HW#5 -Phys273-Spring 2003

Due Tuesday, March 18 , 2003, by 9.30am

Prof. Melanie Becker
Room 4125, (301)405-1774
melanieb@physics.umd.edu

Problem 1. [*10 points*]

The current $I = I_0\ e^{-at}\ cos(\omega t)$ passes through a series RL circuit.

a) Find V_{RL}, the voltage across this combination. Write your answer in the form $V_{RL} = V_0(t)\ cos(\omega t + \theta_0)$.

b) Compute V_{RL} for $I_0 = 3$A, $a = 2$ and $\omega = 40$ rad/sec.

Problem 2. [*10 points*]

The electrical circuits discussed in class were electrical circuits in series. We now would like to to a similar analysis for the electrical circuits in parallel, that are sketched below.

a) Show, that the resonant frequency for the pure LC parallel-tuned circuit of figure 1 is the same, as that for the series tuned circuit and is given by

$$f_r = \frac{1}{2\pi\sqrt{LC}}. \tag{1}$$

b) Compute the resonant frequency of the circuit shown in figure 2.

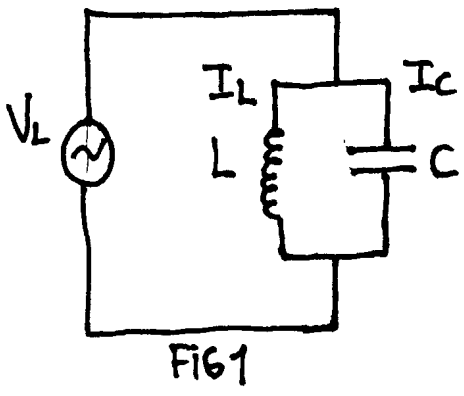

Fig1

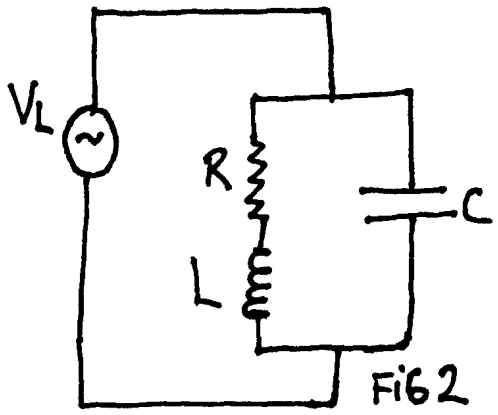

Fig2

Problem3 [*10 points*]

Find the two normal modes of vibration for a pair of identical damped coupled harmonic oscillators, that are described by the equation of motion

$$mx_1'' + bx_1' + k'x_1 + k_c\ x_2 = 0, \tag{2}$$

with a similar equation, which exchanges x_1 with x_2 and we have defined $k' = k + k_c$. Hint: Make an exponential ansatz $x_i = A_i e^{i\omega t}$, for $i = 1, 2$.