POLE PLACEMENT TECHNIQUE – DC MOTOR POSITION

%% Pole Placement Technique

J = 3.2284E-6; %moment of inertia

b = 3.5077E-6; %motor viscous friction constant

K = 0.0274; %Gain

R = 4; %electric resistance

L = 2.75E-6; %electric inductance

s = tf('s'); %define transfer function

p\_motor = K/(s\*((J\*s+b)\*(L\*s+R)+K\*K)) %define transfer function

step(p\_motor)

sys\_ss=ss(p\_motor) % Converting to state space

A1=sys\_ss.A; % A matrix

B1=sys\_ss.B; % B matrix

C1=sys\_ss.C; % C matrix

D1=sys\_ss.D; % D matrix

p1= -0.2666 + 0.2797i;

p2= -0.2666 - 0.2797i;

p3= -0.145;

k=place(A1,B1,[p1 p2 p3]);

sys\_cl= ss(A1-B1\*k,B1,C1,D1)

[sys\_new\_num sys\_new\_den]=ss2tf(A1-B1\*k,B1,C1,D1);

tf(sys\_new\_num,sys\_new\_den)

step(sys\_cl)

The transfer function for the motor position is described as:

p\_motor =

0.0274

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8.878e-12 s^3 + 1.291e-05 s^2 + 0.0007648 s

Continuous-time transfer function.

Performing the state space conversion, we get values of A, B, C, and D matrices.

sys\_ss =

a =

x1 x2 x3

x1 -1.455e+06 -1.052e+04 0

x2 8192 0 0

x3 0 1 0

b =

u1

x1 512

x2 0

x3 0

c =

x1 x2 x3

y1 0 0 735.8

d =

u1

y1 0

Continuous-time state-space model.

Step response of this system:



Considering the values of new poles to be:

p1= -0.2666 + 0.2797i;

p2= -0.2666 - 0.2797i;

p3= -0.145;

Using **place** function in MATLAB, and using **ss** the poles and modify the values of system to get state space representation of (A-B\*k), B, C, and D matrices.

sys\_cl =

a =

x1 x2 x3

x1 -0.6782 -2.766e-05 -2.643e-06

x2 8192 0 0

x3 0 1 0

b =

u1

x1 512

x2 0

x3 0

c =

x1 x2 x3

y1 0 0 735.8

d =

u1

y1 0

Continuous-time state-space model.

Finally the value of transfer function becomes:

ans =

3.086e09

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s^3 + 0.6782 s^2 + 0.2266 s + 0.02165

Corresponding step response of the system:

