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Exercise – 1.2

Given the values of R, L, C and the supply voltage V of a series RLC circuit, write a MATLAB program to

i) Find the resonant frequency and to obtain the current, power and voltage drop across the various elements under resonance.
ii) Plot the resonance curve (*i* vs. *f*) by varying the supply frequency within a range of +/- 25 Hz from the resonant frequency. Repeat (ii) for different values of L and C keeping LC constant. Observe and comment on the nature of the curve.

Choose R = 30 Ω, C = 80 μF, L = 80 mH, and supply voltage = 150V.

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M-code:

```
% Ex-1.2 (Circuit Theory)
% Sambhav R Jain
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clc;
clear all;
close all;

fprintf('Ex-1.2 Resonance in a series RLC circuit\n');
fprintf(' - Sambhav R Jain (107108103)\n\n');

V=input('Enter the supply voltage (in V): ');
L=input('Enter the value of inductance L (in H): ');
C=input('Enter the value of capacitance C (in F): ');
R=input('Enter the value of resistance R (in ohm): ');

% Resonance occurs when Xl=Xc
fr=1/(2*pi*sqrt(L*C));
disp('Resonant frequency (in Hz): ');
disp(fr);

Xl = L*2*pi*fr;
Xc = 1/(C*2*pi*fr);

I=V/(R+1j*Xl-1j*Xc);
disp('Current (in A): ');
disp(abs(I));

Vr=I*R;
Vl=I*1j*Xl;
Vc=I*-1j*Xc;

disp('V_r (in V): ');
disp(abs(Vr));
disp('V_l (in V): ');
disp(abs(Vl));
disp('V_c (in V): ');
disp(abs(Vc));

Pr=Vr*I*1e-3;
Pl=Vl*I*1e-3;
Pc=Vc*I*1e-3;

disp('Real power dissipated across R (in kW): ');
disp(Pr);
disp('Reactive power across L (in kVAr): ');
disp(Pl);
disp('Reactive power across C (in kVAr): ');
disp(Pc);

for L=60e-3:10e-3:100e-3
    C=(1/(2*pi*fr)^2)/L;
    m=1;
    for f=fr-25:1:fr+25
        Xl = L*2*pi*f;
        Xc = 1/(C*2*pi*f);
        I(m)=V/(R+j*Xl-j*Xc);
        m=m+1;
    end
    f=[fr-25:1:fr+25];

    plot(f,I);
    hold on;
    grid on;
    title('Resonance curve');
```

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```
    xlabel('Frequency (Hz) ----->');
    ylabel('Current (A) ----->');
    % legend(sprintf('L = %d mH',L*1e3));
end
```

Terminal Display:

```
Ex-1.2 Resonance in a series RLC circuit
 - Sambhav R Jain (107108103)

Enter the supply voltage (in V): 150
Enter the value of inductance L (in H): 80e-3
Enter the value of capacitance C (in F): 80e-6
Enter the value of resistance R (in ohm): 30
Resonant frequency (in Hz):
   62.9115

Current (in A):
     5

V_r (in V):
   150

V_l (in V):
  158.1139

V_c (in V):
  158.1139

Real power dissipated across R (in kW):
   0.7500 - 0.0000i

Reactive power across L (in kVAr):
   0.0000 + 0.7906i

Reactive power across C (in kVAr):
  -0.0000 - 0.7906i
```

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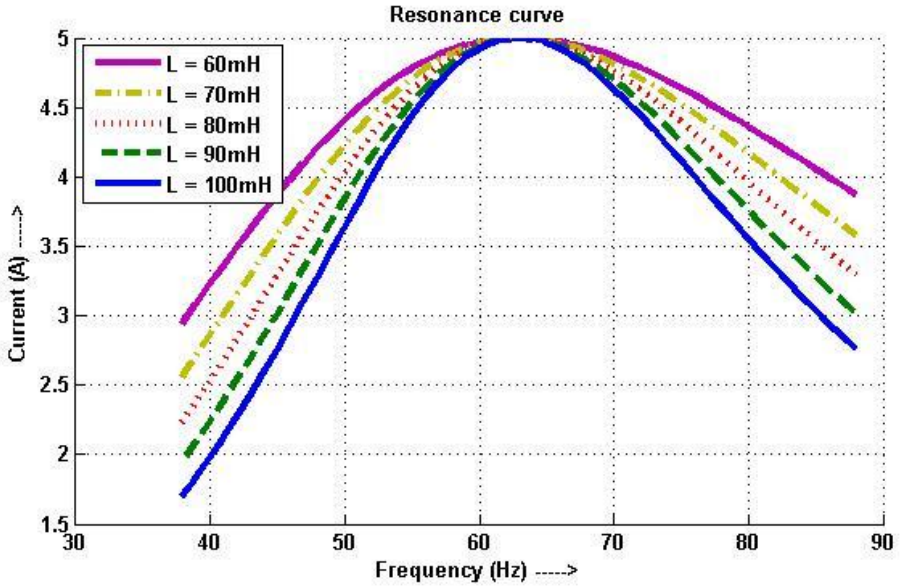
Waveforms:



Results:

Hence the resonant frequency for the given values of R, L and C is found and the resonance curve is plotted. Now, the values of L and C are varied keeping LC constant. Thus resonance is found to occur at the same frequency, however the envelope is found to shrink as L is increased. In other words, the selectivity of the circuit improves as the bandwidth reduces.