clc; clear all; close all;

N = 20; M = 40; D\_0 = 7; %introducing values

phi = randn(N, M);

w\_in = randn(D\_0, 1);

w = zeros(M, 1);

r = randi([1,M],D\_0,1);

w(r) = w\_in; %True value of w

NMSE = zeros(5,1);

j = 1;

for sigma\_sq\_dB = -20:5:0

sigma\_sqr = 10 ^ (sigma\_sq\_dB/10);

noise = sigma\_sqr.\* randn(20,1);

t = phi \* w + noise; % our measurements t

max\_ite = 1000000; threshold = 10^(-3); ite = 1;error\_ite = 0;

alpha = 100;

A = alpha \* eye(40);

posterior\_mean\_old = 0.001 \* ones(40,1);

while(1)

posterior\_var = inv(((1/sigma\_sqr) \* (phi' \* phi)) + A); %posterior variance is taken here

posterior\_mean = (1/sigma\_sqr) \* posterior\_var \* phi' \* t; %posterior mean is thus calculated

for i = 1:M

gamma(i) = 1 - A(i,i) \* posterior\_var(i,i);

alpha\_new(i) = gamma(i)/(posterior\_mean(i) \* posterior\_mean(i));

end

A = diag(alpha\_new); %optimizing parameter values

error\_ite = (norm((posterior\_mean - posterior\_mean\_old), 2))/(norm(posterior\_mean\_old, 2)); %updating anc calculate error

if(error\_ite <= threshold)

break;

end

posterior\_mean\_old = posterior\_mean;

end

w\_est = posterior\_mean; % w as MAP estimate of posterior

NMSE(j) = (norm((w\_est - w), 2))/(norm(w, 2)); %calculating NMSE for each sigma

j = j + 1;

end

semilogy([-20:5:0], NMSE)

xlabel("sigma square dB"); ylabel("NMSE");

title("MAP estimate of weights and NMSE vs variance plot")