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**EXTRA CREDIT #2**

PROBLEM 1.-

MATLAB Code:

clear; clc; close all

q0 = [0; 0];

h = 0.01;

t = 0:h:10;

A = [0 1;-5 -4];

B = [0; 1]

yexact = exp(-2\*t).\*(0.25\*cos(t)-1.75\*sin(t))-0.25\*cos(3\*t)+0.75\*sin(3\*t);

qstar = zeros(2,length(t));

qstar(:,1) = q0;

for i=1:(length(t)-1)

k1 = A\*qstar(:,i)+B\*(10\*cos(3\*(t(i))));

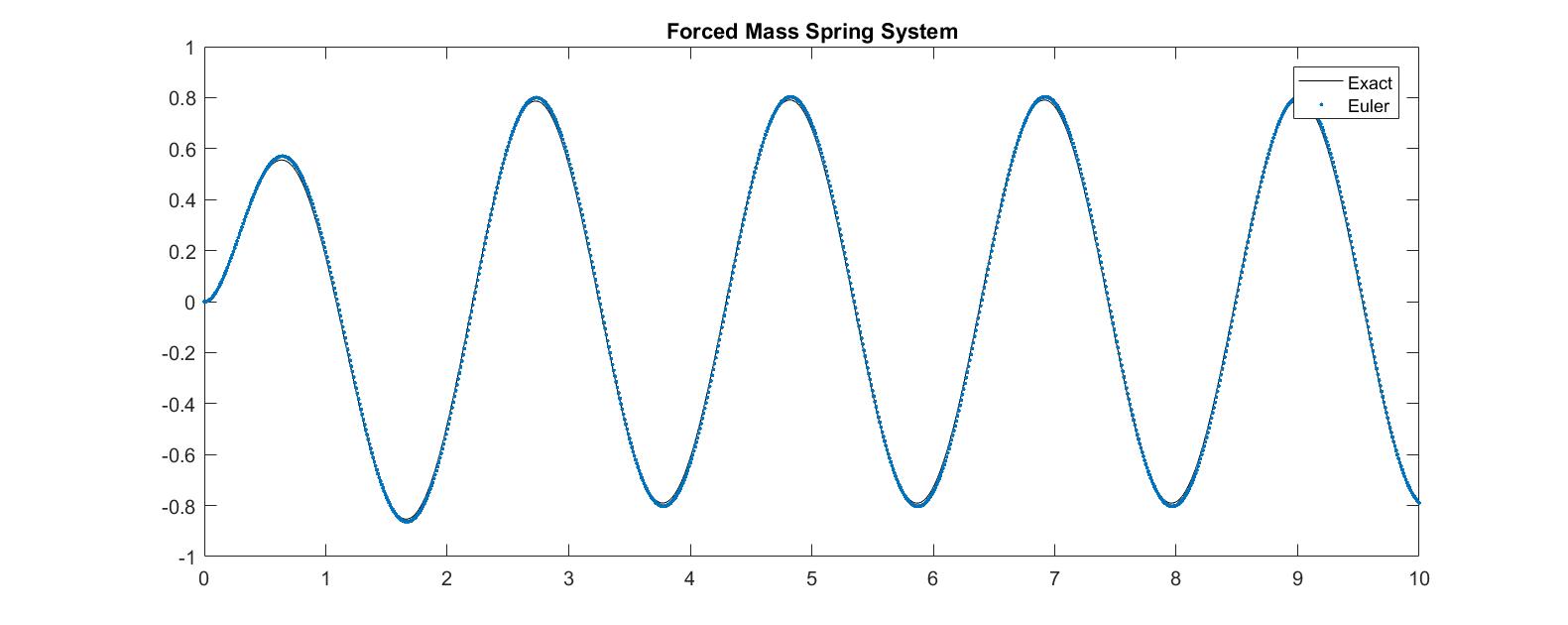
qstar(:,i+1) = qstar(:,i) + k1\*h;

end

plot(t,yexact,'k-'), hold on, plot(t,qstar(1,:),'.');

legend('Exact','Euler');

title('Forced Mass Spring System');

hold off

PROBLEM 2.-

MATLAB code:

clear; clc; close all

q0 = [0; 0];

h = 0.005;

t = 0:h:100;

A = [0 1;-1 0];

B = [0; 1]

yexact = t.\*sin(t)

qstar = zeros(2,length(t));

qstar(:,1) = q0;

for i=1:(length(t)-1)

