EE301 Nov. 4, 2011

Quiz 8a – No Calculators – pencil (or pen) and paper only

Equations: \( i_c(t) = C \frac{dv_c(t)}{dt} \), \( v_c(t) = \frac{1}{C} \int i_c \, dt + v_c(0) \), \( i_L(t) = \frac{1}{L} \int v_L \, dt + i_L(0) \), \( v_L(t) = L \frac{di_L(t)}{dt} \)

\[ W_L = \frac{1}{2} L i_L^2(t), \quad W_C = \frac{1}{2} C v_c^2(t), \quad v_{rms} = \sqrt{\frac{1}{T} \int v(t)^2 \, dt} \]

\[ Z_R = R + j \omega L, \quad Z_C = 0 - j \frac{1}{\omega C}, \quad Z_L = 0 + j \omega L \]

Problem 1:

Given:

\( R_1 = 1 \Omega, \quad R_2 = 2 \Omega, \quad L = 4 \text{H}, \quad C = 6 \text{F}, \quad V_S(t) = 4 \cos(10t + \frac{\pi}{2}) \text{V} \)

Find:

The phasor

The impedances

The voltage across C

The current through L

Note: Calculations are not necessary – for the voltage and current – just the equations.

\[ V_S = 4 \cos \left( \frac{\pi}{2} \right) \text{V} \]

\[ Z_{R_1} = 1 \Omega \]

\[ Z_{R_2} = 2 \Omega \]

\[ Z_\omega L = j \omega L = j (4 \times 6) \Omega = 40 \times 6 \Omega = 40 \Omega \]

\[ Z_\omega C = -j \frac{1}{\omega C} = -j \frac{1}{6 \times 2 \pi \text{F}} = -j \frac{1}{12 \pi} \]

\[ V_C = \frac{Z_C}{Z_{C} + Z_{R_2}} \cdot V_S \]

\[ i_L = \frac{V_S}{Z_L + Z_{R_1}} \]