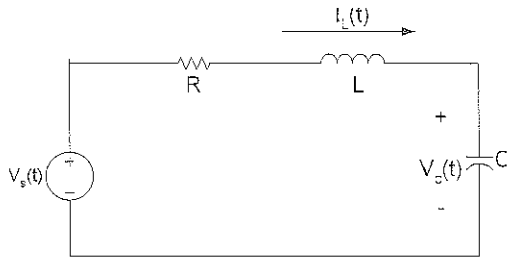
ECE 233 General Make-up

30-01-2014

Q-1- For the circuit below phasors can be used to find the state variables $I_L(t)$ at Sinusoidal Steady-State (SSS) conditions. The circuit parameters are follows: **Vs(t)=Cos(wt+θ) Volt** with **θ=0 degree and w=2 rad/sec, R=2 Ohm, L=0.5 Henry, C=0.5 Farad.**



Follow the procedure below and find $I_L(t)$ at SSS.

a) Find the phasor representationof the circuit **(8 points)**

X_L→impedance of the inductor L

$$X_L=jwL \text{ Ohm}$$

X_C→impedance of the capacitor C,

$$X_C=1/(jwC) \text{ Ohm}$$

X_R→impedance of the Resistor R,

$$X_R=R \text{ Ohm}$$

Vs_p→phasor representation of the input Vs(t).

$$Vs_p=e^{j\theta} \text{ Volt}$$

b) Find the phasor value of $I_L(t)$ which is I_{Lp} **(5 points)**

$$I_{Lp}=Vs_p/(X_L+X_C+X_R) \text{ Ampere}$$

c) Convert phasor I_{Lp} to time domain signal $I_L(t)$. The result that you find is the SSS solution of $I_L(t)$. **(2 points)**

Q-2- r(t) is the ramp function. Draw k(t)=u(t)+r(t)+r(t-1)-2r(t-2)-2r(t-3)+r(t-4)+r(t-5) with full details. (10 points)

Q-3- The differential equation governing the circuit variable $I_L(t)$ is given by

$$\frac{d^4 I_L}{dt^4} - I_L = Sin(2t)$$

Find the particular solution of this differential equation. (25 points)

Q-4- Design a second order circuit with **two resistors** and **two capacitors** and **a voltage** source V_s which has the following state space representation. (50 points)

$$\begin{bmatrix} \frac{dV_{C1}}{dt} \\ \frac{dV_{C2}}{dt} \end{bmatrix} = \begin{bmatrix} -2 & -1 \\ 0.5 & -0.5 \end{bmatrix} \begin{bmatrix} V_{C1} \\ V_{C2} \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} V_S$$