

เอกสารอ้างอิง

1. T.K.P. Medicheria and R. Billinton and M.S. Sachdev. Generation Rescheduling and Load Shedding to Alleviate Line Overload-Analysis. IEEE Transaction on Power Apparatus and Systems. Vol. PAS-98, No. 6pp. 1876-1884, Nov./Dec. 1979
2. T.K.P. Medicheria and R. Billinton and M.S. Sachdev. Generation Rescheduling and Load Shedding to Alleviate Line Overload-System Studies. IEEE Transaction on Power Apparatus and Systems. Vol PAS-100, No. 1 pp. 36-42, Jan 1981.
3. Slobodan T. Despotovic. A New Decoupled Loadflow Method IEEE Transaction on Power Apparatus and Systems. Vol. PAS-93, pp. 884-889, May/June 1974.
4. R. Deutsch, System Analysis Techniques, PP. 338-346, New Jersey : Prentice-Hall Inc., 1969.
5. B. Stott and Alsac. Fast Decoupled Loadflow. IEEE. Transaction on power Apparatus and Systems. Vol. PAS-93, pp: 859-869, May/June 1974.
6. Stagg and El-Abiad, Computer Methods in Power System Analysis, pp. 233-277 International Student Edition, Tosho Printing Co., Ltd. Tokyo, Japan.
7. ยืน ภู่วรรณ และคนอื่น ๆ, โปรแกรมคอมพิวเตอร์ภาษาเบสิก พิมพ์ครั้งที่ 2 กรุงเทพมหานคร, โรงพิมพ์เอเชียเพรส, 2526.
8. A.M.H. Rashed, A. Moussa, M.Y. Gamal El-DIN. Steady State Optimal Load Sheddings Solution in Power Systems IEEE. 1979 Power Engineering Society Summer Meeting. A 79 449-0.

ภาคผนวก ก

```

2      REM main programme
4      DIM LLINE(20),SB(20),EB(20),RSER(20),XSER(20),YSHT(20),XX(20,20),YY(30,3
0),PSEAL(10)
6      DIM CMAX(20),BUS(10),TYPEB(10),G(10,10),H(10,10),VSPEC(10),LRR(10),LLR(1
0),QSEAC(10)
8      DIM PG(10),PGMAX(10),PD(10),QD(10),QMIN(10),QMAX(10),P(10),HADP(10),HADQ
(10),PCURT(10),LSR(10),LSA(10)
10     DIM YCAP(10),GBUS(10),DOC(10),GSE(10),BSE(20),LN(20),Q(10),T(10),C(10),Q
CURT(10),PFT(10)
12     DIM LM(20),CR(20),CJ(20),CRJ(20),NLD(20),EE(10),FF(10),AB(10,10),PDD(10)
,QDD(10)
14     DIM DP(10),DQ(10),PDL(10),SHEDP(10),SHEDQ(10),QDL(10),PTION(7),RTX(20),P
GG(10)
16     DIM RPG(10),RQG(10),SLOADP(10),SLOADQ(10),NBTYPE(10),EEN(10),FFN(10),PGO
(10),RLC(20),ILC(20),MLC(20)
18     DIM NK(10),PDN(10),QDN(10),PGN(10),VSPECN(10),QMAXN(10),PREAL(10),QREAC(
10),QGO(10),XTX(20),INSPEC(20)
20     DIM QMINN(10),GBUSN(10),PGNMAX(10),VN(10),AA(10),B(10),PAM(10),PAN(10)
22     DIM CC(10),DD(10),PCAL(10),QCAL(10),AV(10),AVN(10),DELV(10),QG(10),QGN(1
0),NBTPN(10)
26     DIM ZSER(20),YTPQ(20),DR(10),DI(10),AMAT(20,20),INVERA(20,20),AY(20,20),
AYTPQ(10)
28     DIM BMAT1(10,10),Y(20,20),LPEAK(10),LQEAK(10),VAN(10),VAM(10),PI(10),QI(
10)
32     REM NBUS = number of buses
34     REM NLINE = number of lines
36     REM VBASE = base KVA.
38     REM BASEMVA = base mega-volt amp
40     REM LNIT = maximum iteration
42     REM CP,CQ = tolerance for active and reactive power mismatches
44     REM LLINE(I) = line number i
46     REM XSER(I) = line reactance
48     REM RSER(I) = line resistance
50     REM YCAP(I) = half of the line charging
52     REM SB(I),EB(I) = terminal bus of line no. i
54     REM BUS(I) = bus number i
56     REM TYPEB(I) = type of the bus i
60     REM QMIN(I) = minimum reactive power at bus i
62     REM QMAX(I) = maximum reactive power at bus i
66     REM GBUS(I) = generator bus
68     REM CMAX(I) = line current rating
70     REM YSHT(I) = shunt susceptance
72     REM PG(I) = scheduled generation
74     REM PGMAX(I) = sum of operating generation and spinning reserve
76     REM PD(I) = active load
78     REM QD(I) = reactive load
80     REM SHEDP(I) = amount of active load for shedding
82     REM SHEDQ(I) = amount of reactive load for shedding

```

```
1000 GOSUB 10000
1010 IF CP <> 0! THEN 1030
1020 CP = .00001
1030 IF CQ <> 0! THEN 1050
1040 CQ = .00001
1050 IF LNIT <> 0 THEN 1070
1060 LNIT = 50
1070 IF STEM <> 0 THEN 1090
1080 STEM = 1
1090 IF ACP <> 0 THEN 1105
1100 ACP = 1!
1105 OVERL = 0
1110 ALPA = 0
1115 FOR I = 1 TO NBUS
1120 PGO(I) = 0!
1130 QGO(I) = 0!
1140 PDL(I) = 0!
1150 PCURT(I) = 0!
1160 QCURT(I) = 0!
1170 HADP(I) = 0!
1180 HADQ(I) = 0!
1190 NEXT I
1200 NLOD = 0!
1210 PCLO = 0!
1220 PASK = 0
1230 LA = 1
1240 LSTART = 1
1430 GOSUB 11000
1440 IF CNEWS < > 123 THEN 1430
1450 GOSUB 12000
1460 IF CYBUS < > 123 THEN 1450
1465 AFTER = 999
1470 GOSUB 13000
1480 IF CFAST < > 123 THEN 1470
1490 GOSUB 15000
1500 IF OVERL = 1 THEN 1940
1510 IF ALPA = 1 THEN 1930
1600 GOSUB 16000
1700 GOSUB 17000
1800 GOSUB 18000
1825 FOR I = 1 TO NBUS
1830 AA(I) = AA(I) + EE(I)
1835 IF I = NBUS THEN 1890
1840 B(I) = B(I) + FF(I)
1850 PDN(I) = PDL(I)
1860 QDN(I) = QDL(I)
1870 PGN(I) = PGO(I)
1875 QGN(I) = QGO(I)
1880 PCURT(I) = PCURT(I) + SHEDP(I)
1885 QCURT(I) = QCURT(I) + SHEDQ(I)
1890 NEXT I
1895 AFTER = 123
1900 GOSUB 13000
```

```

1910  PASK = PASK + 1
1920  GOTO 1490
1930  GOSUB 26000
1940  FOR I = 1 TO NBUS
1950  K = NK(I)
1960  RPG(K) = PGN(I)*MBASE
1970  RQG(K) = QGN(I)*MBASE
1980  SLOADP(K) = PCURT(I)*MBASE
1990  SLOADQ(K) = QCURT(I)*MBASE
2000  PGG(K) = PG(K)*MBASE
2010  NEXT I
2020  GOSUB 24000
2100  STOP
2200  END
8310  END
9000  DATA 6, 7,100, 0.0001, 0.0001, 50, 1,100, 3, 0,999
9010  DATA 1, 1, 2, 0.0250, 0.1682, 0.0 , 0.0 , 0.1297, 2.00 , 1,999
9020  DATA 2, 2, 3, 0.0238, 0.2108, 0.0 , 0.0 , 0.1509, 1.25 , 1,999
9030  DATA 3, 3, 4, 0.0328, 0.1325, 0.0 , 0.0 , 0.0163, 1.75 , 1,999
9040  DATA 4, 4, 5, 0.1021, 0.4980, 0.0 , 0.0 , 0.2492, 0.90 , 1,999
9050  DATA 5, 5, 6, 0.2130, 0.8957, 0.0 , 0.0 , 0.1203, 0.45 , 1,999
9060  DATA 6, 6, 2, 0.1494, 0.3692, 0.0 , 0.0 , 0.0206, 1.00 , 1,999
9070  DATA 7, 6, 3, 0.1191, 0.2704, 0.0 , 0.0 , 0.0164, 0.60 , 1,999
9080  DATA 1, 2, 1, 1.0000, 1.5000, 0.0000, 1.7000, 0.0000, 0.0000, 0.0000
, 1.5000, 0.0000,999
9090  DATA 2, 1, 2, 1.0000, 0.0000, 0.0000, 0.0000, 0.5634, 0.0390, 0.0000
, 0.0000,-0.3000,999
9100  DATA 3, 3, 1, 1.0000, 0.5000, 0.0000, 1.2000, 1.6998, 0.0904, 0.0000
, 0.5000,-0.9500,999
9110  DATA 4, 2, 1, 1.0000, 0.5000, 0.0000, 0.7000, 0.9167, 0.1500, 0.0000
, 0.5000, 0.0000,999
9120  DATA 5, 2, 1, 1.0000, 3.8000, 0.0000, 4.0000, 2.4713, 0.5249, 0.0000
, 2.0000,-0.3000,999
9130  DATA 6, 1, 2, 1.0000, 0.0000, 0.0000, 0.0000, 0.9845, 0.1025, 0.0000
, 0.0000, 0.0000,999
9140  DATA 0, 0, 0, 0, 0, 0, 0, 1,999

