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% Chapter 5 Frequency Response example (chap5_freq_resp1.m)
% Calculate frequency response of a LR series circuit.
clear;clc;close all;
w = 0:50:5000; % frequency range
LR = 0.002; % ratio L/R
H = 1./(1+j*w*LR); % System frequency response
Hmag= abs(H); Hphase= angle(H)*180/pi;
% Calculate frequency response at w = 500 rad/s
w1 = 500; T1 = 2*pi./w1; t1 = -3*T1:T1/25:3*T1;
x1 = 10*cos(w1*t1); H1 = 1/(1+j*w1*LR);
y1 = 10*abs(H1)*cos(w1*t1+angle(H1));
% Calculate frequency response at w = 4500 rad/s
w2 = 4500; T2 = 2*pi./w2; t2 = -3*T2:T2/25:3*T2;
x2 = 10*cos(w2*t2+pi/2); H2 = 1/(1+j*w2*LR);
y2 = 10*abs(H2)*cos(w2*t2+pi/2+angle(H2));
% Plot everything out
subplot(211),plot(w,Hmag),ylabel(['|{\itH}(\omega)|'],'fontsize',16,...
    'fontname','times')
title('Frequency Response of Series LR Circuit, L/R = 0.002 s',...
    'fontsize',16,'fontname','times');
subplot(212),plot(w,Hphase),xlabel('\omega (rad/sec)',...
