

ECE 207 – FIRST RC ORDER CIRCUITS – INVESTIGATION 25 SINUSOIDAL STEADY STATE RESPONSES OF RL CIRCUITS

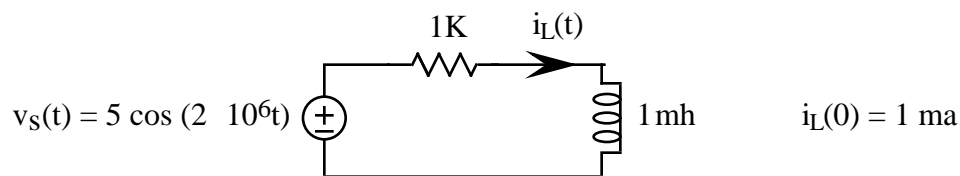
FALL 2000

A.P. FELZER

To do "well" on this investigation you must not only get the right answers but must also do neat, complete and concise writeups that make obvious what each problem is, how you're solving the problem and what your answer is. You also need to include drawings of all circuits as well as appropriate graphs and tables.

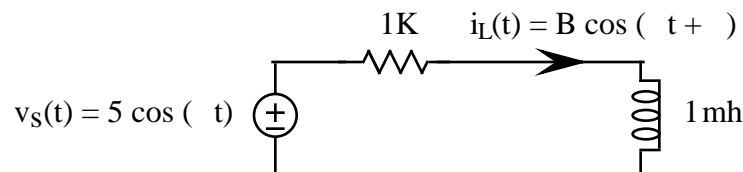
The objective of this investigation is to calculate the sinusoidal steady state responses of first order RL circuits and compare them to the corresponding steady state responses of RC circuits.

1. We begin with the following first order RL circuit with a sinusoidal input



- a. Sketch $v_s(t)$. What is its period
- b. Find the time constant and then make use of it to sketch the natural response $i_n(t)$
- c. How many periods of the sinusoid will it take for the circuit to reach steady state
- d. Write the differential equation for $i_L(t)$
- e. Make use of your result in part (d) to find and sketch the sinusoidal steady state response of $i_L(t)$

2. Given the following first order RL circuit



- a. Find and sketch B as a function of
 - b. How does the sinusoidal steady state response of the current through an inductor differ from that of the sinusoidal steady state response of the current "through" a capacitor as the frequency increases. **Memorize** this result.
3. How do the initial conditions of an RLC circuit affect the amplitude and phase of its sinusoidal steady state response.
 4. Make use of your memorized result that steady state (forced) responses of linear circuits satisfy superposition to find and sketch the steady state response of the following circuit. Be sure to make use of your calculations in Problem (1)