```

```

10000  REM SUBROUTINE READING DATA
10010  INSPEC(1) = 111
10020  READ NBUS,NLINE,MBASE,CP,CQ,LNIT,ACP,VBASE,SWG,RTL,INSPEC(1)
10030  IF INSPEC(1) = 999 THEN 10050
10040  PRINT "INFORMATION IN DATA NUMBER 9000 IS ERROR"
10050  FOR I = 1 TO NLINE
10070  INSPEC(I) = 111
10080  READ LLINE(I),SB(I),EB(I),RSER(I),XSER(I),RTX(I),XTX(I),YCAP(I),CMAX(I),
,T(I),INSPEC(I)
10090  IF INSPEC(I) = 999 THEN 10110
10095  LNE = 10000 + 10*I
10100  PRINT "INFORMATION IN DATA NUMBER"; LNE ;"IS ERROR"
10110  IF CMAX(I) <> 0! THEN 10130
10120  CMAX(I) = 2!
10130  IF T(I) <> 0! THEN 10150
10140  T(I) = 1!
10150  NEXT I
10160  FOR I = 1 TO NBUS
10170  INSPEC(I) = 111
10180  READ BUS(I),TYPEB(I),GBUS(I),VSPEC(I),PG(I),QG(I),PGMAX(I),PD(I),QD(I),
QMIN(I),QMAX(I),YSHT(I),INSPEC(I)
10190  IF INSPEC(I) = 999 THEN 10220
10200  BNE = 10000 + (NLINE + I)*10
10210  PRINT "INFORMATION IN DATA NUMBER"; BNE ;"IS ERROR"
10220  IF VSPEC(I) <> 0! THEN 10240
10230  VSPEC(I) = 1!
10240  NEXT I
10250  INSPEC(1) = 111
10260  READ PTION(1),PTION(2),PTION(3),PTION(4),PTION(5),PTION(6),PTION(7),INS
PEC(1)
10270  IF INSPEC(1) = 999 THEN 10300
10280  POE = 10000 + 10*(NBUS+LLINE+1)
10290  PRINT "INFORMATION IN DATA NUMBER"; POE ;"IS ERROR"
10300  RETURN
10310  END
11000  REM SUBROUTINE RENUMBER OF BUS
11010  NLOAD = 0
11015  NGEN = 0
11020  NCON = 0
11030  NOOB = 1
11040  NLD = 0
11050  FOR I = 1 TO NBUS
11060  NBTYPE(I) = TYPEB(I)
11070  ON TYPEB(I) GOTO 11080,11100,11120
11080  NLOAD = NLOAD+1
11090  GOTO 11120
11100  NCON = NCON+1
11120  V(I) = VSPEC(I)
11130  AV(I) = 0!
11140  NEXT I
11150  NGN = NLOAD
11160  ON TYPEB(NOOB) GOTO 11180,11210,11240
11170  GOTO 11400
11180  NLD = NLD+1
11190  N = NLD
11200  GOTO 11250

```

```
11210   NGN = NGN+1
11220   N = NGN
11230   GOTO 11250
11240   N = NBUS
11250   NK(N) = NOOB
11260   GBUSN(N) = GBUS(NOOB)
11265   PGN(N) = PG(NOOB)
11270   QGN(N) = QG(NOOB)
11280   PDN(N) = PD(NOOB)
11290   QDN(N) = QD(NOOB)
11295   LPEAK(N) = PD(NOOB)
11300   LQEAK(N) = QD(NOOB)
11305   PGO(N) = PG(NOOB)
11310   VN(N) = V(NOOB)
11320   AVN(N) = AV(NOOB)
11330   QMAXN(N) = QMAX(NOOB)
11340   QMINN(N) = QMIN(NOOB)
11350   PGNMAX(N) = PGMAX(NOOB)
11360   NBTYPN(N) = NBTYPE(NOOB)
11370   NOOB = NOOB+1
11380   IF NOOB <= NBUS THEN 11160
11390   GOTO 11410
11400   LPRINT:LPRINT"type of bus is not find "; NOOB
11410   FOR I = 1 TO NBUS
11420   IF GBUS(I) <> 1 THEN 11440
11430   NGEN = NGEN + 1
11440   NEXT I
11450   CNEWS = 123
11460   RETURN
11470   END
```



```

12000   REM SUBROUTINE YBUS MATRIX
12010   FOR I = 1 TO NBUS
12020   FOR J = 1 TO NBUS
12030   Y(I,J) = 0!
12040   AY(I,J) = 0!
12050   NEXT J
12060   NEXT I
12070   FOR I = 1 TO NLINE
12080   IF I = RTL THEN 12840
12100   KS = SB(I)
12110   JE = EB(I)
12120   RSN = RSER(I) + RTX(I)
12130   XSN = XSER(I) + XTX(I)
12140   ZSER(I) = SQR(RSN^2 + XSN^2)
12220   YTPQ(I) = 1! / ZSER(I)
12230   IF RSN < 0! THEN 12270
12250   AYTPQ(I) = -ATN(XSN / RSN)
12260   GOTO 12275
12270   AYTPQ(I) = -(3.141592654# + ATN(XSN / RSN))
12275   IF T(I) = 1 THEN 12290
12280   YTPQ(I) = YTPQ(I)/T(I)^2
12290   RSN = Y(KS,KS)*COS(AY(KS,KS))+YTPQ(I)*COS(AYTPQ(I))
12300   XSN = Y(KS,KS)*SIN(AY(KS,KS))+YTPQ(I)*SIN(AYTPQ(I))+YCAP(I)
12310   Y(KS,KS) = SQR(RSN^2+XSN^2)
12320   IF RSN < 0! THEN 12360
12340   AY(KS,KS) = ATN(XSN / RSN)
12350   GOTO 12365
12360   AY(KS,KS) = 3.141592654# + ATN(XSN / RSN)
12365   IF T(I) = 1 THEN 12380
12370   YTPQ(I) = YTPQ(I)*T(I)^2
12380   RSN = Y(JE,JE)*COS(AY(JE,JE))+YTPQ(I)*COS(AYTPQ(I))
12390   XSN = Y(JE,JE)*SIN(AY(JE,JE))+YTPQ(I)*SIN(AYTPQ(I))+YCAP(I)
12400   Y(JE,JE) = SQR(RSN^2+XSN^2)
12410   IF RSN < 0! THEN 12450
12430   AY(JE,JE) = ATN(XSN / RSN)
12440   GOTO 12460
12450   AY(JE,JE) = 3.141592654# + ATN(XSN / RSN)
12460   IF T(I) = 1 THEN 12680
12470   YTPQ(I) = YTPQ(I)/T(I)
12680   RSN = Y(KS,JE)*COS(AY(KS,JE))-YTPQ(I)*COS(AYTPQ(I))
12690   XSN = Y(KS,JE)*SIN(AY(KS,JE))-YTPQ(I)*SIN(AYTPQ(I))
12700   Y(KS,JE) = SQR(RSN^2+XSN^2)
12710   IF RSN < 0! THEN 12750
12730   AY(KS,JE) = ATN(XSN / RSN)
12740   GOTO 12760
12750   AY(KS,JE) = 3.141592654# + ATN(XSN / RSN)
12760   RSN = Y(JE,KS)*COS(AY(JE,KS))-YTPQ(I)*COS(AYTPQ(I))
12770   XSN = Y(JE,KS)*SIN(AY(JE,KS))-YTPQ(I)*SIN(AYTPQ(I))
12780   Y(JE,KS) = SQR(RSN^2+XSN^2)
12790   IF RSN < 0! THEN 12830
12810   AY(JE,KS) = ATN(XSN / RSN)
12820   GOTO 12840
12830   AY(JE,KS) = 3.141592654# + ATN(XSN / RSN)
12840   NEXT I

```



```
12850   FOR I = 1 TO NBUS
12860   FOR J = 1 TO NBUS
12870   IF J <> I OR YSHT(I) = 0! THEN 12950
12880   RSN = Y(I,J)*COS(AY(I,J))
12890   XSN = Y(I,J)*SIN(AY(I,J)) + YSHT(I)
12900   Y(I,J) = SQR(RSN^2 + XSN^2)
12910   IF RSN < 0! THEN 12940
12920   AY(I,J) = ATN(XSN / RSN)
12930   GOTO 12950
12940   AY(I,J) = 3.14159265# + ATN(XSN / RSN)
12950   NEXT J
12960   NEXT I
12970   CYBUS = 123
12980   RETURN
12990   END
```

```

13000   REM SUBROUTINE FAST DECOUPLED LOADFLOW
13005   IF AFTER <> 999 THEN 13240
13010   NSJ = NBUS-1
13020   N = NLOAD
13030   NOG = NCON
13040   NGN = NLOAD
13050   NIT1 = 0
13060   FOR I = 1 TO NBUS
13070   FOR J = 1 TO NBUS
13080   BMAT1(I,J) = 0!
13090   NEXT J
13100   NEXT I
13110   FOR I = 1 TO NBUS
13120   K = NK(I)
13130   FOR J = 1 TO NBUS
13140   L = NK(J)
13150   G(I,J) = Y(K,L)*COS(AY(K,L))
13160   H(I,J) = Y(K,L)*SIN(AY(K,L))
13170   BMAT1(I,J) = -H(I,J)
13180   NEXT J
13190   NEXT I
13200   FOR I = 1 TO NBUS
13210   AA(I) = ABS(VN(I))
13220   B(I) = AVN(I)
13222   IF PDN(I) = 0! THEN 13228
13224   PFT(I) = PDN(I)/QDN(I)
13226   GOTO 13230
13228   PFT(I) = 1!
13230   NEXT I
13240   FOR I = 1 TO NSJ
13250   P(I) = PGN(I)-PDN(I)
13260   Q(I) = QGN(I)-QDN(I)
13270   NEXT I
13280   KP = 1
13290   KQ = 1
13300   FOR I = 1 TO NSJ
13310   PCAL(I) = 0!
13320   NEXT I
13330   FOR I = 1 TO NSJ
13340   FOR J = 1 TO NBUS
13350   BR = B(I)-B(J)
13360   PCAL(I) = PCAL(I)+AA(J)*(G(I,J)*COS(BR)+H(I,J)*SIN(BR))
13370   NEXT J
13380   PCAL(I) = PCAL(I)*AA(I)
13390   NEXT I
13400   DPMAX = 0!
13410   FOR I = 1 TO NSJ
13420   DP(I) = P(I)-PCAL(I)
13430   IF ABS(DP(I)) < DPMAX THEN 13450
13440   DPMAX = ABS(DP(I))
13450   NEXT I
13460   IF DPMAX <= CP THEN 14140
13470   N = NSJ

```

```
13480   FOR I = 1 TO NSJ
13490   DELV(I) = DP(I)/AA(I)
13500   FOR J = 1 TO NSJ
13510   AB(I,J) = BMAT1(I,J)
13520   NEXT J
13530   NEXT I
13540   GOSUB 22000
13550   FOR I = 1 TO NSJ
13570   B(I) = B(I) + ACP*DELV(I)
13580   NEXT I
13590   KQ = 1
13600   FOR I = 1 TO NLOAD
13610   QCAL(I) = 0!
13620   NEXT I
13630   FOR I = 1 TO NLOAD
13640   FOR J = 1 TO NBUS
13650   BR = B(I)-B(J)
13660   QCAL(I) = QCAL(I) + AA(J)*(G(I,J)*SIN(BR)-H(I,J)*COS(BR))
13670   NEXT J
13680   QCAL(I) = QCAL(I)*AA(I)
13690   NEXT I
13700   DQMAX = 0!
13710   FOR I = 1 TO NLOAD
13720   DQ(I) = Q(I) - QCAL(I)
13730   IF ABS(DQ(I)) < DQMAX THEN 13750
13740   DQMAX = ABS(DQ(I))
13750   NEXT I
13760   IF DQMAX <= CQ THEN 14170
13770   N = NLOAD
13780   FOR I = 1 TO NLOAD
13790   DELV(I) = DQ(I)/AA(I)
13800   FOR J = 1 TO NLOAD
13810   AB(I,J) = BMAT1(I,J)
13820   NEXT J
13830   NEXT I
13840   GOSUB 22000
13850   FOR I = 1 TO NLOAD
13870   AA(I) = AA(I) + ACP*DELV(I)
13880   NEXT I
13890   IF (NOG = 0) THEN 14100
13900   IJ = NLOAD+1
13910   JI = NLOAD+NOG
13920   FOR I = IJ TO JI
13930   IF NBTPN(I) <> 2 THEN 14090
13940   Q(I) = 0!
13945   IF AFTER = 123 THEN 13960
13950   AA(I) = 1!
13960   FOR J = 1 TO NBUS
13970   BR = B(I)-B(J)
13980   Q(I) = Q(I)+AA(J)*(G(I,J)*SIN(BR)-H(I,J)*COS(BR))
13990   NEXT J
14000   Q(I) = Q(I)*AA(I)
14010   QGN(I) = Q(I)+QDN(I)
14020   IF QGN(I) > QMAXN(I) THEN 14060
```

```

14030   IF QGN(I) < QMINN(I) THEN 14080
14040   Q(I) = QGN(I) - QDN(I)
14050   GOTO 14090
14060   QGN(I) = QMAXN(I)
14070   GOTO 14090
14080   QGN(I) = QMINN(I)
14090   NEXT I
14100   KP = 1
14110   NIT1 = NIT1 + 1
14120   IF NIT1 > LNIT THEN 14510
14130   GOTO 13300
14140   KP = 0
14150   IF (KQ = 0) THEN 14200
14160   GOTO 13600
14170   KQ = 0
14180   IF (KP = 0!) THEN 14200
14190   GOTO 14110
14200   FOR I = 1 TO NSJ
14210   K = NK(I)
14220   V(K) = AA(I)
14230   AV(K) = B(I)
14240   IF GBUSN(I) <> 1 THEN 14280
14250   PGO(I) = PGN(I)
14260   QGO(I) = QGN(I)
14270   GOTO 14300
14280   PGO(I) = 0!
14290   QGO(I) = 0!
14295   C(I) = QGN(I)
14300   PI(K) = PGN(I)
14310   QI(K) = QGN(I)
14320   NEXT I
14330   YX = 0!
14340   AYX = 0!
14350   B(NBUS) = 0!
14360   AA(NBUS) = VSPEC(SWG)
14370   FOR I = 1 TO NBUS
14380   BR = - B(I)
14390   YX = YX + AA(I)*(G(NBUS,I)*COS(BR)+H(NBUS,I)*SIN(BR))
14400   AYX = AYX + AA(I)*(G(NBUS,I)*SIN(BR)-H(NBUS,I)*COS(BR))
14410   NEXT I
14420   PI(SWG) = YX*AA(NBUS) + PDN(NBUS)
14430   QI(SWG) = AYX*AA(NBUS) + QDN(NBUS)
14440   IF GBUSN(NBUS) <> 1 THEN 14480
14450   PGO(NBUS) = PGN(NBUS)
14460   QGO(NBUS) = QI(SWG)
14470   GOTO 14520
14480   PGO(NBUS) = 0!
14490   QGO(NBUS) = 0!
14500   GOTO 14520
14510   LPRINT TAB(40),"convergence not obtained in"; NIT1 ;"iterations":GOTO 1
4992
14520   IF AFTER = 123 THEN 14600
14525   FOR I = 1 TO NBUS
14530   PDD(I) = PD(I)*MBASE
14540   QDD(I) = QD(I)*MBASE

```

```

14550   PREAL(I) = PI(I)*MBASE
14560   QREAC(I) = QI(I)*MBASE
14565   PAM(I) = PREAL(I) - PDD(I)
14570   PAN(I) = QREAC(I) - QDD(I)
14580   VAM(I) = V(I)*COS(AV(I))
14585   VAN(I) = V(I)*SIN(AV(I))
14590   NEXT I
14600   FOR I = 1 TO NLINE
14605   IF I = RTL THEN 14990
14610   L = SB(I)
14620   M = EB(I)
14630   DVM = VAM(L) - VAM(M)
14640   DVN = VAN(L) - VAN(M)
14650   MVN = SQR(DVM^2 + DVN^2) * YTPQ(I)
14660   IF DVM < 0! THEN 14690
14670   AMVN = ATN( DVN / DVM ) + AYTPQ(I)
14680   GOTO 14700
14690   AMVN = 3.141592654# + ATN( DVN / DVM ) + AYTPQ(I)
14700   VSHT = V(L)*YCAP(I)
14710   AVSHT = AV(L) + 1.5707963#
14720   VMS = MVN*COS(AMVN) + VSHT*COS(AVSHT)
14730   VNS = -(MVN*SIN(AMVN) + VSHT*SIN(AVSHT))
14740   S = V(L)*SQR(VMS^2 + VNS^2)
14750   IF VMS < 0! THEN 14790
14760   AS = AV(L) + ATN(VNS / VMS)
14780   GOTO 14800
14790   AS = AV(L) + 3.141592654# + ATN(VNS / VMS)
14800   SREAL = S*COS(AS)
14810   SREAC = S*SIN(AS)
14820   CVM = VAM(M) - VAM(L)
14830   CVN = VAN(M) - VAN(L)
14840   TMVN = SQR(CVM^2 + CVN^2) * YTPQ(I)
14850   IF CVM < 0! THEN 14880
14860   ATMVN = ATN(CVN / CVM) + AYTPQ(I)
14870   GOTO 14890
14880   ATMVN = 3.141592654# + ATN(CVN / CVM) + AYTPQ(I)
14890   BSHT = V(M)*YCAP(I)
14900   ABSHT = AV(M) + 1.5707963#
14905   BMS = TMVN*COS(ATMVN) + BSHT*COS(ABSHT)
14910   BNS = -(TMVN*SIN(ATMVN) + BSHT*SIN(ABSHT))
14915   PR = V(M)*SQR(BMS^2 + BNS^2)
14920   IF BMS < 0! THEN 14935
14925   APR = AV(M) + ATN(BNS / BMS)
14930   GOTO 14940
14935   APR = AV(M) + 3.141592654# + ATN(BNS / BMS)
14940   RREAL = PR*COS(APR)
14945   RREAC = PR*SIN(APR)
14950   PSEAL(I) = SREAL
14955   QSEAC(I) = SREAC
14960   IF AFTER = 123 THEN 14990
14970   LSR(I) = SREAL*MBASE
14975   LSA(I) = SREAC*MBASE
14980   LRR(I) = RREAL*MBASE
14985   LLR(I) = RREAC*MBASE
14990   NEXT I
14992   CFAST = 123
14994   RETURN
14996   END

```

```

15000   REM SUBROUTINE TO FIND THE LINE OVERLOAD
15100   OVERL = 0
15110   ALPA = 0
15370   LD = 0
15380   FOR I = 1 TO NLINE
15390   DOC(I) = 0!
15400   NEXT I
15410   FOR I = 1 TO NLINE
15415   IF I = RTL THEN 15640
15420   FOR J = 1 TO NBUS
15430   IF SB(I) = NK(J) THEN 15460
15440   IF EB(I) = NK(J) THEN 15480
15450   GOTO 15490
15460   LN(I) = J
15470   GOTO 15440
15480   LM(I) = J
15490   NEXT J
15500   L = LN(I)
15510   M = LM(I)
15520   GSE(I) = YTPQ(I)*COS(AYTPQ(I))
15530   BSE(I) = YTPQ(I)*SIN(AYTPQ(I))
15540   CR(I) = (AA(L)*COS(B(L))-AA(M)*COS(B(M)))*GSE(I)-(AA(L)*SIN(B(L))-AA(M)
*SIN(B(M)))*BSE(I)-YCAP(I)*AA(L)*SIN(B(L))
15550   CJ(I) = (AA(L)*SIN(B(L))-AA(M)*SIN(B(M)))*GSE(I)+(AA(L)*COS(B(L))-AA(M)
*COS(B(M)))*BSE(I)+YCAP(I)*AA(L)*COS(B(L))
15560   BR = CR(I)
15570   BI = CJ(I)
15580   CRJ(I) = SQR(BR^2 + BI^2)
15582   IF PASK <> 0 THEN 15590
15584   RLC(I) = CR(I)
15586   ILC(I) = CJ(I)
15588   MLC(I) = CRJ(I)
15590   DC = CMAX(I) - CRJ(I)
15600   IF DC => 0! THEN 15640
15605   PSO = CMAX(I) * .05
15608   IF ABS(DC) < PSO THEN 15640
15610   LD = LD+1
15620   NLD(LD) = I
15625   DOC(LD) = DC
15630   IF PASK <> 0 THEN 15640
15632   NLOD = I
15634   PCLO = (ABS(DC)/CRJ(I))*100
15636   LOD = LD
15640   NEXT I
15650   IF LD = 0 AND PASK = 0 THEN 15954
15660   IF LD = 0 THEN 15958
15670   N = NBUS*2-1
15680   FOR I = 1 TO LD
15690   FOR J = 1 TO N
15700   AMAT(I,J) = 0!
15710   NEXT J
15720   NEXT I
15730   FOR I = 1 TO LD
15740   K = NLD(I)
15750   L = LN(K)
15760   M = LM(K)
15770   BR = CR(K)/CRJ(K)

