCTION VALUES AT THE SOLUTION.     000625
C       IW     - INTEGER ARGUMENT WHICH MUST BE SET TO THE LENGTH OF W. 000626
C                ITS VALUE MUST BE AT LEAST                             000627
C                                                                       000628
C                     IWR=2*MF*NV+5*NV*NV+4*MF+8*NV+4*IIC+3             000629
C                                                                       000630
C       ICH    - INTEGER ARGUMENT WHICH MUST BE SET TO THE UNIT NUMBER  000631
C                THAT IS TO BE USED FOR THE PRINTED OUTPUT GENERATED BY 000632
C                THE PACKAGE. IF ICH IS LESS THAN OR EQUAL TO ZERO, NO  000633
C                PRINTED OUTPUT WILL BE GENERATED BY THE PACKAGE.       000634
C       IPR    - INTEGER ARGUMENT WHICH CONTROLS THE PRINTED OUTPUT GE- 000635
C                NERATED BY THE PACKAGE. FOR EXTENSIVE DETAILS PLEASE   000636
C                REFER TO REPORT SOS-82-5-U2, AUGUST 1983.              000637
C       IFALL  - INTEGER VARIABLE WHICH ON EXIT CONTAINS INFORMATION    000638
C                ABOUT THE SOLUTION:                                    000639
C                IFALL=-2 FEASIBLE REGION IS EMPTY,                     000640
C                IFALL=-1 INCORRECT INPUT DATA,                         000641
C                IFALL= 0 REGULAR SOLUTION; REQUIRED ACCURACY OBTAINED, 000642
C                IFALL= 1 SINGULAR SOLUTION; REQUIRED ACCURACY OBTAINED, 000643
C                IFALL= 2 MACHINE ACCURACY REACHED,                     000644
C                IFALL= 3 MAXIMUM NUMBER OF FUNCTION EVALUATIONS REACHED, 000645
C                IFALL= 4 ITERATION TERMINATED BY THE USER.             000646
C                                                                       000647
C       DEFINE PARAMETERS FOR THE MMLC PACKAGE                          000648
C                                                                       000649
        NV=5                                                            000650
```

```
      MF=47                                                                  000651
      L=0                                                                    000652
      LEQ=0                                                                  000653
      IIC=1                                                                  000654
      DX=0.05                                                                000655
      EPS=1.E-6                                                              000656
      MAXF=50                                                                000657
      KEQS=3                                                                 000658
      IW=4000                                                                000659
      ICH=6                                                                  000660
      IPR=10                                                                 000661
      NCOUNT=1                                                               000662
C                                                                            000663
      CALL MMLC1A(FDF,NV,MF,L,LEQ,B,C,IIC,X,DX,EPS,MAXF,KEQS,W,IW,ICH,       000664
     1            IPR,IFALL)                                                 000665
C                                                                            000666
  900 STOP                                                                   000667
      END                                                                    000668
C                                                                            000669
```

```
C                                                                       000670
      SUBROUTINE FDF(NV,MF,X,DF,F)                                      000671
      REAL X(NV),F(MF),DF(MF,NV)                                        000672
      REAL OMEGA(47),SURL(47),SLRL(47),WURL(47),WLRL(47),               000673
     1     SU(100,8),SL(100,8),WU(100,8),WL(100,8)                      000674
      INTEGER RLSCODE(47),SPCODE(100,8),CHBCODE(8,2)                    000675
      REAL CM(8,8,8),WGL(8),DRL(296),FIL(8),DIL(8,296)                  000676
      INTEGER IR(8),IRT(8),LC(8,36),KC(8,36)                            000677
      COMMON /BLK2/CM,WGL                                               000678
      COMMON /BLK3/OMEGA,SURL,SLRL,WURL,WLRL,SU,SL,WU,WL,               000679
     1             RLSCODE,SPCODE,NCOUNT,MODE,NCH,MO,                   000680
     2             NFREQ,NFRL,CHBCODE,IFLAGJS,IFLAGDP,IDISPER           000681
      COMMON/BLK8/IR,IRT,LC,KC                                          000682
C                                                                       000683
C     UPDATE OPTIMIZATION VARIABLES                                     000684
C                                                                       000685
      IF(IR(1).EQ.0)GO TO 20                                            000686
      IR1=IR(1)                                                         000687
      DO 10 IV=1,IR1                                                    000688
      CM(1,LC(1,IV),KC(1,IV))=X(IV)                                     000689
