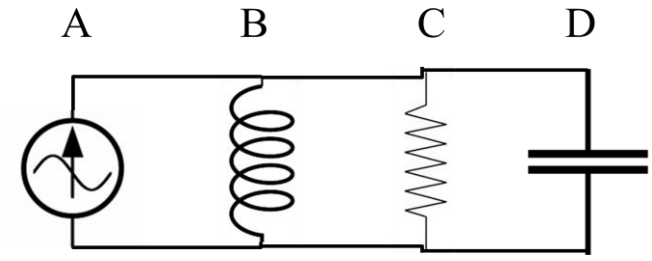
Electrical circuits and networks (EE2015)

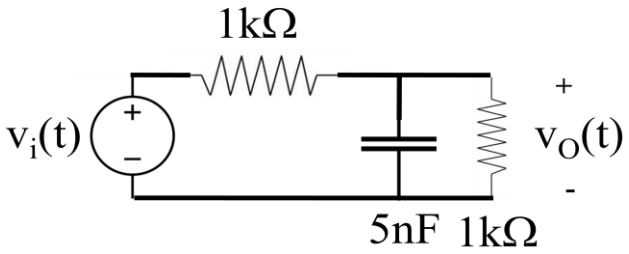
Tutorial 7 (27th September, 2019)

Q1) Represent the following in phasor notation:
$2Sin(30t)$, $2Sin(30t+2)$, $-2Sin\left(30t-\frac{5\pi}{6}\right)+2Cos\left(30t-\frac{5\pi}{6}\right)$, $2Sin\left(-30t+\frac{5\pi}{6}\right)+2Sin\left(30t+\frac{5\pi}{6}\right)$

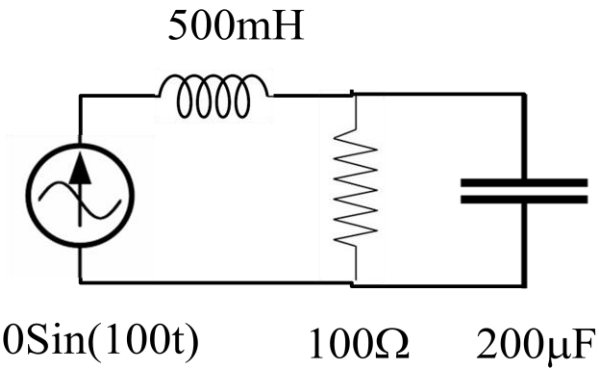
Q2) In the network shown below, the currents in the section AB, BC, and CD have maximum values of 5, 5, and 4 A respectively, and the maximum voltage across the parallel combination is 120V. Determine the values of the impedances of the three branches of the network and the phase angle between I_{AB} and I_{CB}.



Q3) For the figure below, determine the steady state response $v_0(t)$ when $v_i(t)=5Cos(\omega t+\pi/4)V$ and $\omega=500$ krad/s. Determine the initial condition $v_o(0^-)$ so that the natural response is zero for the above input.



Q4) Determine all branch voltages and currents in steady state, and a phasor diagram representing these currents and voltages for the circuit below.



Q5) With refer to the figure below, the following observations are made about the sinusoidal current source in the figure.

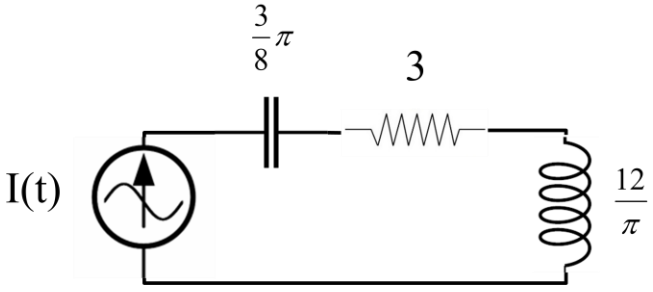
(a) At time t_1, I=10A, and dI/dt is negative

(b) At time t_1+2, I=10A, and dI/dt is positive

(c) In the time interval $t=t_1$ to $t=t_1+2$, I(t) has never been more than 10A.

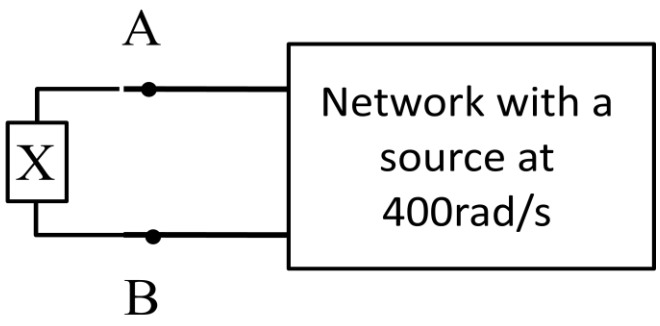
(d) The energy stored in the inductor has a maximum value of 2400/π Joules.

Determine the steady state voltage waveform across the inductor, resistor, and capacitor. What is the energy dissipated in the resistor over one cycle.

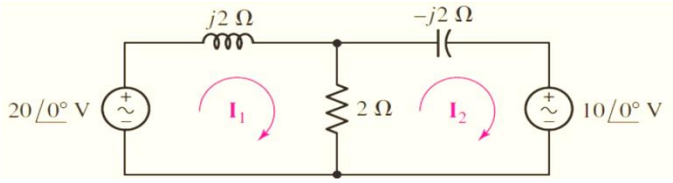


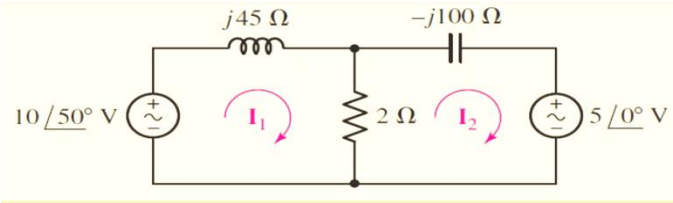
Q6) Refer to the figure below. When the element X across AB is a 2.5μF capacitor, the voltage $V_{AB}=E_1$, where $|E_1|=100V$. When X is a 2H inductor, $V_{AB}=E_2$, where $|E_2|=40V$. E_2 leads E_1 by 90^O. Determine I_{SC}, the

short circuit current flowing from A to B if X is replaced by a short, and its phase angle with respect to E_1.

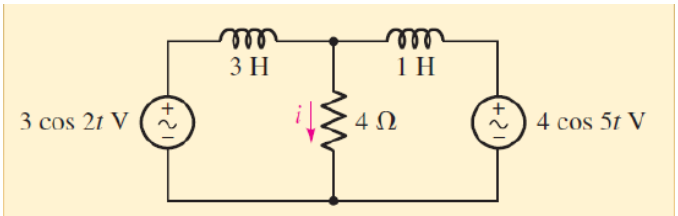


Q7) Find $\mathbf{I_1}$ and $\mathbf{I_2}$ using mesh analysis and superposition for the circuits below.





Q8) Determine the current through the 4 Ohm resistor.



Q9) Find the s-domain Thevenin equivalent in the highlighted network. Given $V_{C_\pi}(0^-)$= 1V