NSGT- MODBIB

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*                                                           *
*  NETZWERKEINGABE FUER PROGRAMMSYSTEM 'STADYNET'  -  22.12.1983  *
*                                                           *
*************************************************************

BEF.NR LK-EINGABESTROM
======================
  1      TABE TABKAP(X)=2.,6E-5,6E-4,1.,-.33,.6,5E-5,2E-5,5E-4
  2      TABE TABEN(X)=.73,.23,.189,.0424,.86,.0252,.8,-1.6,-2.,3.,1E-5,#
         -.88,.65,-.4,.8,.8,.261,-.14,.0119,1.1,0,2.,-.6,-1.,5E-4,.8,.4213447(
  3      TABE TABDT(X)= -3.25,-1.5,-2.5,2.1,.34,.04,.05,.8,.025,.65,-1.6,-2.,#
         4.,-.4,.8,.8,-.35,0.,-.6,-.5,-.1,2.,-.6,-1.,5E-4,.8
  4       PROZ KON ENTRY(FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16))#
                  RETURNS(FLOAT(16));
          KON:PROC(DIFF,POLY,ALU,GATE)RETURNS(FLOAT(16));
               DCL (DIFF,POLY,ALU,GATE,LAMBDA,CGATE,CPOLY,CDIFF,CALU)FLOAT(1(
            /*************************************************************
            *     SPANNUNGSUNABHAENGIGE  LASTKAPAZITAET                 *
            *     C** **-** = KON(DIFF,POLY,ALU,GATE)                   *
            *     DIFF:FLAECHE IN LAMBDA**2                             *
            *     POLY:FLAECHE IN LAMBDA**2                             *
            *     ALU :FLAECHE IN LAMBDA**2                  >GH-INT    *
            *     GATE:FLAECHE IN LAMBDA**2     NSGT2S PH6/82 V:5/83     *
            *                                                           *
            *************************************************************/
            LAMBDA=2.;CGATE=5E-4;CPOLY=5E-5;CDIFF=6E-5;CALU=3E-5;
            RETURN(LAMBDA**2*(GATE*CGATE+DIFF*CDIFF+POLY*CPOLY+ALU*CALU));
          END KON;

  5      PROZ CDEP ENTRY(FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),#
                  FLOAT(16),(26)FLOAT(16),FLOAT(16)) RETURNS(FLOAT(16));
          CDEP:PROC(UG,UD,US,UB,BB,LL,T,MOD) RETURNS(FLOAT(16));
            DCL(UG,UD,US,UB,BB,LL,B,L,T(26),VG,VD,VB,M,HILF,A,K2,K3,K4,K5,
            MM,MOD,VX,VFB,K11,UDT,UT0,VSAT,UTT,UT1,K54,K0) FLOAT(16);
          /*************************************************************

               GATE-SOURCE,DRAIN,BULK-KAPAZITAET FUER
               DEPLETIONTRS, NSGT2S MIT KURZ-UND SCHMALKANALEFFEKT;
               BB,LL-ANGABE IN LAMBDA-EINHEITEN;          V: 5/83
               T(1)=UDT0    T(8)=K5D       T(15)=Y1       T(22)=LAMBDA
               T(2)=UT00    T(9)=BETAD     T(16)=Z1       T(23)=KVB=VVB+DB
               T(3)=UTT0    T(10)=2VF      T(17)=DUDT     T(24)=KVL=VVL+DL
               T(4)=K11D   (T(11)=DB)      T(18)=DK3D     T(25)=CGATEOX
               T(5)=K2D    (T(12)=DL)      T(19)=DK11D    T(26)=XJ
               T(6)=K3D     T(13)=LEFF     T(20)=DUTT
               T(7)=K4D     T(14)=X1       T(21)=DK2D       >GH-INT
               HINWEIS:  MOD=0: GATE-BULK-KAP.
                         MOD=1: GATE-DRAIN-KAP.
                         MOD=-1: GATE-SOURCE-KAP.