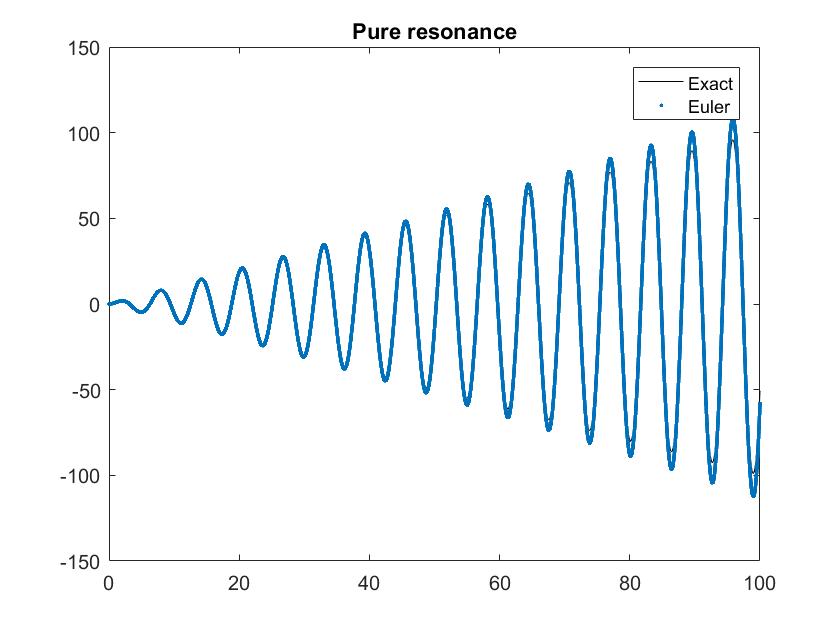
k1 = A\*qstar(:,i)+B\*(2\*cos(t(i)));

qstar(:,i+1) = qstar(:,i) + k1\*h;

end

plot(t,yexact,'k-'), hold on, plot(t,qstar(1,:),'.');

legend('Exact','Euler');

title('Pure resonance');

hold off

PROBLEM 3.-

MATLAB code:

clear; clc; close all

q0 = [0; 0];

h = 0.00005;

t = 0:h:3;

A = [0 1;-484\*pi^2 0];

B = [0; 1]

yexact = (1/(1848\*pi.^2)).\*(((sin(22\*pi\*t)).\*(21\*sin(2\*pi\*t)+sin(42\*pi\*t)))+(cos(22\*pi\*t)).\*(21\*cos(2\*pi\*t)+cos(42\*pi\*t)-22))

qstar = zeros(2,length(t));

qstar(:,1) = q0;

for i=1:(length(t)-1)

k1 = A\*qstar(:,i)+B\*(cos(20\*pi\*t(i)));

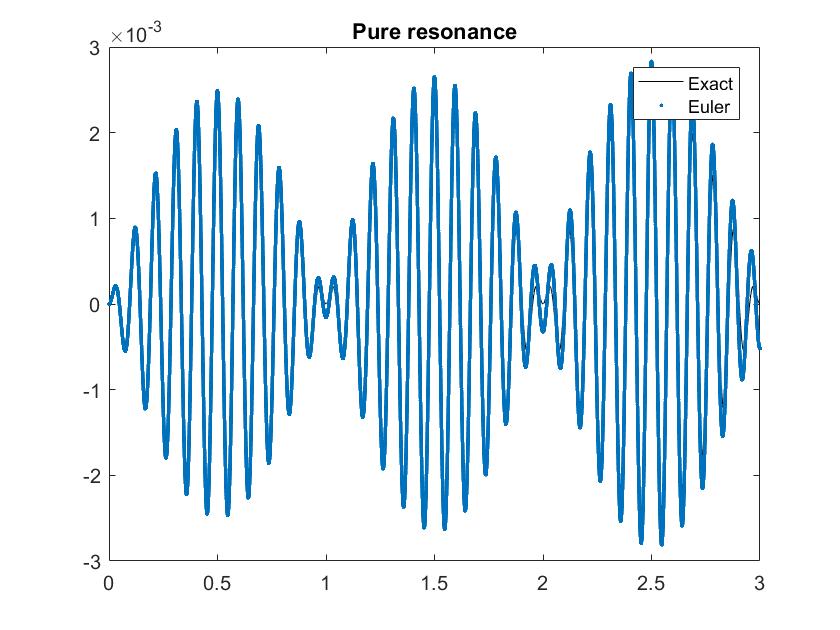
qstar(:,i+1) = qstar(:,i) + k1\*h;

end

plot(t,yexact,'k-'), hold on, plot(t,qstar(1,:),'.');

legend('Exact','Euler');

title('Pure resonance');

hold off