```

```
15780   BI = CJ(K)/CRJ(K)
15790   IF L = NBUS THEN 15830
15800   DN = BR*(-GSE(K)*AA(L)*SIN(B(L)) - BSE(K)*AA(L)*COS(B(L)) - YCAP(K)*AA(L)*COS(B(L)))
15810   DM = BI*(GSE(K)*AA(L)*COS(B(L)) - BSE(K)*AA(L)*SIN(B(L)) - YCAP(K)*AA(L)*SIN(B(L)))
15820   AMAT(I,L) = DN+DM
15830   IF M = NBUS THEN 15870
15840   DN = BR*(GSE(K)*AA(M)*SIN(B(M)) + BSE(K)*AA(M)*COS(B(M)))
15850   DM = BI*(-GSE(K)*AA(M)*COS(B(M)) + BSE(K)*AA(M)*SIN(B(M)))
15860   AMAT(I,M) = DN+DM
15870   DN = BR*(GSE(K)*COS(B(L)) - BSE(K)*SIN(B(L)) - YCAP(K)*SIN(B(L)))
15880   DM = BI*(GSE(K)*SIN(B(L)) + BSE(K)*COS(B(L)) + YCAP(K)*COS(B(L)))
15890   J = NSJ+L
15900   AMAT(I,J) = DN+DM
15910   DN = BR*(-GSE(K)*COS(B(M)) + BSE(K)*SIN(B(M)))
15920   DM = BI*(-GSE(K)*SIN(B(M)) - BSE(K)*COS(B(M)))
15930   J = NSJ+M
15940   AMAT(I,J) = DN+DM
15950   NEXT I
15952   GOTO 15980
15954   OVERL = 1
15956   GOTO 15980
15958   ALPA = 1
15980   RETURN
15990   END
```

```
16000   REM SUBROUTINE PSEUDO INVERSE  MATRIX
16005   FOR I = 1 TO LD
16010   FOR J = 1 TO N
16015   XX(J,I) = AMAT(I,J)
16020   NEXT J
16025   NEXT I
16030   FOR I = 1 TO LD
16035   FOR J = 1 TO LD
16040   YY(I,J) = 0!
16045   FOR K = 1 TO N
16050   YY(I,J) = YY(I,J)+AMAT(I,K)*XX(K,J)
16055   NEXT K
16060   NEXT J
16065   NEXT I
16070   NN = LD*2
16075   VD = LD+1
16078   IF LD = 1 THEN 16258
16080   FOR I = 1 TO LD
16085   FOR J = VD TO NN
16090   YY(I,J) = 0!
16095   VM = J-LD
16100   IF I <> VM THEN 16105
16102   YY(I,J) = 1!
16105   NEXT J
16110   NEXT I
16115   FOR I = 1 TO LD
16117   YL = YY(I,I)
16120   FOR J = 1 TO NN
16125   YY(I,J) = YY(I,J)/YL
16130   NEXT J
16135   BK = I+1
16138   IF BK > LD THEN 16175
16140   FOR K = BK TO LD
16143   YC = YY(K,I)
16145   FOR J = 1 TO NN
16150   YA = YY(I,J)*YC
16155   YY(K,J) = YY(K,J)-YA
16160   NEXT J
16165   NEXT K
16175   IF I = 1 THEN 16225
16180   JQ = I-1
16185   FOR K = JQ TO 1 STEP -1
16190   JP = I
16193   YU = YY(K,I)
16195   FOR J = JP TO NN
16200   YA = YY(I,J)*YU
16205   YY(K,J) = YY(K,J) - YA
16210   NEXT J
16215   NEXT K
16225   NEXT I
16230   FOR I = 1 TO LD
16235   FOR J = 1 TO LD
16240   K = J+LD
16245   YY(I,J) = YY(I,K)
16250   NEXT J
```



```
16255     NEXT I
16256     GOTO 16260
16258     YY(LD,LD) = 1/YY(LD,LD)
16260     FOR I = 1 TO N
16265     FOR J = 1 TO LD
16270     INVERA(I,J) = 0:
16275     FOR K = 1 TO LD
16285     INVERA(I,J) = INVERA(I,J)+XX(I,K)*YY(K,J)
16290     NEXT K
16295     NEXT J
16300     NEXT I
16305     RETURN
16310     END
```

```
17000 REM SUBROUTINE INCREMENT IN BUS INJECTED POWER TO ALLEVIATE LINE OVERLO
AD
17002 FOR I = 1 TO NBUS
17004 EE(I) = 0!
17006 FF(I) = 0!
17008 NEXT I
17010 FOR I = 1 TO N
17020 FOR J = 1 TO LD
17030 IF I > NSJ THEN 17060
17035 K = I
17040 FF(K) = FF(K) + INVERA(I,J)*DOC(J)
17050 GOTO 17080
17060 K = I-NSJ
17070 EE(K) = EE(K) + INVERA(I,J)*DOC(J)
17080 NEXT J
17090 NEXT I
17100 FOR I = 1 TO NBUS
17130 K = NK(I)
17140 EEN(K) = EE(I)
17150 FFN(K) = FF(I)
17170 NEXT I
17180 FOR I = 1 TO NSJ
17185 DP(I) = 0!
17190 FOR J = 1 TO NSJ
17200 DP(I) = DP(I) + BMAT1(I,J)*FF(J)
17210 NEXT J
17220 DP(I) = DP(I)*AA(I)
17230 NEXT I
17240 FOR I = 1 TO NBUS
17245 DQ(I) = 0!
17250 FOR J = 1 TO NBUS
17260 DQ(I) = DQ(I) + BMAT1(I,J)*EE(J)
17270 NEXT J
17280 DQ(I) = DQ(I)*AA(I)
17290 NEXT I
17295 RETURN
17300 END
```

```
18000 REM SUBROUTINE GENERATING RESCHEDULING AND LOAD SHEDDING
18295 NOSH = 0
18310 FOR I = 1 TO NSJ
18320 SHEDP(I) = 0!
18325 HADP(I) = 0!
18330 BI = 0!
18340 BR = 0!
18350 IF GBUSN(I) < > 1 THEN 18560
18360 BR = PGO(I) + DF(I)
18370 IF BR > PGNMAX(I) THEN 18430
18380 IF BR < 0! THEN 18410
18385 PGO(I) = BR
18390 PDL(I) = PDN(I)
18395 SHEDP(I) = 0!
18397 HADP(I) = 0!
18400 GOTO 18580
18410 PGO(I) = 0!
18415 SHEDP(I) = 0!
18417 HADP(I) = BR
18420 GOTO 18580
18430 PGO(I) = PGNMAX(I)
18440 BI = PDN(I) - (DP(I)-(BR-PGNMAX(I)))
18450 IF BI > LPEAK(I) THEN 18500
18460 IF BI < 0! THEN 18530
18470 PDL(I) = BI
18480 SHEDP(I) = PDN(I) - BI
18490 GOTO 18580
18500 PDL(I) = LPEAK(I)
18510 HADP(I) = BI - PDL(I)
18515 SHEDP(I) = 0!
18520 GOTO 18580
18530 SHEDP(I) = PDN(I)
18540 PDL(I) = 0!
18545 HADP(I) = 0!
18550 GOTO 18580
18560 BI = PDN(I) - DP(I)
18570 GOTO 18450
18580 IF SHEDP(I) = 0! THEN 18584
18582 NOSH = 1
18584 NEXT I
18587 IF NOSH = 0 THEN 19075
18610 FOR I = 1 TO NSJ
18620 IF SHEDP(I) = 0! THEN 18980
18630 FOR J = 1 TO NLINE
18635 IF J = RTL THEN 18970
18640 IF SHEDP(I) = 0! THEN 18970
18650 JB = 0
18660 FOR K = 1 TO LD
18670 IF J <> NLD(K) THEN 18690
18680 JB = NLD(K)
18690 NEXT K
18700 IF JB <> 0 THEN 18970
18710 L = LN(J)
18720 M = LM(J)
18730 IF I <> L THEN 18970
```

```

18740 IF PSEAL(J) > 0! THEN 18970
18750 IF HADP(M) <= 0! THEN 18970
18760 IF HADP(M) > SHEDP(I) THEN 18820
18770 SHEDP(I) = SHEDP(I) - HADP(M)
18790 PDL(I) = PDL(I) + HADP(M)
18800 HADP(M) = 0!
18810 GOTO 18970
18820 HADP(M) = HADP(M) - SHEDP(I)
18830 PDL(I) = PDL(I) + SHEDP(I)
18840 SHEDP(I) = 0!
18850 GOTO 18970
18860 IF GBUSN(M) <> 1 THEN 18970
18870 IF PGO(M) => PGNMAX(M) THEN 18970
18880 PIS = PGNMAX(M) - PGO(M)
18890 IF SHEDP(I) > PIS THEN 18940
18900 PGO(M) = PGO(M) + SHEDP(I)
18910 PDL(I) = PDL(I) + SHEDP(I)
18920 SHEDP(I) = 0!
18930 GOTO 18970
18940 SHEDP(I) = SHEDP(I) - PIS
18950 PDL(I) = PDL(I) + PIS
18960 PGO(M) = PGNMAX(M)
18970 NEXT J
18980 NEXT I
19075 NOSH = 0
19080 FOR I = 1 TO NSJ
19090 SHEDQ(I) = 0!
19100 HADQ(I) = 0!
19110 BI = QDN(I) - DQ(I)
19130 IF BI > LQEAK(I) THEN 19180
19140 IF BI < 0! THEN 19220
19150 QDL(I) = BI
19160 SHEDQ(I) = QDN(I) - BI
19165 HADQ(I) = 0!
19170 GOTO 19360
19180 QDL(I) = LQEAK(I)
19190 HADQ(I) = BI - LQEAK(I)
19200 SHEDQ(I) = 0!
19210 GOTO 19360
19220 QDL(I) = 0!
19225 HADQ(I) = 0!
19230 SHEDQ(I) = QDN(I)
19360 IF SHEDQ(I) = 0! THEN 19363
19362 NOSH = 1
19363 NEXT I
19367 IF NOSH = 0 THEN 19710
19510 FOR I = 1 TO NSJ
19520 IF SHEDQ(I) = 0! THEN 19700
19530 FOR J = 1 TO NLINE
19535 IF J = RTL THEN 19690
19540 IF SHEDQ(I) = 0! THEN 19690
19550 L = LN(J)
19560 M = LM(J)
19570 IF I <> L THEN 19690
19580 IF QSEAC(J) > 0! THEN 19690

```

```
19590 IF HADQ(M) <= 0! THEN 19690
19600 IF HADQ(M) > SHEDQ(I) THEN 19650
19610 SHEDQ(I) = SHEDQ(I) - HADQ(M)
19620 QDL(I) = QDL(I) + HADQ(M)
19630 HADQ(M) = 0!
19640 GOTO 19690
19650 HADQ(M) = HADQ(M) - SHEDQ(I)
19660 QDL(I) = QDL(I) + SHEDQ(I)
19670 SHEDQ(I) = 0!
19680 GOTO 19710
19690 NEXT J
19700 NEXT I
19710 FOR I = 1 TO NSJ
19712 PTD = .01*PDN(I)
19714 QTD = .01*QDN(I)
19720 IF SHEDP(I) <= PTD AND SHEDQ(I) <= QTD THEN 19840
19725 IF PFT(I) => 2 THEN 19860
19730 IF SHEDP(I) => SHEDQ(I) THEN 19775
19740 PPFT = SHEDQ(I)*PFT(I)
19750 ICG = PPFT - SHEDP(I)
19760 PDL(I) = PDL(I) - ICG
19765 SHEDP(I) = PPFT
19770 GOTO 19910
19775 QPFT = SHEDP(I)/PFT(I)
19780 IF QPFT => SHEDQ(I) THEN 19825
19790 PPFT = SHEDQ(I)*PFT(I)
19800 ICG = PPFT - SHEDP(I)
19810 PDL(I) = PDL(I) - ICG
19815 SHEDP(I) = PPFT
19820 GOTO 19910
19825 ICG = QPFT - SHEDQ(I)
19830 QDL(I) = QDL(I) - ICG
19835 SHEDQ(I) = QPFT
19837 GOTO 19910
19840 SHEDP(I) = 0!
19845 SHEDQ(I) = 0!
19850 GOTO 19910
19860 IF SHEDP(I) <> 0! THEN 19910
19870 IF SHEDQ(I) = 0! THEN 19910
19880 PPFT = 1.33* SHEDQ(I)
19890 SHEDP(I) = PPFT
19900 PDL(I) = PDL(I) - PPFT
19910 NEXT I
19920 RETURN
19930 END
```



```

22000  REM SUBROUTINE GAUSS ELIMINATION METHOD
22005  FOR I = 1 TO N
22010  DDD = AB(I,I)
22015  FOR J = I TO N
22016  IF DDD = 0! THEN 22027
22020  AB(I,J) = AB(I,J)/DDD
22025  NEXT J
22026  GOTO 22030
22027  LPRINT "DEVISION AB(";I ;I;" ) IN SUBROUTINE 22000 = 0.0 "
22028  GOTO 22095
22030  DELV(I) = DELV(I)/DDD
22035  FOR J = I TO N
22040  IF(I = J) THEN 22050
22045  DELV(J) = DELV(J)-DELV(I)*AB(J,I)
22050  NEXT J
22055  IF (I = N) THEN 22095
22060  FOR KK = I TO N
22065  IF (KK = I) THEN 22090
22070  DDD = AB(KK,I)
22075  FOR J = 1 TO N
22080  AB(KK,J) = AB(KK,J)-AB(I,J)*DDD
22085  NEXT J
22090  NEXT KK
22095  NEXT I
22100  K = N-1
22105  FOR I = K TO 1 STEP -1
22106  LL = I+1
22110  FOR J = N TO LL STEP -1
22115  IF (J = 1) THEN 22125
22120  DELV(I) = DELV(I)-AB(I,J)*DELV(J)
22125  NEXT J
22130  NEXT I
22135  RETURN
22140  END

```

```

24000  REM SUBROUTINE PRINTOUT
24001  OPT = 0
24002  FOR I = 1 TO 7
24003  OPT = OPT + PTION(I)
24004  NEXT I
24005  IF OPT <> 0 THEN 24010
24006  PTION(7) = 1
24010  IF PTION(1) <> 1 THEN 24125
24020  LPRINT TAB(50) "SYSTEM INFORMATION":LPRINT
24030  LPRINT TAB(25) "TOTAL NUMBER OF SYSTEM.....
";STEM
24040  LPRINT TAB(25) "TOTAL NUMBER OF BUS.....
";NBUS
24050  LPRINT TAB(25) "TOTAL NUMBER OF GENERATOR.....
";NGEN
24060  LPRINT TAB(25) "TOTAL NUMBER OF LINE AND TRANSFORMER.....
";NLINE
24070  LPRINT TAB(25) "ACCELERATION FACTOR FOR VOL.ANGLE CORR TN.....
";ACF
24080  LPRINT TAB(25) "ACCELERATION FACTOR FOR VOL.MAGN CORR TN.....
";ACE
24090  LPRINT TAB(25) "BASE MVA. USED.....
";MBASE
24100  LPRINT TAB(25) "ITERATION LIMITED.....
";LNIT
24110  LPRINT TAB(25) "NUMBER OF Swing BUS AT.....
";SWG
24120  LPRINT:LPRINT:LPRINT
24125  IF PTION(2) <> 1 THEN 24225
24130  LPRINT TAB(62) "BUS DATA OF THE ";NBUS;" BUS MODEL SYSTEM":LPRINT
24140  LPRINT TAB(25) "-----
"
24150  LPRINT TAB(25) "BUS          SCHEDULED          MAXIMUM
PEAK LOAD          SHUNT          "
24160  LPRINT TAB(25) "NO.          GENERATION          GENERATION          R
EAL          REACTIVE          SUSCEPTANCE          "
24170  LPRINT TAB(25) "-----
"
24180  FOR I = 1 TO NBUS
24190  LPRINT TAB(25);:LPRINT USING "##          ";I;:LPRINT USING "###.####
";PG(I),PGMAX(I),PD(I),QD(I),YSHT(I):LPRINT
24200  NEXT I
24210  LPRINT TAB(25) "-----
"
24220  LPRINT:LPRINT:LPRINT
24225  IF PTION(3) <> 1 THEN 24320
24230  LPRINT TAB(62) "LINE DATA OF THE ";NBUS;" BUS MODEL SYSTEM":LPRINT
24240  LPRINT TAB(25) "-----
"
24250  LPRINT TAB(25) "LINE          FROM          TO          R
X          B/2          CURRENT"
24260  LPRINT TAB(25) " NO.          BUS          BUS          (P.U)
(P.U)          (P.U)          RATING"
24270  LPRINT TAB(25) "-----
"

```

```

24280 FOR I = 1 TO NLINE
24285 IF I = RTL THEN 24300
24290 LPRINT TAB(25);:LPRINT USING " ##          ";LLINE(I),SB(I),EB(I);:LPRINT
  USING "###.###"          ";RSER(I),XSER(I),YCAP(I),CMAX(I):LPRINT
24300 NEXT I
24310 LPRINT TAB(25) "-----"
-----"
24320 IF PTION(4) <> 1 THEN 24590
24325 LPRINT:LPRINT:LPRINT
24330 LPRINT TAB(68)," BUS ADMITTANCE MATRIX "
24340 LPRINT
24350 FOR I = 1 TO NBUS
24360 FOR J = 1 TO NBUS
24370 LPRINT";-----";
24380 NEXT J
24390 LPRINT";"
24400 FOR J = 1 TO NBUS
24410 LPRINT";          ";
24420 NEXT J
24430 LPRINT";"
24440 FOR K = 1 TO NBUS
24450 DR(K) = Y(I,K)*COS(AY(I,K))
24460 DI(K) = Y(I,K)*SIN(AY(I,K))
24470 LPRINT USING "!   ###.##### j###.##### ";DR(K),DI(K),
24480 NEXT K
24490 LPRINT "!"
24500 FOR J = 1 TO NBUS
24510 LPRINT";          ";
24520 NEXT J
24530 LPRINT "!"
24540 NEXT I
24550 FOR K = 1 TO NBUS
24560 LPRINT";-----";
24570 NEXT K
24580 LPRINT";"
24590 IF PTION(5) <> 1 THEN 24690
24595 LPRINT:LPRINT:LPRINT
24600 LPRINT TAB(72)," POWER and VOLTAGE BUS ":LPRINT
24610 LPRINT TAB(25),"-----"
-----"
"
24620 LPRINT TAB(25)," BUS          VOLTAGE          GEN
ERATION          LOAD          BUS POWER
"
24630 LPRINT TAB(25)," NAME          MAGN.          ANGLE          MW
MVAR          MW          MVAR          MW          MVAR"
"
24640 LPRINT TAB(25),"-----"
-----"
":LPRINT
24650 FOR I = 1 TO NBUS
24660 LPRINT TAB(29);:LPRINT USING " ## ";BUS(I);: LPRINT USING " ###.
#####";V(I),AV(I);: LPRINT USING " #####          #####";PREAL(I),QR
EAC(I),PDD(I),QDD(I),PAM(I),PAM(I):LPRINT
24670 NEXT I

```



```

24680 LPRINT TAB(25),"-----
-----
":LPRINT
24690 LPRINT:LPRINT:LPRINT
24695 IF PTION(6) <> 1 THEN 24810
24700 LPRINT:LPRINT TAB(62)," POWER and CURRENT FLOW ON THE TRANSMISSION LIN
ES ":LPRINT
24710 LPRINT TAB(25),"-----
-----"
24720 LPRINT TAB(25)," line from to POWER
FLOW LINE CURRENT "
24730 LPRINT TAB(25)," name bus bus MW
MVAR Ir Ij Ipq "
24740 LPRINT TAB(25),"-----
-----":LPRINT
24750 FOR I = 1 TO NLINE
24755 IF I = RTL THEN 24780
24760 LPRINT TAB(32);:LPRINT USING " ## " ;LLINE(I),SB(I),EB(I);:LPRINT U
SING " #####.##### " ;LSR(I),LSA(I);:LPRINT USING " ###.#### " ;RLC(I
),ILC(I),MLC(I):LPRINT
24770 LPRINT TAB(42);:LPRINT USING " ## " ;EB(I),SB(I);:LPRINT USING "
#####.##### " ;LRR(I),LLR(I):LPRINT
24780 NEXT I
24790 LPRINT TAB(25),"-----
-----":LPRINT
24800 LPRINT TAB(40),"convergence in"; NIT1 ;"iterations" :LPRINT:LPRINT:LPRIN
T
24810 IF PTION(7) <> 1 THEN 24930
24812 LPRINT TAB(29) "REMOVE TRANSMISSION LINE NUMBER.....
..... " ;RTL
24814 LPRINT TAB(29) "TOTAL LINE OVERLOAD.....
..... " ;LOD
24816 LPRINT TAB(29) "OVERLOAD LINE NUMBER.....
..... " ;NLOD
24818 LPRINT TAB(29) "PERCENTAGE OVERLOAD.....
..... " ;:LPRINT USING "###.##";PCLO
24820 LPRINT TAB(29) "TOTAL OVERLOAD ALLEVIATION PASS.....
..... " ;PASK
24822 LPRINT:LPRINT:LPRINT
24824 LPRINT TAB(53) "RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOA
DS":LPRINT
24830 LPRINT TAB(25),"-----
-----"
24840 LPRINT TAB(25)," BUS SCHEDULED RESCHEDULED
LOAD SHEDDING "
24850 LPRINT TAB(25)," NAME GENERATION GENERATION
P Q "
24860 LPRINT TAB(25)," (MW) (MW)
(MW) (MVAR) "
24870 LPRINT TAB(25),"-----
-----":LPRINT
24880 FOR I = 1 TO NBUS
24890 LPRINT TAB(25);:LPRINT USING " ### " ;BUS(I);:LPRINT USING "
###.##### " ;PREAL(I),RPG(I),SLOADP(I),SLOADQ(I);:LPRINT:LPRINT
24900 NEXT I
24910 LPRINT TAB(25),"-----
-----"
24930 RETURN
24940 END

```

```

26000   REM SUBROUTINE COMPUTE SWING BUS GENERATING
26010   YX = 0!
26020   AYX = 0!
26030   B(NBUS) = 0!
26050   FOR I = 1 TO NBUS
26060   BR = - B(I)
26070   YX = YX + AA(I)*(G(NBUS,I)*COS(BR) + H(NBUS,I)*SIN(BR))
26080   AYX = AYX + AA(I)*(G(NBUS,I)*SIN(BR) - H(NBUS,I)*COS(BR))
26090   NEXT I
26100   PI(SWG) = YX*AA(NBUS)
26110   QI(SWG) = AYX*AA(NBUS)
26120   IF GBUSN(NBUS) <> 1 THEN 26290
26130   PGS = PI(SWG) + PDN(NBUS)
26150   IF PGS > PGNMAX(NBUS) THEN 26210
26160   IF PGS < 0! THEN 26250
26170   PGO(NBUS) = PGS
26180   SHEDP(NBUS) = 0!
26190   PDL(NBUS) = PDN(NBUS)
26200   GOTO 26370
26210   PGO(NBUS) = PGNMAX(NBUS)
26220   SHEDP(NBUS) = PGS - PGNMAX(NBUS)
26230   PDL(NBUS) = PDN(NBUS) - SHEDP(NBUS)
26240   GOTO 26370
26250   PGO(NBUS) = 0!
26260   SHEDP(NBUS) = 0!
26270   PDL(NBUS) = PDN(NBUS)
26280   GOTO 26370
26290   AFI = -PI(SWG)
26295   IF AFI > LPEAK(NBUS) THEN 26340
26300   PDL(NBUS) = AFI
26310   SHEDP(NBUS) = LPEAK(NBUS) - AFI
26330   GOTO 26370
26340   PDL(NBUS) = LPEAK(NBUS)
26350   SHEDP(NBUS) = 0!
26370   IF SHEDP(NBUS) = 0! THEN 26680
26380   FOR I = 1 TO NLINE
26385   IF I = RTL THEN 26670
26390   IF SHEDP(NBUS) = 0! THEN 26670
26400   JB = 0
26410   FOR K = 1 TO LD
26420   IF I <> NLD(K) THEN 26440
26430   JB = NLD(K)
26440   NEXT K
26450   IF JB <> 0 THEN 26670
26460   L = LN(I)
26470   M = LM(I)
26480   IF NBUS <> L THEN 26670
26490   IF PSEAL(I) > 0! THEN 26670
26500   IF GBUSN(M) <> 1 THEN 26670
26510   IF PGN(M) => PGNMAX(M) THEN 26670
26520   PIS = PGNMAX(M) - PGO(M)
26530   IF SHEDP(NBUS) > PIS THEN 26570
26540   PGN(M) = PGN(M) + SHEDP(NBUS)
26550   SHEDP(NBUS) = 0!

```

```
26560 GOTO 26670
26570 SHEDP(NBUS) = SHEDP(NBUS) - PIS
26580 PGN (M) = PGNMAX(M)
26600 PDL(M) = PDL(NBUS) + PIS
26670 NEXT I
26680 PDN(NBUS) = PDL(NBUS)
26690 QDN(NBUS) = QDL(NBUS)
26700 PGN(NBUS) = PGO(NBUS)
26710 PCURT(NBUS) = SHEDP(NBUS)
26720 QCURT(NBUS) = SHEDQ(NBUS)
26730 RETURN
26740 END
```



ภาคผนวก ข

POWER and VOLTAGE BUS

BUS NAME	VOLTAGE		GENERATION		LOAD		BUS POWER	
	MAGN.	ANGLE	MW	MVAR	MW	MVAR	MW	MVAR
2	0.97706	-0.06439	0.0000	0.0000	56.3400	3.9000	-56.3400	-3.9000
3	1.00000	0.00000	249.8008	110.0520	169.9800	9.0400	79.8208	101.0120
4	1.00000	0.04157	50.0000	11.9729	91.6700	15.0000	-41.6700	-3.0271
5	1.00000	0.43819	380.0000	55.0893	247.1300	52.4900	132.8700	2.5993
6	0.92506	-0.10089	0.0000	0.0000	98.4500	10.2500	-98.4500	-10.2500