          *************************************************************/
            IF UD>=US THEN DO;
              VG=UG-US; VD=UD-US; VB=UB-US; M=1; END;
            ELSE DO;
              VG=UG-UD; VD=US-UD; VB=UB-UD; M=-1; END;
              B=BB*T(22)+T(23);
              L=LL*T(22)+T(24);
            IF VB>T(10) THEN VB=T(10);
              HILF=T(13)/L-1;  A=SQRT(T(10)-VB)-SQRT(T(10));
              K2=T(5)+T(21)*HILF+T(16)/B;
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      K3=T(6)+T(18)*HILF;
      K4=T(7)*(1+HILF);
      K5=T(8)/(1+(1-T(8))*HILF);
      UDT=T(1)+(T(14)*T(1)+T(15))/B+T(17)*HILF+K2*A;
      UTO=T(2);
    IF VG>UTO THEN VSAT=VG-UDT; ELSE DO;
      K11=T(4)+T(19)*HILF;
      UTT=T(3)+T(20)*HILF-K11*A;
      UT1=2*UTT-UTO;
    IF VG<UT1 THEN VSAT=UTT-UDT; ELSE DO;
      VSAT=UTT-UDT+(VG-UT1)**2/(4*(UTO-UTT)); END; END;
      VSAT=VSAT*K5;
    IF MOD=0 THEN DO; VFB=-1.1;  /* GATE-BULK-KAP. */
     IF VSAT<=VFB THEN RETURN(T(25)*B*(L-2*T(26))) ;ELSE
     IF VSAT>=0   THEN RETURN(0);
                  ELSE RETURN(T(25)*B*(L-2*T(26))/VFB*VSAT);
    END; ELSE     MM=M*MOD; VX=T(10)*.5;
     IF VD<VX THEN VD=VX ;
    IF MM>0 THEN DO;          /* GATE-DRAIN-KAP. */
     IF VSAT<=VX & VSAT<=VD THEN RETURN(T(25)*B*T(26)); ELSE
     RETURN(T(25)*B*(T(26)+2/3*L*(1-(VSAT/(2*VSAT-VD))**2))); END;
    ELSE                      /* GATE-SOURCE-KAP. */
     IF VSAT<=0 THEN RETURN(T(25)*B*T(26));ELSE
     IF VSAT<=VX THEN
     RETURN(T(25)*B*(2*L*VSAT/(3*VX)+T(26))); /* CGS-GERADE */
     ELSE
     IF VSAT<=VD THEN
     RETURN(T(25)*B*(T(26)+2/3*L));ELSE        /* CGS-EINGESCH.*/
     RETURN(T(25)*B*(T(26)+2/3*L*(1-((VSAT-VD)/(2*VSAT-VD))**2)));
  END CDEP;                                     /* CGS-AKTIV */


6   PROZ CENH ENTRY(FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),#
            FLOAT(16),(27)FLOAT(16),FLOAT(16)) RETURNS(FLOAT(16));
    CENH:PROC(UG,UD,US,UB,BB,LL,T,MOD) RETURNS(FLOAT(16));
      DCL(UG,UD,US,B,L,T(27),HILB,BB,LL,UT,K20,K21,BETA,M,BL,HILZ,HILF,
      K3,K4,K5,MM,MOD,VX,VFB,
      TERM,VSAT,K0,K54,IREST,VG,VD,UB,VBK,UET,UTBO)FLOAT(16);
    /*****************************************************************

        GATE-SOURCE,DRAIN,BULK-KAPAZITAET FUER
        ENHANCEMENT BZW.ZEROTRANS.NSGT2S (INT) MIT KURZ UND SCHMALKANA
        EFFEKT;BB,LL-ANGABE IN LAMBDA-EINHEITEN    V.:5/83
        T(1)=K20    (T(8) =DB )    T(15)=YT      T(22)=LAMBDA (IN UM)
        T(2)=K21    (T(9) =DL )    T(16)=Z1      T(23)=KVB=VVB*DB
        T(3)=K3      T(10)=LEFF    T(17)=DK3     T(24)=KVL=VVL*DL
        T(4)=K4      T(11)=IWEAK   T(18)=DK5     T(25)=CGATEOX (PF/UM**2)
        T(5)=K5      T(12)=VBK     T(19)=DBETA   T(26)=XJ
        T(6)=BETA    T(13)=2VF     T(20)=DVBK    T(27)=N*UT
        T(7)=UPO     T(14)=X1      T(21)=DK20            >GH-INT
        HINWEIS:     MOD=0: GATE-BULK-KAPAZITAET
                     MOD=1: GATE-DRAIN-KAPAZITAET
                     MOD=-1: GATE-SOURCE-KAPAZITAET

