GRGM CODE

%Generalized Reduced Gradient Method

%1.3,0.5568,0.3450

X(:,1)=[1.3;0.5568;0.3450];%starting point

alpha=0;%initial alpha value

ii=0;%out iteration

tol=1e-04;

%functions

F = @(x) x(1)^4-2\*x(1)^2\*x(2)+x(1)\*x(2)^2-2\*x(1)+4;

hh = @(x) x(1)^2+x(2)^2-2;

gg = @(x) 0.25\*x(1)^2+0.75\*x(2)^2-1+x(3); %adding slack variable x(3)

while(1)

ii=ii+1;%counter

Z=X(1,ii); %Z x1 Y x2 x3

Y=X(2:3,ii);

%calculating gradient

%finite difference

GF=gradientf(F,X,ii)'

GH=[gradientf(hh,X,ii)';gradientf(gg,X,ii)']

A=[GH(:,1)];

B=[GH(:,2) GH(:,3)];

GFZ=[GF(:,1)];

GFY=[GF(:,2);GF(:,3)];

Q=B\A;

GR=GFZ-Q'\*GFY;

S=-GR

%computing stepsize alpha

q=0;

alpha(1,1)=0;

x1=X(1,ii);

x2=X(2,ii);

%x1=(2 - x2^2)^(1/2) h1x

%x1=(4.0 - 3.0\*x2^2)^(1/2) h2x

if abs(x2)>sqrt(2)

alpha1=-x1/S;

else

alpha1=sqrt(2 - x2^2)-x1/S;

end

if abs(x2)>2\*sqrt(3)/3

alpha2=-x1/S;

else

alpha2=sqrt(4.0 - 3.0\*x2^2)-x1/S;

end

alpha(3,1)=min(alpha1,alpha2);

alpha(2,1)=alpha(3,1)/2;

%calculating f(a)

q=1;%initial q

while(q<=3)%3 iterations

DZ=alpha(q)\*S;

Z=Z+DZ;

DY=-(B\A)\*DZ;

while(1)

Y=Y+DY;%step 3

X(:,ii+1)=[Z;Y]

H=[hh(X(:,ii+1));gg(X(:,ii+1))]

if H<=tol

break

else

DY=B\(-H-A\*DZ)

end

end%problem with the loop

fa(q,1)=F(X);%get fa(q)

q=q+1;

end

%quadratic interpolation

x1=alpha(1,1);

x2=alpha(1,2);

x3=alpha(1,3);

f1=fa(1,1);

f2=fa(2,1);

f3=fa(3,1);

%computing alphastar

a2 = (((f3-f1)/(x3-x1))-((f2-f1)/(x2-x1)))/(x3-x2);

a1 = ((f2-f1)/(x2-x1))-a2\*(x1+x2);

a0 = f1-a1\*x1-a2\*x1^2;

FA=@(x) a0+a1\*x+a2\*x^2;

alphastar=Golden\_Section\_2D(FA,x1,x2);

DZ=alphastar\*S;

Z=Z+DZ;

DY=-(B\A)\*DZ;

while(1)

Y=Y+DY;%step 3

X(:,ii)=[Z;Y];

H=[hh(X(:,ii));gg(X(:,ii))];

if H==0

break

else

DY=B\-H;

end

end

%Updating X

X(:,ii+1)=[Z;Y]

%critieria

DX=X(:,ii+1)-X(:,ii);

if DX'\*DX<=tol

break

end

if ii==50

break

end

end

plot(X(1,:),X(2,:),'LineWidth',2);

%ploting

x1=linspace(0,4,100);

x2=linspace(0,4,100);

[X1,X2]=meshgrid(x1,x2);

f = @(x1,x2) x1.^4-2.\*(x1.^2).\*x2+(x1.^2)+x1.\*(x2.^2)-2.\*x1+4;

f(X1,X2);

Z=f(X1,X2);

contour(X1,X2,Z,0:1:50)

hold on

ezplot('x1^2+x2^2-2',[0,4,0,4])

hold on

ezplot('0.25\*x1^2+0.75\*x2^2-1',[0,4,0,4])

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%