    'fontsize',16,'fontname','times'),
ylabel('\angle {\itH}(\omega) (degrees)','fontsize',16,...
    'fontname','times')
figure,
plot(t1,x1,'r-',t1,y1,'b-',[-3*T1 3*T1],[0 0],'k-',[0 0],[-11 15],'k-'),
axis([-3*T1 3*T1 -11 15]),
xlabel('{\itt} (sec)','fontsize',16,'fontname','times'),
ylabel(['System Input & Output at \omega = 500 rad/s'],...
    'fontsize',14,'fontname','times')
title('Frequency Response of Series LR Circuit, L/R = 0.002 s',...
    'fontsize',16,'fontname','times');
legend('x_1(t)= 10cos(500t)','y_1(t)= 10|H(500)|cos[500t+\angle H(500)]');
figure,
plot(t2,x2,'r-',t2,y2,'b-',[-3*T2 3*T2],[0 0],'k-',[0 0],[-11 15],'k-'),
axis([-3*T2 3*T2 -11 15]),
xlabel('{\itt} (sec)','fontsize',16,'fontname','times'),
ylabel(['System Input & Output at \omega = 4500 rad/s'],...
    'fontsize',14,'fontname','times')
title('Frequency Response of Series LR Circuit, L/R = 0.002 s',...
    'fontsize',16,'fontname','times');
legend('x_2(t)= 10cos(4500t+\pi/2)',...
