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% SD_Hw4_prob3
% reference: time_analysis_example
close all;clear;clc;
opengl hardware;

%-----
% Parameters
%-----
Tn = (0.1:0.001:5);
wn = (2*pi)./Tn;
dmp = [0 0.02 0.05 0.1 0.2]; % damping ratio = 0,2,5,10,20%

%-----
% Load input ground motion
%-----
load ELC_input % "tt_acc" will show up in Workspace.
% The first column in tt_acc is the time vector
% The second column in tt_acc is the ground acceleration in m/sec^2
dt = tt_acc(2,1)-tt_acc(1,1);

%-----
% Form ABCD
%-----
max_disp = zeros(length(dmp),length(Tn));
max_acc = zeros(length(dmp),length(Tn));

for j = 1:length(dmp)
    for i = 1:length(wn)
        Ac = [0 1;-wn(i)^2 -2*dmp(j)*wn(i)];
        Bc = [0; -1];
        Cc = [1 0;[-wn(i)^2 -2*dmp(j)*wn(i)]]; % displacement and abs.
        acceleration
        Dc = [0;0];
        %==
        sim('eq_analysis',[0 100]);
        %==
        max_disp(j,i) = max(abs(y(:,1))));
        max_acc(j,i) = max(abs(y(:,2))));
    end
end
sys_sdof = ss(Ac,Bc,Cc,Dc);

%-----
% Run Simulink
%-----
sim('eq_analysis',[0 100]); % [0 100] means the time starting from 0 to 100

%-----
% Plot
%-----
figure();
set(gcf,'position',[50 50 800 600]);

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subplot(2,1,1);
plot(Tn,max_disp(1,:), 'r-',Tn,max_disp(2,:), 'g-',Tn,max_disp(3,:), 'b-',Tn,max_disp(4,:), 'm',Tn,max_disp(5,:), 'c');
legend( '\zeta = 0 %', '\zeta = 2 %', '\zeta = 5 %', '\zeta = 10 %', '\zeta = 20 %');
xlabel('period (sec)', 'fontsize', 14);
ylabel('displacement (m)', 'fontsize', 14);

subplot(2,1,2);
plot(Tn,max_acc(1,:), 'r-',Tn,max_acc(2,:), 'g-',Tn,max_acc(3,:), 'b-',Tn,max_acc(4,:), 'm-',Tn,max_acc(5,:), 'c');
legend( '\zeta = 0 %', '\zeta = 2 %', '\zeta = 5 %', '\zeta = 10 %', '\zeta = 20 %');
xlabel('period (sec)', 'fontsize', 14);
ylabel('acceleration (g)', 'fontsize', 14);

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