LINE DATA and POWER FLOW

line name	from bus	to bus	POWER FLOW		Ir	LINE CURRENT	
			MW	MVAR		Ij	Ipq
1	1	2	-38.33237	-18.80564	-0.3791	0.2173	0.4370
	2	1	38.72797	-3.88454			
2	1	2	-30.52688	-20.63079	-0.2982	0.2308	0.3771
	2	1	30.76887	-6.72153			
3	2	3	-29.39971	6.29969	-0.2940	-0.0630	0.3007
	3	2	29.70384	-8.33112			
4	3	4	-71.37598	5.30196	-0.7109	-0.0826	0.7157
	4	3	77.51005	-25.22263			
5	4	5	55.35982	-2.18086	0.4920	0.2546	0.5540
	5	4	-48.62538	8.17589			
6	5	1	-12.15081	-9.71261	-0.1201	0.1177	0.1682
	1	5	12.51892	6.89289			
7	5	2	-37.67431	-8.70805	-0.3957	0.1347	0.4180
	2	5	39.72401	10.31821			

convergence in 4 iterations

BUS ADMITTANCE MATRIX

0.86457 j -5.68710	-0.86457 j 5.81680	0.00000 j 0.00000	0.00000 j 0.00000	0.00000 j 0.00000	0.00000 j 0.00000
-0.86457 j 5.81680	2.33524 j -12.82717	-0.52885 j 4.68412	0.00000 j 0.00000	0.00000 j 0.00000	-0.94182 j 2.32744
0.00000 j 0.00000	-0.52885 j 4.68412	3.65350 j -15.65925	-1.76040 j 7.11139	0.00000 j 0.00000	-1.36425 j 3.09733
0.00000 j 0.00000	0.00000 j 0.00000	-1.76040 j 7.11139	2.15548 j -8.77292	-0.39508 j 1.92703	0.00000 j 0.00000
0.00000 j 0.00000	0.00000 j 0.00000	0.00000 j 0.00000	-0.39508 j 1.92703	0.64636 j -2.91422	-0.25128 j 1.05669
0.00000 j 0.00000	-0.94182 j 2.32744	-1.36425 j 3.09733	0.00000 j 0.00000	-0.25128 j 1.05669	2.55735 j -6.32416

BUS ADMITTANCE MATRIX

SYSTEM INFORMATION

TOTAL NUMBER OF SYSTEM.....	1
TOTAL NUMBER OF BUS.....	5
TOTAL NUMBER OF GENERATOR.....	3
TOTAL NUMBER OF LINE AND TRANSFORMER.....	7
ACCELERATION FACTOR FOR VOL.ANGLE CORR TN.....	1
ACCELERATION FACTOR FOR VOL.MAGN CORR TN.....	1
BASE MVA. USED.....	100
ITERATION LIMITED.....	50
NUMBER OF SLACK BUS AT.....	2

BUS DATA OF THE 5 BUS MODEL SYSTEM

BUS NO.	SCHEDULED GENERATION	MAXIMUM GENERATION	PEAK LOAD		SHUNT SUSCEPTANCE
			REAL	REACTIVE	
1	0.0000	0.0000	0.5634	0.0390	-0.3000
2	0.5000	1.2000	1.6998	0.0904	-0.9500
3	0.5000	0.7000	0.9167	0.1500	0.0000
4	3.8000	4.0000	2.4713	0.5249	-0.3000
5	0.0000	0.0000	0.9845	0.1025	0.0000

LINE DATA OF THE 5 BUS MODEL SYSTEM

LINE NO.	FROM BUS	TO BUS	R (P.U)	X (P.U)	B/2 (P.U)	CURRENT RATING
1	1	2	0.0250	0.1682	0.1297	2.0000
2	1	2	0.0238	0.2108	0.1509	1.2500
3	2	3	0.0328	0.1325	0.0163	1.7500
4	3	4	0.1021	0.4980	0.2492	0.9000
5	4	5	0.2130	0.8957	0.1203	0.4500
6	5	1	0.1494	0.3692	0.0206	1.0000
7	5	2	0.1191	0.2704	0.0164	0.6000

REMOVE TRANSMISSION LINE NUMBER..... 0
 TOTAL NUMBER OF THE LINE OVERLOAD..... 1
 OVERLOAD LINE NUMBER..... 5
 PERCENTAGE OVERLOAD..... 12.25
 TOTAL OF OVERLOAD ALLEVIATION PASS..... 1

RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
1	150.00000	150.00000	0.00000	0.00000
2	0.00000	0.00000	3.25956	2.45079
3	106.15600	90.93522	0.00000	0.00000
4	50.00000	55.87050	1.63324	1.22800
5	380.00000	367.90300	0.00000	0.00000
6	0.00000	0.00000	13.88459	0.00000

REMOVE TRANSMISSION LINE NUMBER..... 1
 TOTAL NUMBER OF THE LINE OVERLOAD..... 1
 OVERLOAD LINE NUMBER..... 5
 PERCENTAGE OVERLOAD..... 20.38
 TOTAL OF OVERLOAD ALLEVIATION PASS..... 2

RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
2	0.00000	0.00000	5.18700	3.90000
3	251.41440	120.00000	96.12942	0.00000
4	50.00000	63.94001	4.61044	3.46649
5	380.00000	351.37770	0.00000	0.00000
6	0.00000	0.00000	36.45608	0.00000

REMOVE TRANSMISSION LINE NUMBER..... 2
 TOTAL NUMBER OF THE LINE OVERLOAD..... 0
 OVERLOAD LINE NUMBER..... 0
 PERCENTAGE OVERLOAD..... 0.00
 TOTAL OF OVERLOAD ALLEVIATION PASS..... 0

RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
1	150.00000	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000	0.00000
3	120.26720	0.00000	0.00000	0.00000
4	50.00000	0.00000	0.00000	0.00000
5	380.00000	0.00000	0.00000	0.00000
6	0.00000	0.00000	0.00000	0.00000

REMOVE TRANSMISSION LINE NUMBER 3
 TOTAL NUMBER OF THE LINE OVERLOAD 1
 OVERLOAD LINE NUMBER 5
 PERCENTAGE OVERLOAD 51.25
 TOTAL OF OVERLOAD ALLEVIATION PASS 2

RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
1	150.00000	150.00000	0.00000	0.00000
2	0.00000	0.00000	5.18700	3.90000
3	115.89720	72.25246	0.00000	0.00000
4	50.00000	70.00000	20.00000	0.00000
5	380.00000	279.10870	4.23242	3.18227
6	0.00000	0.00000	31.15633	0.00000

REMOVE TRANSMISSION LINE NUMBER.....	5
TOTAL NUMBER OF THE LINE OVERLOAD.....	1
OVERLOAD LINE NUMBER.....	4
PERCENTAGE OVERLOAD.....	26.89
TOTAL OF OVERLOAD ALLEVIATION PASS.....	2



RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
1	150.00000	150.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000	0.00000
3	118.80590	108.57420	0.00000	0.00000
4	50.00000	70.00000	20.24931	0.18746
5	380.00000	342.65840	0.00000	0.00000
6	0.00000	0.00000	0.00000	0.00000

REMOVE TRANSMISSION LINE NUMBER.....	6
TOTAL NUMBER OF THE LINE OVERLOAD.....	1
OVERLOAD LINE NUMBER.....	5
PERCENTAGE OVERLOAD.....	20.11
TOTAL OF OVERLOAD ALLEVIATION PASS.....	2

RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
1	150.00000	150.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000	0.00000
3	109.10040	79.35381	0.00000	0.00000
4	50.00000	63.24002	5.29130	3.97842
5	380.00000	352.81320	0.00000	0.00000
6	0.00000	0.00000	30.89799	0.00000

REMOVE TRANSMISSION LINE NUMBER.....	7
TOTAL NUMBER OF THE LINE OVERLOAD.....	1
OVERLOAD LINE NUMBER.....	5
PERCENTAGE OVERLOAD.....	22.62
TOTAL OF OVERLOAD ALLEVIATION PASS.....	2

RESCHEDULING AND LOAD SHEDDING TO ALLEVIATE LINE OVERLOADS

BUS NAME	SCHEDULED GENERATION (MW)	RESCHEDULED GENERATION (MW)	LOAD SHEDDING	
			P (MW)	Q (MVAR)
1	150.00000	150.00000	0.00000	0.00000
2	0.00000	0.00000	3.43049	2.57931
3	111.74940	95.19780	0.00000	0.00000
4	50.00000	67.70958	13.64568	10.25991
5	380.00000	343.92220	0.00000	0.00000
6	0.00000	0.00000	12.55161	1.35010

ประวัติผู้เขียน

นายสมชัย วงศ์วัฒนศานต์ เกิดที่ อำเภอกาญจนบุรี จังหวัดสงขลา เมื่อปี พ.ศ. 2499
ศึกษาจบปริญญาวิศวกรรมศาสตรบัณฑิต สาขาวิศวกรรมไฟฟ้า (ไฟฟ้ากำลัง) จากสถาบันเทคโนโลยี
พระจอมเกล้า (ธนบุรี) เมื่อปีการศึกษา 2523 ปัจจุบันเป็นพนักงานของบริษัท ไทยออยล์ จำกัด
ตำแหน่ง รองผู้จัดการฝ่ายกิจการสัมพันธ์ สำนักงานใหญ่ กรุงเทพมหานคร