    'y_2(t)= 10|H(4500)|cos[4500t+\pi/2+\angle H(4500)]');
set(findobj('type','line'),'linewidth',1.5)
set(findobj('type','text'),'fontname','times')
set(findobj('type','axes'),'linewidth',2,'fontname','times','fontsize',12)
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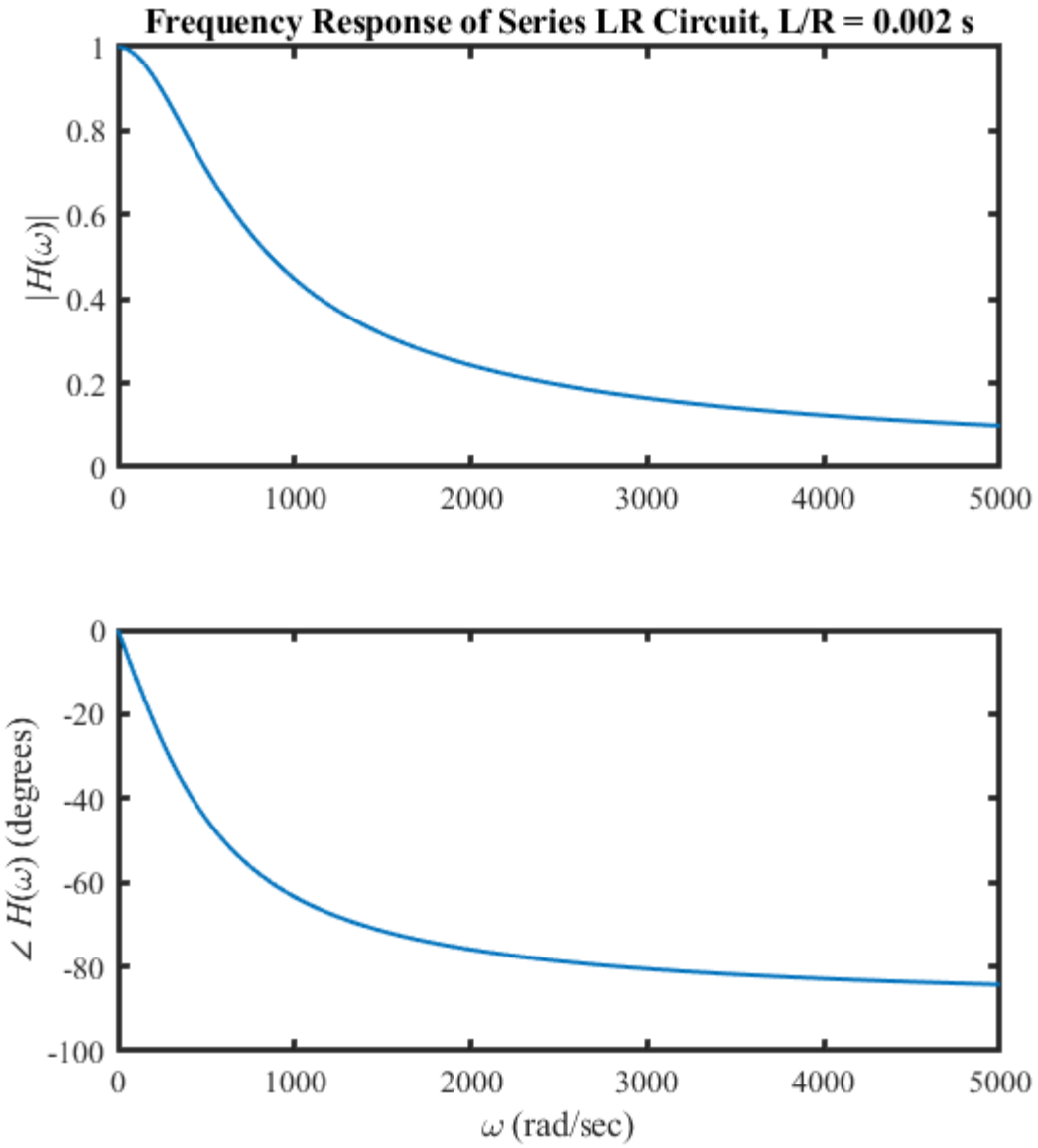
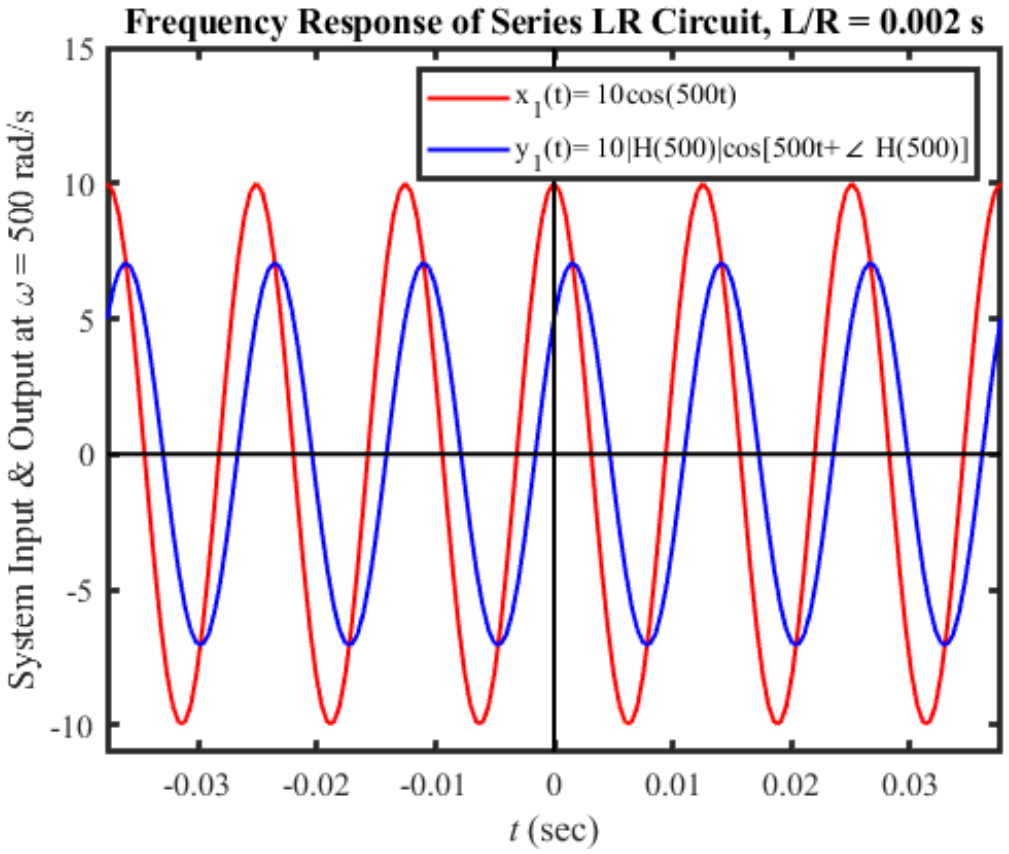
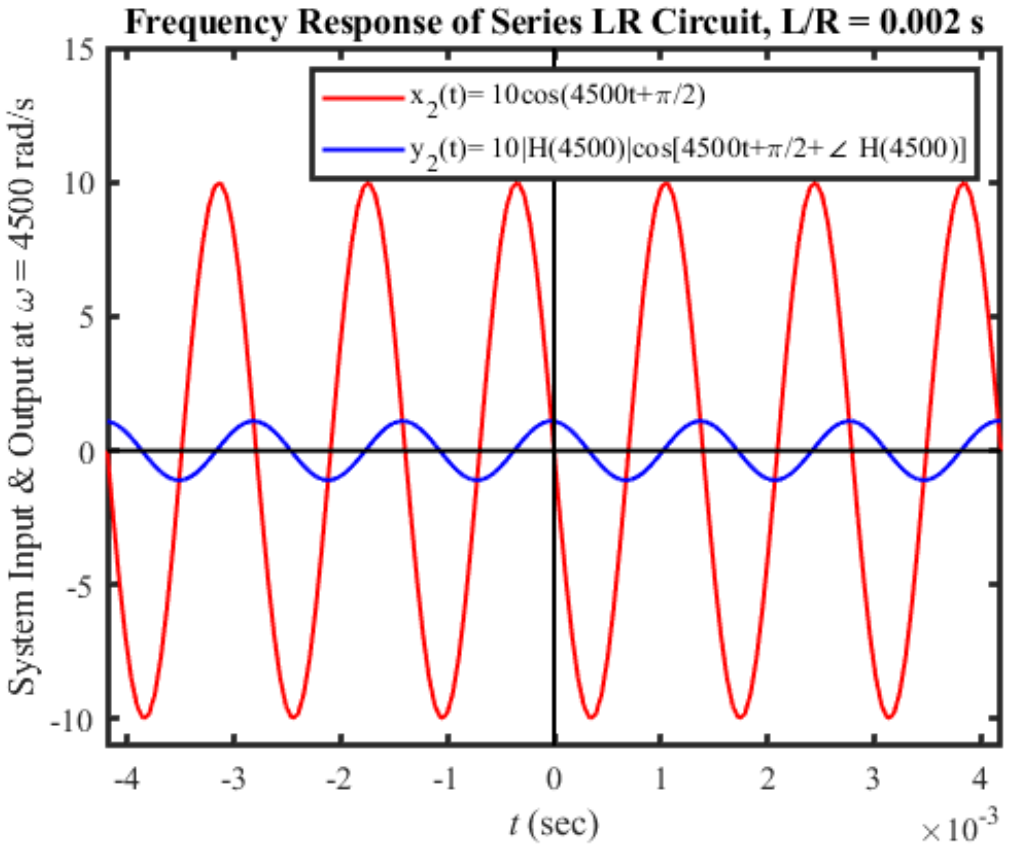

Frequency Response of Series LR Circuit, L/R = 0.002 s
|H(ω)|
1
0.8
0.6
0.4
0.2
0
0
1000
2000
3000
4000
5000
∠ H(ω) (degrees)
0
-20
-40
-60
-80
-100
ω (rad/sec)


Frequency Response of Series LR Circuit, L/R = 0.002 s
x1(t)= 10cos(500t)
y1(t)= 10|H(500)|cos[500t+∠ H(500)]
System Input & Output at ω = 500 rad/s
15
10
5
0
-5
-10
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
t (sec)


Frequency Response of Series LR Circuit, L/R = 0.002 s
x2(t)= 10cos(4500t+π/2)
y2(t)= 10|H(4500)|cos[4500t+π/2+∠ H(4500)]
System Input & Output at ω = 4500 rad/s
15
10
5
0
-5
-10
-4
-3
-2
-1
0
1
2
3
4
t (sec)
×10-3