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Apêndice

Programas

```
% Metodo de Taylor %

clc;
xErb  = [-300 -600 600];
yErb  = [100  -100 -100];

tol = 10^-5;
mu = 0;
sigma = 10;
Ndim  = 2;
delt  = eye(Ndim)+ones(Ndim);
Q     = (sigma^2)*delt;
Qinv  = inv(Q);

disp(['   xTaylor   yTaylor   interacoes'])
disp(['  '])
for i = 1:1
   xmovel = [0];
   ymovel = [-600];
   c = 3*10^8;
   a = c*10^-5;
   retardo = [0.2538 0.2614 0.2614].*a;
   for j = 1:2
   R(j,1) = (retardo(j+1)-retardo(1));
   end
   xo = 0;
   yo = -650;

   x = xo;
   y = yo;

   intTaylor = 1;
   ind = 0;
   while ind == 0;
      f = sqrt((xErb(:)-x).^2+(yErb(:)-y).^2);
      h = zeros(2,1);
      G = zeros(2,2);
      for w = 1:2
         h(w,1) = R(w) - (f(w+1) - f(1));
         G(w,1) = ((xErb(1)-x)/f(1)) - ((xErb(w+1)-x)/f(w+1));
         G(w,2) = ((yErb(1)-y)/f(1)) - ((yErb(w+1)-y)/f(w+1));
      end
      delta = zeros(2,1);
      delta = inv(G'*Qinv*G)*G'*Qinv*h;
      x = x + delta(1);
      y = y + delta(2);
```

```
        erro = ((x-xo)^2+(y-yo)^2)/(x^2+y^2);
        if erro < tol
           break;
        end
        xo=x;
        yo=y;
         intTaylor = intTaylor + 1;
    end
    xTaylor = x;
    yTaylor = y;

     disp([ x y intTaylor]);
end
```



```
% Metodo de Chan usando 3 ERBs %

clc;

% Posicao das ERBs em metros
X = [-300 -600 600];
Y = [100 -100 -100];
```

```
matriz1 = [ X(2) -X(1) Y(2) -Y(1); X(3) -X(1) Y(3) -Y(1)];

c=3*10^8; % velocidade da luz

a = c*10^-5;
Retardo = [0.2538 0.2614 0.2614].*a;


   for j=1:2
      RR(j,1) = (Retardo(j+1)-Retardo(1));

   end
      for i=1:3
      K(i) = X(i)^2 + Y(i)^2;
      end

 R1 = Retardo(1);


matriz2 = [RR.*R1];
matriz3 = 0.5*(RR).^2;
matriz4=-0.5*[K(2)-K(1);K(3)-K(1)];


Result1= -inv(matriz1)*(matriz2+matriz3+matriz4);
x = Result1(1)
y = Result1(2)
```



```
% Metodo de Chan para 4 ou mais ERBs %

clc;

xErb  = [ -300 -600 600 300];
yErb  = [100  -100 -100 100];

tol = 10^-5;
mu = 0;
sigma = 10;
```

```
Ndim  = 3;
delt  = eye(Ndim)+ones(Ndim);
Q     = (sigma^2)*delt;
Qinv  = inv(Q);

disp(['    xChan    yChan'])
disp(['  '])
for i = 1:1
c = 3*10^8;
a = c*10^-5;
retardo = [0.104 0.2250 0.2253 0.1333].*a;
Dretardo = [retardo(2)-retardo(1);retardo(3)-retardo(1);retardo(4)-retardo(1)];
rMed = [Dretardo(1);Dretardo(2);Dretardo(3)];
xmovel= [0];
ymovel = [200];


   % Fontes Perto %

   K = xErb.^2+yErb.^2;
   for s = 1:3
      h(s,1)  = rMed(s)^2-K(s+1);
      Ga(s,1) = xErb(s+1);
      Ga(s,2) = yErb(s+1);
      Ga(s,3) = rMed(s);
   end
   Ga = -2*Ga;
   for k = 1:3
      r(k) = sqrt((xmovel - xErb(k+1))^2 + (ymovel - yErb(k+1))^2 );
   end
   B = diag(r);
   ipsi = inv(B*Q*B)/4;
   Za = inv(Ga'*ipsi*Ga)*Ga'*ipsi*h;
   hL = Za.^2;
   BL = diag(Za);
   GaL = [1 0; 0 1; 1 1];
   ipsiL = (inv(BL)*Ga'*ipsi*Ga*inv(BL))/4;
   ZaL = inv(GaL'*ipsiL*GaL)*GaL'*ipsiL*hL;
   t(1) = sign(xmovel(i));
   t(2) = sign(ymovel(i));
   P = diag(t);
   ZP = P*sqrt(ZaL);
   perto = ZP;

   % Fontes Distantes %

   Za = inv(Ga'*Qinv*Ga)*Ga'*Qinv*h;
   hL = Za.^2;
   BL = diag(Za);
   GaL = [1 0; 0 1; 1 1];
```

```
   ipsiL = (inv(BL)*Ga'*ipsi*Ga*inv(BL))/4;
   ZaL = inv(GaL'*ipsiL*GaL)*GaL'*ipsiL*hL;
   t(1) = sign(xmovel(i));
   t(2) = sign(ymovel(i));
   P = diag(t);
   ZP = P*sqrt(ZaL);
   distante = ZP;

% Escolha do termo de menor erro %

   msePerto = mse(xmovel(i)-perto(1)) + mse(ymovel(i) -perto(2));
   mseDistante = mse(xmovel(i) -distante(1)) + mse(ymovel(i)-distante(2));
   if msePerto > mseDistante
      xChan = distante(1);
      yChan = distante(2);
   else
      xChan = perto(1);
      yChan = perto(2);
   end

    disp([ xChan yChan]);
end
```



```
% Calculo de Medidas de Desempenho para o Metodo de Taylor %
%Regiao A%
clc;

X1 = [0 0];
Y1 = [-600 -500];
xtaylor1 = [0 -0.53];
ytaylor1 = [-588.12 -479.18];

a1 = [X1-xtaylor1];
b1 = [Y1-ytaylor1];


erro1 = mse(a1)+ mse(b1);

RMS1 = sqrt(erro1);
```

```
sigmax1 = Var(xtaylor1);
sigmay1 = Var(ytaylor1);

CEP1 = 0.75*sqrt(sigmax1 + sigmay1);

GDOP1 = CEP1 /(0.75*RMS1);

disp(['-----------------------------------------']);
disp(['|    RMS1   |   CEP1    |   GDOP1   |']);
disp([      RMS1        CEP1        GDOP1     ]);
disp(['-----------------------------------------']);

%Regiao B%

X2 = [0 0];
Y2 = [-400 -300];
xtaylor2 =[0.82  -0.63];
ytaylor2 =[-383.04 -321.90];
a2 = [X2-xtaylor2];
b2 = (Y2-ytaylor2);

erro2 = MSE(a2)+ MSE(b2);

RMS2 = sqrt(erro2);

sigmax2 = Var(xtaylor2);
sigmay2 = Var(ytaylor2);

CEP2 = 0.75*sqrt(sigmax2 + sigmay2);

GDOP2 = CEP2 /(0.75*RMS2);

disp(['-----------------------------------------']);
disp(['|    RMS2   |   CEP2    |   GDOP2   |']);
disp([      RMS2        CEP2        GDOP2     ]);
disp(['-----------------------------------------']);


%Regiao C %

X3 = [0 0];
Y3 = [-200 -100];
xtaylor3 = [-0.60 -0.15];
ytaylor3 = [-178.21 -100.97];

a3 = [X3-xtaylor3];
b3 = (Y3-ytaylor3);

erro3 = mse(a3)+ mse(b3);
```

```
RMS3 = sqrt(erro3);

sigmax3 = Var(xtaylor3);
sigmay3 = Var(ytaylor3);

CEP3 = 0.75*sqrt(sigmax3 + sigmay3);

GDOP3 = CEP3 /(0.75*RMS3);

disp(['----------------------------------------']);
disp(['|    RMS3   |   CEP3   |   GDOP3   |']);
disp([      RMS3       CEP3       GDOP3     ]);
disp(['----------------------------------------']);

% Regiao D

X4 = [0 0];
Y4 = [0 100];
xtaylor4 =[1.06 -2.04];
ytaylor4 =[-8.43 71.21];
a4 = [X4-xtaylor4];
b4 = [Y4-ytaylor4];


erro4 = mse(a4)+ mse(b4);

RMS4 = sqrt(erro4);

sigmax4 = Var(xtaylor4);
sigmay4 = Var(ytaylor4);

CEP4 = 0.75*sqrt(sigmax4 + sigmay4);

GDOP4 = (CEP4/0.75)/(RMS4);

disp(['----------------------------------------']);
disp(['|    RMS4   |   CEP4   |   GDOP4   |']);
disp([      RMS4       CEP4       GDOP4     ]);
disp(['----------------------------------------']);

% Regiao E

X5 = [0 0];
Y5 = [200 300];
xtaylor5 =[-0.52 0.50];
ytaylor5 =[226.92 295.00];
a5 = [X5-xtaylor5];
b5 = [Y5-ytaylor5];
```

```
erro5 = mse(a5)+ mse(b5);

RMS5 = sqrt(erro5);

sigmax5 = Var(xtaylor5);
sigmay5 = Var(ytaylor5);

CEP5 = 0.75*sqrt(sigmax5 + sigmay5);

GDOP5 = (CEP5/0.75)/(RMS5);

disp(['-----------------------------------------']);
disp(['|    RMS5   |   CEP5    |   GDOP5   |']);
disp([      RMS5        CEP5        GDOP5     ]);
disp(['-----------------------------------------']);

% Regiao F

X6 = [0 0 0];
Y6 = [400 500 600];
xtaylor6 =[-4.44 -1.85 -2.5];
ytaylor6 =[358.07 534.04 520.5];
a6 = [X6-xtaylor6];
b6 = [Y6-ytaylor6];


erro6 = mse(a6)+ mse(b6);

RMS6 = sqrt(erro6);

sigmax6 = Var(xtaylor6);
sigmay6 = Var(ytaylor6);

CEP6 = 0.75*sqrt(sigmax6 + sigmay6);

GDOP6 = (CEP6/0.75)/(RMS6);

disp(['-----------------------------------------']);
disp(['|    RMS6   |   CEP6    |   GDOP6   |']);
disp([      RMS6        CEP6        GDOP6     ]);
disp(['-----------------------------------------']);
```

```
% Calculo de Medidas de Desempenho para o Metodo de Chan %
clc;
% Regiao A

X1 = [0 0];
Y1 = [-600 -500];

xchan1 =[0 -0.54];
ychan1 =[-586.90 -474.73];
a1 = [X1-xchan1];
b1 = [Y1-ychan1];

erro1 = mse(a1)+ mse(b1);

RMS1 = sqrt(erro1);

sigmax1 = Var(xchan1);
sigmay1 = Var(ychan1);

CEP1 = 0.75*sqrt(sigmax1 + sigmay1);

GDOP1 = (CEP1/0.75)/(RMS1);

disp(['----------------------------------------------------------------------------------------']);
disp(['|    erro1    |    RMS1    |    CEP1    |    GDOP1    |    sigmax1    |    sigmay1
|']);
disp([      erro1        RMS1        CEP1        GDOP1        sigmax1        sigmay1
]);
```

```
disp(['-----------------------------------------------------------------------------------------']);

% Regiao B

X2 = [0 0];
Y2 = [-400 -300];

xchan2 =[0.84 -0.63];
ychan2 =[-377.48 -323.25];

a2 = [X2-xchan2];
b2 = [Y2-ychan2];

erro2 = mse(a2)+ mse(b2);

RMS2 = sqrt(erro2);

sigmax2 = Var(xchan2);
sigmay2 = Var(ychan2);

CEP2 = 0.75*sqrt(sigmax2 + sigmay2);
GDOP2 = (CEP2/0.75)/(RMS2);

disp(['-----------------------------------------------------------------------------------------']);
disp(['|    erro2    |    RMS2    |    CEP2    |    GDOP2    |    sigmax2    |    sigmay2
|']);
disp([      erro2        RMS2        CEP2        GDOP2        sigmax2        sigmay2
]);
disp(['-----------------------------------------------------------------------------------------']);