    *****************************************************************
      M=1;
      IF US=0 THEN DO; VG=UG; VD=UD; VB=UB; END;
     ELSE DO;
      IF UD>US THEN DO; VG=UG-US; VD=UD-US; VB=UB-US; END;
      ELSE DO; VG=UG-UD; VD=US-UD; VB=UB-UD;M=-1; END; END;
        B=T(22)*BB+T(23);
        L=T(22)*LL+T(24);                        /* ELEKTR.WIRK.B UND L */
        HILB=T(16)/B;
        UT=T(7)+(T(14)*T(7)+T(15))/B;
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    IF (T(10)-.1)<L  & (T(10)+.1)>L THEN DO;  /*KURZKANAL L=LEFF */
      K20=T(1)+HILB; K21=T(2)+HILB;
      BETA=T(6); VBK=T(12);
      K3=T(3); K4=T(4); K5=T(5); END;
    ELSE DO;
      HILF=T(10)/L-1;HILZ=T(21)*HILF+HILB;    /*LANGKANAL*/
      K20=T(1)+HILZ; K21=T(2)+HILB;            K3=T(3)+T(17)*HILF;
      BETA=T(6)+T(19)*HILF; K4=T(4)*(1+HILF); K5=T(5)+T(18)*HILF;
      VBK=T(12)+T(20)*HILF; END;
    IF  VB>=0 THEN UET=UT;                /* UBULK=0 : UET=UT */
    ELSE DO;
    IF VB<=VBK   THEN DO;                  /* BULKSPNG <= VBK ? */
      UTB0=UT+K20*(SQRT(-VBK+T(13))-SQRT(T(13)));
      UET=UTB0+K21*(SQRT(-VB+T(13))-SQRT(-VBK+T(13))); END;
    ELSE DO;
      UET=UT+K20*(SQRT(-VB+T(13))-SQRT(T(13))); END; END; BL=B/L;
      VSAT=K5*(VG-UET);
    IF MOD=0 THEN DO; VFB=-1.1;  /* GATE-BULK-KAP. */
      IF VSAT<=VFB THEN RETURN(T(25)*B*(L-2*T(26)));ELSE
      IF VSAT>=0   THEN RETURN(0);
                   ELSE RETURN(T(25)*B*(L-2*T(26))/VFB*VSAT);
    END; ELSE      MM=M*MOD; VX=T(13)*.5;
      IF VB<VX THEN VD=VX ;
    IF MM>0 THEN DO;          /* GATE-DRAIN-KAP. */
      IF VSAT<=VX | VSAT<=VD THEN RETURN(T(25)*B*T(26)) ;ELSE
      RETURN(T(25)*B*(T(26)+2/3*L*(1-(VSAT/(2*VSAT-VD))**2))); END;
  ELSE                        /* GATE-SOURCE-KAP. */
      IF VSAT<=0 THEN RETURN(T(25)*B*T(26)) ;ELSE
      IF VSAT<=VX THEN
      RETURN(T(25)*B*(2*L*VSAT/(3*VX)+T(26))); /* CGS-GERADE */
      ELSE
      IF VSAT<=VD THEN
      RETURN(T(25)*B*(T(26)+2/3*L)) ;ELSE        /* CGS-EINGESCH.*/
      RETURN(T(25)*B*(T(26)+2/3*L*(1-((VSAT-VD)/(2*VSAT-VD))**2)));
  END CENH;                                      /* CGS-AKTIV */

