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%           Advanced vibration
% Free response of a 3 DOF damped system.
%
clc;clear all;format long
n=3; % D.O.F
m1=5;m2=10;m3=10; % Masses
k1=500;k2=500;k3=1000;k4=1000; % Stiffnesses
c1=5;c2=10;c3=10;c4=5; % Dampers
x0=[1 0 0]';dx0=[-1 0 0]'; % initial conditions
m=[m1 0 0; 0 m2 0; 0 0 m3]; % Mass matrix
c=[c1+c2 -c2 0; -c2 c2+c3 -c3; 0 -c3 c3+c4]; % Damping matrix
k=[k1+k2 -k2 0; -k2 k2+k3 -k3; 0 -k3 k3+k4]; % Stiffness matrix
%
[v d]=polyeig(k,c,m)
for i=1:n
    yy(i)=v(i,1);yy1(i)=v(i,2);
end
%
yyx=yy*m*yy';yyy1=yy*k*yy';ome=sqrt(yyy1/yyx)
yyy=yy*m*yy1';yyy1=yy*k*yy1';ome=sqrt(yyy1/yyy)
yyy=yy*m*yy1';yyy1=yy*c*yy1';damp=(yyy1/yyy)/(2*ome)
%
d1=diag(d);v1=v*d1;vv1=[v;v1];
x=[x0;dx0];a1=inv(vv1)*x;
t0=0;tf=5.;dt=.005;
t=0:dt:tf;
nn=length(t);
for i=1:nn
    y(:,i)=v*diag(exp(d*t(i)))*a1;
end
set(0,'DefaultAxesColorOrder',[0 0 0],... % compute & plot responses
'DefaultAxesLineStyleOrder','-|-.|---|:')
plot(t,y(1,:),t,y(2,:),t,y(3,:),t,y(4,:),t,y(5,:))

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