% Regiao C

X3 = [0 0];
Y3 = [-200 -100];

xchan3 =[-0.61 -0.15];
ychan3 =[-178.93 -110.51];

a3 = [X3-xchan3];
b3 = [Y3-ychan3];

erro3 = mse(a3)+ mse(b3);

RMS3 = sqrt(erro3);

sigmax3 = Var(xchan3);
sigmay3 = Var(ychan3);

CEP3 = 0.75*sqrt(sigmax3 + sigmay3);
```

```
GDOP3 = (CEP3/0.75)/(RMS3);

disp(['----------------------------------------------------------------------------------']);
disp(['|    erro3    |    RMS3    |    CEP3    |    GDOP3    |    sigmax3    |    sigmay3
|']);
disp([      erro3        RMS3        CEP3        GDOP3        sigmax3        sigmay3
]);
disp(['----------------------------------------------------------------------------------']);

% Regiao D

X4 = [0 0];
Y4 = [0 100];

xchan4 =[1.06 -0.50];
ychan4 =[-8.28 138.01];

a4 = [X4-xchan4];
b4 = [Y4-ychan4];

erro4 = mse(a4)+ mse(b4);

RMS4 = sqrt(erro4);

sigmax4 = Var(xchan4);
sigmay4 = Var(ychan4);

CEP4 = 0.75*sqrt(sigmax4 + sigmay4);

GDOP4 = (CEP4/0.75)/(RMS4);

disp(['----------------------------------------------------------------------------------']);
disp(['|    erro4    |    RMS4    |    CEP4    |    GDOP4    |    sigmax4    |    sigmay4
|']);
disp([      erro4        RMS4        CEP4        GDOP4        sigmax4        sigmay4
]);
disp(['----------------------------------------------------------------------------------']);

% Regiao E

X5 = [0 0];
Y5 = [200 300];

xchan5 =[-0.50 0.54];
ychan5 =[221.46 291.16];

a5 = [X5-xchan5];
b5 = [Y5-ychan5];

erro5 = mse(a5)+ mse(b5);
```

```
RMS5 = sqrt(erro5);

sigmax5 = Var(xchan5);
sigmay5 = Var(ychan5);

CEP5 = 0.75*sqrt(sigmax5 + sigmay5);

GDOP5 = (CEP5/0.75)/(RMS5);

disp(['----------------------------------------------------------------------------------------']);
disp(['|    erro5    |    RMS5    |    CEP5    |    GDOP5    |    sigmax5    |    sigmay5
|']);
disp([      erro5        RMS5        CEP5        GDOP5        sigmax5        sigmay5
]);
disp(['----------------------------------------------------------------------------------------']);

% Regiao F

X6 = [0 0 0];
Y6 = [400 500 600];

xchan6 =[-3.32 -2.11 -1.61];
ychan6 =[329.58 526.97 540.21];

a6 = [X6-xchan6];
b6 = [Y6-ychan6];


erro6 = mse(a6)+ mse(b6);

RMS6 = sqrt(erro6);

sigmax6 = Var(xchan6);
sigmay6 = Var(ychan6);

CEP6 = 0.75*sqrt(sigmax6 + sigmay6);

GDOP6 = (CEP6/0.75)/(RMS6);

disp(['----------------------------------------------------------------------------------------']);
disp(['|    erro6    |    RMS6    |    CEP6    |    GDOP6    |    sigmax6    |    sigmay6
|']);
disp([      erro6        RMS6        CEP6        GDOP6        sigmax6        sigmay6
]);
disp(['----------------------------------------------------------------------------------------']);
```