7   PROZ EMOS ENTRY(FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),#
            FLOAT(16),(27)FLOAT(16)) RETURNS(FLOAT(16));
  EMOS:PROC(UG,UD,US,UB,BB,LL,T) RETURNS(FLOAT(16));
    DCL(UG,UD,US,B,L,T(27),HILB,BB,LL,UT,K20,K21,BETA,M,BL,HILZ,HILF,
    K3,K4,K5,
    TERM,VSAT,K0,K54,IREST,VG,VD,UB,VBK,UET,UTB0)FLOAT(16);
  /*****************************************************************

      ENHANCEMENT BZW.ZEROTRANS.NSGT2S (INT) MIT KURZ UND SCHMALKANAL
      EFFEKT:BB,LL-ANGABE IN LAMBDA-EINHEITEN   V.15/85
      T(1)=K20    (T(8) =DB )    T(15)=Y1      T(22)=LAMBDA( IN UM )
      T(2)=K21    (T(9) =DL )    T(16)=Z1      T(23)=KVB=VVB+DB
      T(3)=K3      T(10)=LEFF    T(17)=DK3     T(24)=KVL=VVL+DL
      T(4)=K4      T(11)=IWEAK   T(18)=DK5     T(25)=CGATEOX (PF/UM**2)
      T(5)=K5      T(12)=VBK     T(19)=DBETA   T(26)=  XJ
      T(6)=BETA    T(13)=2VF     T(20)=DVBK    T(27)=N*UT
      T(7)=UPO     T(14)=X1      T(21)=DK20            >GH-INT

  *****************************************************************,
    M=1;
    IF US=0 THEN DO; VG=UG; VD=UD; VB=UB; END;
   ELSE DO;
    IF UD>US THEN DO; VG=UG-US; VD=UD-US; VB=UB-US; END;
    ELSE DO; VG=UG-UD; VD=US-UD; VB=UB-UD;M=-1; END; END;
      B=T(22)*BB+T(23);
      L=T(22)*LL+T(24);                        /* ELEKTR.WIRK.B UND L */
      HILB=T(16)/B;
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      UT=T(7)+(T(14)*T(7)+T(15))/B;
    IF (T(10)-.1)<L  & (T(10)+.1)>L THEN DO;  /*KURZKANAL L=LEFF */
      K20=T(1)+HILB; K21=T(2)+HILB;
      BETA=T(6); VBK=T(12);
      K3=T(3); K4=T(4); K5=T(5); END;
    ELSE DO;
      HILF=T(10)/L-1;HILZ=T(21)*HILF+HILB;   /*LANGKANAL*/
      K20=T(1)+HILZ; K21=T(2)+HILB;            K3=T(3)+T(17)*HILF;
      BETA=T(6)+T(19)*HILF; K4=T(4)*(1+HILF); K5=T(5)+T(18)*HILF;
      VBK=T(12)+T(20)*HILF; END;
     IF VB>=0 THEN UET=UT;                /* UBULK=0 : UET=UT */
    ELSE DO;
    IF VB<=VBK   THEN DO;                  /* BULKSPNG <= VBK ? */
      UTB0=UT+K20*(SQRT(-VBK+T(13))-SQRT(T(13)));
      UET=UTB0+K21*(SQRT(-VB+T(13))-SQRT(-VBK+T(13))); END;
    ELSE DO;
      UET=UT+K20*(SQRT(-VB+T(13))-SQRT(T(13))); END; END; BL=B/L;
      VSAT=VG-UET;
    IF VSAT<=-50*T(27) THEN TERM=1.9287498E-22; ELSE DO;
    IF VSAT>=0 THEN TERM=1; ELSE DO;
       TERM=EXP(VSAT/T(27)); END;END;
      IREST=T(11)*TERM*VD**2*BL*T(10)*.034*M;    /* IREST PRO UM */
        VSAT=K5*VSAT;
        K0=M*BETA*BL/(1+K3*VSAT);
        K54=K5*K4;
    IF VSAT<=K54*VD THEN RETURN(IREST);
   ELSE IF VSAT>VD THEN
      RETURN(K0*VD*(VSAT*2*(1+K54)-VD*(1-K54**2))+IREST); ELSE
      RETURN(K0*(VSAT+K54*VD)**2+IREST);
END EMOS;

