

MAT2003 (Optimization Techniques) Lab

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Newton Method

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%% KHAN MOHD OWAIS RAZA (20BCD7138)
%% Optimization Techniques (MAT2003) Lab
%% Date: 21st October 2022
%% Topic: Newton Method
clc
clear
format long
syms X Y;
f = X - Y + 2*X^2 + 2*X*Y + Y^2;
x(1) = 1;
y(1) = -5;
e = 10^(-8);
i = 1;
df_dx = diff(f, X);
df_dy = diff(f, Y);
J = [subs(df_dx,[X,Y], [x(1),y(1)]) subs(df_dy, [X,Y],
[x(1),y(1)])];
ddf_ddx = diff(df_dx,X);
ddf_ddy = diff(df_dy,Y);
ddf_dxdy = diff(df_dx,Y);
ddf_ddx_1 = subs(ddf_ddx, [X,Y], [x(1),y(1)]);
ddf_ddy_1 = subs(ddf_ddy, [X,Y], [x(1),y(1)]);
ddf_dxdy_1 = subs(ddf_dxdy, [X,Y], [x(1),y(1)]);
H = [ddf_ddx_1, ddf_dxdy_1; ddf_dxdy_1, ddf_ddy_1];
S = inv(H);
while norm(J) > e
    I = [x(i),y(i)]';
    x(i+1) = I(1)-S(1,:)*J';
    y(i+1) = I(2)-S(2,:)*J';
    i = i+1;
    J = [subs(df_dx,[X,Y], [x(i),y(i)]) subs(df_dy, [X,Y],
[x(i),y(i)])];
    ddf_ddx_1 = subs(ddf_ddx, [X,Y], [x(i),y(i)]);
    ddf_ddy_1 = subs(ddf_ddy, [X,Y], [x(i),y(i)]);
    ddf_dxdy_1 = subs(ddf_dxdy, [X,Y], [x(i),y(i)]);
    H = [ddf_ddx_1, ddf_dxdy_1; ddf_dxdy_1, ddf_ddy_1];
    S = inv(H);
end
Iter = 1:i;
X_coordinate = x';
Y_coordinate = y';
Iterations = Iter';
T = table(Iterations,X_coordinate,Y_coordinate);
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fcontour(f, 'Fill', 'On');
hold on;
plot(x,y,'*-r');
grid on;
fprintf('Initial Objective Function Value: %d\n\n',subs(f,[X,Y],
[x(1),y(1)]));
if (norm(J) < e) fprintf('Minimum succesfully obtained...\n\n');
end
fprintf('Number of Iterations for Convergence: %d\n\n', i);
fprintf('Point of Minima: [%d,%d]\n\n', x(i), y(i));
fprintf('Objective Function Minimum Value after Optimization:
%f\n\n', subs(f,[X,Y], [x(i),y(i)]));
disp(T)

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