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APÊNDICE

1- UDF para cálculo do Classificador R

```
DEFINE_ON_DEMAND(Rd)
{
 Domain *domain;
 Thread *t;
 cell_t c;
 real DUDX,DVDY,DVDX,DUDY,D2UDX2,D2UDXY,D2UDY2,D2VDY2,D2VDYX,D2VDX2;
 real C1,C2,C3,C4,ha,hb,hc,hd,he,hf,COMPZ,COMPR,OMEGA,W,WREL,GAMPTO,WEIGHT;
 domain = Get_Domain(1);
/* Derivadas primeiras */
 thread_loop_c (t, domain)
  {
  begin_c_loop(c, t)
  {
                C_UDSI(c,t,0) = (C_U_G(c, t)[0]);
                C_UDSI(c,t,1) = (C_V_G(c, t)[1]);
                C_UDSI(c,t,2) = (C_U_G(c, t)[1]);
                C_UDSI(c,t,3) = (C_V_G(c, t)[0]);
  }
  end_c_loop(c, t)
  }
/* Derivadas segundas */
 thread_loop_c (t, domain)
  {
  begin_c_loop(c, t)
  {
                DUDX = C_UDMI(c,t,0) = (C_UDSI(c,t,0));
                DVDY = C_UDMI(c,t,1) = (C_UDSI(c,t,1));
                DUDY = C_UDMI(c,t,2) = (C_UDSI(c,t,2));
                DVDX = C_UDMI(c,t,3) = (C_UDSI(c,t,3));
                D2UDX2 = C_UDMI(c,t,4) = (C_UDSI_G(c,t,0)[0]);
                D2UDXY = C_UDMI(c,t,5) = (C_UDSI_G(c,t,0)[1]);
                D2UDY2 = C_UDMI(c,t,6) = (C_UDSI_G(c,t,2)[1]);
                D2VDY2 = C_UDMI(c,t,7) = (C_UDSI_G(c,t,1)[1]);
                D2VDYX = C_UDMI(c,t,8) = (C_UDSI_G(c,t,1)[0]);
                D2VDX2 = C_UDMI(c,t,9) = (C_UDSI_G(c,t,3)[0]);
/* CALCULO DO PARAMETRO R  */
                C1=DVDY-DUDX;
                C2=DUDY+DVDX;
                C3=sqrt(pow(C1, 2) + pow(C2, 2));
                C4=2*(pow(C2, 2)+pow(C1, 2)+(C1*C3));
                ha=D2VDYX-D2UDX2;
                hb=D2VDY2-D2UDXY;
                hc=D2UDXY+D2VDX2;
                hd=D2UDY2+D2VDYX;
                he=(C1*ha+C2*hc)/C3;
                hf=(C1*hb+C2*hd)/C3;
```

```
                COMPZ=(C_U(c, t))*((ha+he)*C2-(C1+C3)*hc);
                COMPR=(C_V(c, t))*((hb+hf)*C2-(C1+C3)*hd);
                OMEGA=(COMPZ+COMPR)/C4;
                W=0.5*(DVDX-DUDY);
                WREL=W-OMEGA;
                GAMPTO = C_UDMI(c,t,11) = sqrt(2*(pow(DUDX, 2) + pow(DVDY, 2)) + (pow(C2, 2)));
                WEIGHT = 4*(pow(WREL, 2))/(pow(GAMPTO, 2));
                if (WEIGHT>2)
                        C_UDMI(c,t,10) = 2;
                else
                        C_UDMI(c,t,10) = WEIGHT;
        }
        end_c_loop(c, t)    }}
```

2- UDF para cálculo da Viscosidade em função de R

```
DEFINE_PROPERTY(ViscoRD8, c, t)

/* Calculo da viscosidade em funcao de R e Gamma Ponto */
{
        real mu_lam, visco_shear, visco_extensional, Rd, GAMPTO, C2, fr;
        real KS, NS, KU, NU, VE, To, Too;

/* Parametros da formula da viscosidade cisalhamento */
        KS=10000000;
        NS=1;

/* Parametros da formula da viscosidade de extensional  */
        KU=10000000;
        NU=0.1;
        To=7000000;
    Too=50000000;

/* Fator de ralaxacao para a viscosidade */
        fr=1;
/*Calculo do Gamma Ponto */
        C2 = (C_U_G(c, t)[1]) + (C_V_G(c, t)[0]);
        GAMPTO = C_STRAIN_RATE_MAG(c,t);

/*Calculo das viscosidades de cisalhamento e extensional */

        visco_shear = KS;
        VE = KU*(pow(GAMPTO, NU));
        if (VE > Too)
                {visco_extensional=Too;}
        else if (VE < To)
                {visco_extensional=To;}
        else
                {visco_extensional=VE;}
```

```
        Rd = C_UDMI(c, t, 10);
        if (Rd>0.9)
                mu_lam=(1-fr)*C_MU_L(c, t) + (fr*visco_shear);
        else
                mu_lam=(1-fr)*C_MU_L(c, t) + fr*(pow(visco_shear, Rd))*(pow(visco_extensional, (1-Rd)));
        return mu_lam;
}
```