8   PROZ DMOS ENTRY(FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),#
            FLOAT(16),(26)FLOAT(16)) RETURNS(FLOAT(16));
   DMOS:PROC(UG,UD,US,UB,BB,LL,T) RETURNS(FLOAT(16));
      DCL(UG,UD,US,UB,BB,LL,B,L,T(26),VG,VD,VB,M,HILF,A,K2,K3,K4,K5,
      K11,UDT,UT0,VSAT,UTT,UT1,K54,K0) FLOAT(16);
   /*****************************************************************

        DEPLETIONTRS. NSGT2S MIT KURZ-UND SCHMALKANALEFFEKT;
      BB,LL-ANGABE IN LAMBDA-EINHEITEN;          V: 5/83
      T(1)=UDT0    T(8)=K5D       T(15)=Y1       T(22)=LAMBDA
      T(2)=UT00    T(9)=BETAD     T(16)=Z1       T(23)=KVB=VVB+DB
      T(3)=UTT0    T(10)=2VF      T(17)=DUDT     T(24)=KVL=VVL+DL
      T(4)=K11D   (T(11)=DB)      T(18)=DK3D     T(25)=CGATEOX
      T(5)=K2D    (T(12)=DL)      T(19)=DK11D    T(26)=XJ
      T(6)=K3D     T(13)=LEFF     T(20)=DUTT
      T(7)=K4D     T(14)=X1       T(21)=DK2D       >GH-INT

   *****************************************************************
      IF UD>=US THEN DO;
        VG=UG-US; VD=UD-US; VB=UB-US; M=1; END;
      ELSE DO;
        VG=UG-UD; VD=US-UD; VB=UB-UD; M=-1; END;
        B=BB*T(22)+T(23);
        L=LL*T(22)+T(24);
      IF VB>T(10) THEN VB=T(10);
        HILF=T(13)/L-1;  A=SQRT(T(10)-VB)-SQRT(T(10));
        K2=T(5)+T(21)*HILF+T(16)/B;
        K3=T(6)+T(18)*HILF;
        K4=T(7)*(1+HILF);
        K5=T(8)/(1+(1-T(8))*HILF);
        UDT=T(1)+(T(14)*T(1)+T(15))/B+T(17)*HILF+K2*A;
        UT0=T(2);
      IF VG>UT0 THEN VSAT=VG-UDT; ELSE DO;
        K11=T(4)+T(19)*HILF;
        UTT=T(3)+T(20)*HILF-K11*A;
        UT1=2*UTT-UT0;
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      IF VG<UT1 THEN VSAT=UTT-UDT; ELSE DO;
        VSAT=UTT-UDT+(VG-UT1)**2/(4*(UT0-UTT)); END; END;
        VSAT=VSAT*K5;
      IF VSAT<=0 THEN RETURN(0); ELSE
        K54=K4/K5;
        K0=M*(T(9)-.0015*HILF)*B/(L*(1+K3*VSAT));
      IF VD>VSAT THEN RETURN(K0*(VSAT+2*K54*VD)*VSAT);
                 ELSE RETURN(K0*((1+K54)*2*VSAT-VD)*VD);
    END DMOS;

9   PROZ KAP  ENTRY(FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),FLOAT(16),#
      FLOAT(16),FLOAT(16),(9)FLOAT(16)) RETURNS(FLOAT(16));
    KAP:PROC(UK,UBLK,NFL,NUMF,POLY,ALU,GATE,T)RETURNS(FLOAT(16));
      DCL(UK,UBLK,NFL,NUMF,POLY,ALU,T(9),CSP,UNP,CPOL,CALU,GATE,CGATE)
                                                  FLOAT(16);
      /*****************************************************************
      *                                                                 *
      *     KNOTENKAPAZITAET ZUM BULK (MIT N+ RAND)                     *
      *   C** XX-BULK = KAP(UKXX,UKBULK,NFL,NUMF,POLY,ALU,GATE,TABKAP) *
      *     NFL : FLAECHE  N+ GEBIET IN LAMBDA**2                       *
      *     NUMF:  UMFANG  N+ GEBIET IN LAMBDA                          *
      *     POLY: POLYFLAECHE IN LAMBDA**2                              *
      *     ALU : ALUFLAECHE  IN LAMBDA**2          >GH-INT V.5/83      *
      *     GATE: GATEFLAECHE IN LAMBDA**2          NSGT2S              *
      *     TAB : TABELLE FUER  KAP-PROC. (TABKAP)                      *
      *     T(1)=LAMBDA IN UM                   T(5)=EXPONENT(NEGI)     *
      *     T(2)=FLAECHENKAP.N+ GEB.(PF/UM**2)  T(6)=UDI                *
      *     T(3)=RANDKAP. N+ GEB.   (PF/UM**2)  T(7)=COX-POLY(PF/UM**2)*
      *     T(4)=RANDTIEFE N+ GEB.  (UM )       T(8)=COX-ALU (PF/UM**2)*
      *                                         T(9)=CGATEOX (PF/UM**2)*
      *****************************************************************/
      UNP=ABS(UK-UBLK);                   CGATE=T(9)*GATE;
      CSP =T(2)*NFL+ T(3)*T(4)*NUMF;      CPOL=T(7)*POLY;
      CSP =CSP*((1+UNP/T(6))**T(5));  CALU=T(8)*ALU;
      RETURN(T(1)**2*(CSP+CPOL+CALU+CGATE));
    END KAP;

10  SCHAL  DT  G-D-S-B
11      IDS D-S = DMOS(UKG,UKD,UKS,UKB,'BD','LD',TABDT)
12      CGD G-D = CDEP(UKG,UKD,UKS,UKB,'BD','LD',TABDT,1)
13      CGB G-B = CDEP(UKG,UKD,UKS,UKB,'BD','LD',TABDT,0)
14      CGS G-S = CDEP(UKG,UKD,UKS,UKB,'BD','LD',TABDT,-1)
15  SCHAL  DZ  G-D-B
16      IDS D-G = DMOS(UKG,UKD,UKG,UKB,'BZ','LZ',TABDT)
17      CGD G-D = CDEP(UKG,UKD,UKG,UKB,'BZ','LZ',TABDT,1)
18      CGB G-B = CDEP(UKG,UKD,UKG,UKB,'BZ','LZ',TABDT,0)
19  SCHAL  DTF  G-D-S-B
20      IDS D-S = DMOS(UKG,UKD,UKS,UKB,'BD','LD',TABDT)
21      CGD G-D = 6.7E-4*'BD'*'LD'
22      CGB G-B = 6.7E-4*'BD'*'LD'
23      CGS G-S = 1.3E-3*'BD'*'LD'
24  SCHAL  EN  G-D-S-B
25      IDS D-S = EMOS(UKG,UKD,UKS,UKB,'BE','LE',TABEN)
26      CGD G-D = CENH(UKG,UKD,UKS,UKB,'BE','LE',TABEN,1)
27      CGB G-B = CENH(UKG,UKD,UKS,UKB,'BE','LE',TABEN,0)
28      CGS G-S = CENH(UKG,UKD,UKS,UKB,'BE','LE',TABEN,-1)
29  SCHAL  ENF  G-D-S-B
30      IDS D-S = EMOS(UKG,UKD,UKS,UKB,'BE','LE',TABEN)
31      CGD G-D = 6.7E-4*'BE'*'LE'
32      CGB G-B = 6.7E-4*'BE'*'LE'
33      CGS G-S = 1.3E-3*'BE'*'LE'
34  SCHAL  DZF  G-D-B
35      IDS D-G = DMOS(UKG,UKD,UKG,UKB,'BZ','LZ',TABDT)
36      CGD G-D = 6.7E-4*'BZ'*'LZ'
37      CGB G-B = 1.3E-3*'BZ'*'LZ'
38  SCHAL  ESF  D-S
39      IDS D-S = EMOS(UKS,UKD,UKS,UKS,'BE','LE',TABEN)
40      CGD D-S = 6.7E-4*'BE'*'LE'
```