   10 CONTINUE                                                          000690
   20 DO 40 I=2,NCH                                                     000691
      IX=IRT(I-1)                                                       000692
      IF(IR(I).EQ.0) GO TO 40                                           000693
      IRI=IR(I)                                                         000694
      DO 30 IP=1,IRI                                                    000695
      IXX=IX+IP                                                         000696
      CM(I,LC(I,IP),KC(I,IP))=X(IXX)                                    000697
   30 CONTINUE                                                          000698
   40 CONTINUE                                                          000699
      DO 50 I=1,NCH                                                     000700
      WGL(I)=X(IRT(I))                                                  000701
   50 CONTINUE                                                          000702
C                                                                       000703
C     DEFINE MINIMAX FUNCTIONS AND THEIR GRADIENTS                      000704
C                                                                       000705
      NCHAN=NCH                                                         000706
      MORDER=MO                                                         000707
      KFRL=0                                                            000708
      KFUN=NFRL                                                         000709
      DO 100 I=1,NFREQ                                                  000710
      FREQ=OMEGA(I)                                                     000711
C                                                                       000712
      CALL SIMGRD(FREQ,FRL,DRL,FIL,DIL,NCHAN,MORDER,I,IFLAGJS,          000713
     1            IFLAGDP,IDISPER)                                      000714
C                                                                       000715
      IF(MODE.EQ.1)GO TO 199                                            000716
      IF(RLSCODE(I).EQ.0)GO TO 199                                      000717
      IF(RLSCODE(I).EQ.-1)GO TO 70                                      000718
      IF(RLSCODE(I).EQ.1)GO TO 75                                       000719
      KFRL=KFRL+1                                                       000720
      F(KFRL)=WURL(I)*(FRL-SURL(I))                                     000721
      DO 80 K1=1,NV                                                     000722
      DF(KFRL,K1)=WURL(I)*DRL(K1)                                       000723
   80 CONTINUE                                                          000724
      KFRL=KFRL+1                                                       000725
      F(KFRL)=-WLRL(I)*(FRL-SLRL(I))                                    000726
      DO 85 K2=1,NV                                                     000727
      DF(KFRL,K2)=-WLRL(I)*DRL(K2)                                      000728
   85 CONTINUE                                                          000729
      GO TO 199                                                         000730
   70 KFRL=KFRL+1                                                       000731
      F(KFRL)=-WLRL(I)*(FRL-SLRL(I))                                    000732
      DO 90 K3=1,NV                                                     000733
      DF(KFRL,K3)=-WLRL(I)*DRL(K3)                                      000734
```

```
 90 CONTINUE                                                                    000735
    GO TO 199                                                                   000736
 75 KFRL=KFRL+1                                                                 000737
    F(KFRL)=WURL(I)*(FRL-SURL(I))                                               000738
    DO 95 K4=1,NV                                                               000739
    DF(KFRL,K4)=WURL(I)*DRL(K4)                                                 000740
 95 CONTINUE                                                                    000741
199 CONTINUE                                                                    000742
    IF(MODE.EQ.0)GO TO 100                                                      000743
    DO 105 J=1,NCH                                                              000744
    NCHECK=0                                                                    000745
    IF(I.GE.CHBCODE(J,1).AND.I.LE.CHBCODE(J,2))NCHECK=1                         000746
    IF(NCHECK.EQ.0)GO TO 105                                                    000747
    K=I-CHBCODE(J,1)+1                                                          000748
    IF(SPCODE(K,J).EQ.0)GO TO 105)                                              000749
    IF(SPCODE(K,J).EQ.-1)GO TO 110                                              000750
    IF(SPCODE(K,J).EQ.1)GO TO 115                                               000751
    KFUN=KFUN+1                                                                 000752
    F(KFUN)=WU(K,J)*(FIL(J)-SU(K,J))                                            000753
    DO 120 I1=1,NV                                                              000754
    DF(KFUN,I1)=WU(K,J)*DIL(J,I1)                                               000755
120 CONTINUE                                                                    000756
    KFUN=KFUN+1                                                                 000757
    F(KFUN)=-WL(K,J)*(FIL(J)-SL(K,J))                                           000758
    DO 125 I2=1,NV                                                              000759
    DF(KFUN,I2)=-WL(K,J)*DIL(J,I2)                                              000760
125 CONTINUE                                                                    000761
    GO TO 105                                                                   000762
110 KFUN=KFUN+1                                                                 000763
    F(KFUN)=-WL(K,J)*(FIL(J)-SL(K,J))                                           000764
    DO 130 I3=1,NV                                                              000765
    DF(KFUN,I3)=-WL(K,J)*DIL(J,I3)                                              000766
130 CONTINUE                                                                    000767
    GO TO 105                                                                   000768
115 KFUN=KFUN+1                                                                 000769
    F(KFUN)=WU(K,J)*(FIL(J)-SU(K,J))                                            000770
    DO 135 I4=1,NV                                                              000771
    DF(KFUN,I4)=WU(K,J)*DIL(J,I4)                                               000772
135 CONTINUE                                                                    000773
105 CONTINUE                                                                    000774
100 CONTINUE                                                                    000775
    NCOUNT=NCOUNT+1                                                             000776
    RETURN                                                                      000777
    END                                                                         000778
```

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

MULTIPLEXER PROBLEM MXTST8A

INPUT DATA

NUMBER OF VARIABLES (N)	5
NUMBER OF FUNCTIONS (M)	47
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)	4000
PRINTOUT CONTROL (IPR)	10

STARTING POINT :

	VARIABLES		FUNCTION VALUES
1	6.570000000000E-01	1	1.916845450054E+00
2	6.410000000000E-01	2	2.378704213563E+00
3	6.310000000000E-01	3	-7.706198091697E-02
4	6.330000000000E-01	4	-3.320151426309E-02
5	6.330000000000E-01	5	-3.640973817636E-02
		6	-2.805942078900E-02
		7	-1.125989786684E-02
		8	-1.026900635453E-01
		9	-2.222820737667E-01
		10	-2.319326050170E-01
		11	-2.191684721411E-01
		12	-1.720935987790E-01
		13	-1.067110361903E-01
		14	-1.255173461118E-01
		15	-1.386463916695E-01
		16	-2.099820801185E-01
		17	-5.371261371836E-01
		18	-2.181697273930E-02
		19	-6.391994968411E-03
		20	-1.073324872970E-02
		21	-4.961342421154E-03
		22	-1.311198570946E-04
		23	-1.007199460951E-01
		24	-2.142562069946E-01
		25	-2.224351807663E-01
		26	-2.196796573438E-01
		27	-1.654322124445E-01
		28	-9.594063384560E-02
		29	-1.164718314240E-01
		30	-1.330843862863E-01

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

MULTIPLEXER PROBLEM MXTST3A

31	-1.997366339864E-01
32	-5.183580407325E-01
33	-4.527637211936E-03
34	4.037646389222E-03
35	-6.862274756045E-04
36	2.691548168926E-03
37	1.485042000901E-03
38	-1.027788692785E-01
39	-2.120357978617E-01
40	-2.225063250604E-01
41	-2.233181088666E-01
42	-1.581857586322E-01
43	-8.620875048273E-02
44	-1.078404073324E-01
45	-1.211304899649E-01
46	-1.743337059811E-01
47	-4.617352127407E-01

SOLUTION

	VARIABLES		FUNCTION VALUES
1	5.905646473653E-01	1	-4.716964744796E-02
2	6.741767086192E-01	2	-4.716964744944E-02
3	6.502557033910E-01	3	-3.078157368543E-01
4	6.434725644329E-01	4	-1.123633354947E-01
5	6.587561940955E-01	5	-8.768395521452E-02
		6	-7.885602164624E-02
		7	-4.716964745217E-02
		8	-1.181701653575E-01
		9	-2.282377458328E-01
		10	-2.452064065265E-01
		11	-2.167814137206E-01
		12	-1.659377451666E-01
		13	-1.050264908817E-01
		14	-1.220249775533E-01
		15	-1.260217478276E-01
		16	-1.939745156238E-01
		17	-5.069518557972E-01
		18	-1.764307750538E-01
		19	-8.833478799130E-02
		20	-6.655187853203E-02
		21	-6.258900641760E-02
		22	-5.268392796172E-02
		23	-1.366604666079E-01
		24	-2.282629362020E-01
		25	-2.434824836222E-01
		26	-2.280502708632E-01
		27	-1.583753463314E-01
		28	-9.103418950148E-02
		29	-1.113259713288E-01
		30	-1.177142601913E-01
		31	-1.728155470566E-01
		32	-4.555097591496E-01
		33	-2.431879394293E-01
		34	-1.144858704584E-01

MULTIPLEXER PROBLEM MXTST3A

35	-7.109154702129E-02
36	-7.221982241325E-02
37	-7.171063786986E-02
38	-1.505715275522E-01
39	-2.112448309760E-01
40	-2.361734676834E-01
41	-2.237408934535E-01
42	-1.165937196497E-01
43	-4.716964745192E-02
44	-7.907705890772E-02
45	-8.284033440032E-02
46	-1.056516391803E-01
47	-3.277401482898E-01

TYPE OF SOLUTION (IFALL)	1
NUMBER OF FUNCTION EVALUATIONS	29
NUMBER OF SHIFTS TO STAGE-2	3
EXECUTION TIME (IN SECONDS)	79.635