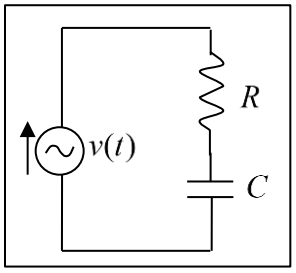
Elementary Engineering Mathematics
Exercises #5 – Application of Complex Numbers in Electrical Engineering

1. A voltage $v(t) = 110\cos\left(120\pi t + \pi/3\right)$ volts is applied to the RC series circuit with $R = 80\,\Omega$ and $C = 50\ \mu$f . Given that the total impedance is $Z = Z_R + Z_c$, find

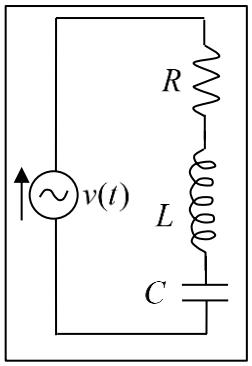


   a) Z in both rectangular and polar form

   b) I the complex current in both rectangular and polar form

   c) $i(t)$ the current as a function of time

2. A voltage $v(t) = 110\cos(120\pi t)$ volts is applied to the RLC series circuit with $R = 75\,\Omega$, $C = 40\ \mu$f , and $L = 300$ mh . Given that the total impedance is the sum $Z = Z_R + Z_c + Z_L$, find

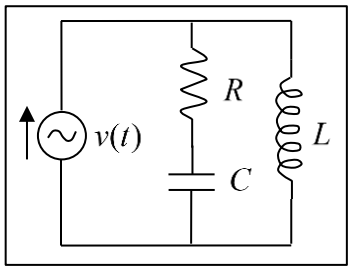


   a) Z in both rectangular and polar form

   b) I the complex current in both rectangular and polar form

   c) $i(t)$ the current as a function of time

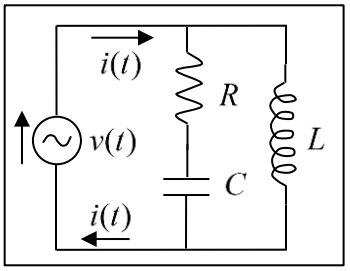
3. A voltage $v(t) = 110\cos(120\pi t)$ volts is applied to the RLC parallel circuit with $R = 100\,(\Omega)$, $C = 35\ \mu$f , and $L = 500$ mh . Given that the equivalent impedance is given by the equation $\boxed{Z_{eq} = \dfrac{\left(Z_R + Z_c\right)Z_L}{\left(Z_R + Z_c\right) + Z_L}}$, find



   a) $\left(Z_R + Z_C\right)$ and Z_L in both rectangular and polar form

   a) Z_{eq} the equivalent impedance in polar form

4. A voltage $v(t) = 110\cos\left(120\pi t + \pi/3\right)$ volts is applied to the RLC parallel circuit with $R = 200\,(\Omega)$, $C = 25\ \mu$f , and $L = 800$ mh . Given that the equivalent impedance is $\boxed{Z_{eq} = \dfrac{\left(Z_R + Z_c\right)Z_L}{\left(Z_R + Z_c\right) + Z_L}}$, find



   a) Z_{eq} in polar form

   b) I the complex current in polar form

   c) $i(t)$ the total current as a function of time

Impedances for AC circuit elements: $\boxed{Z_R = R}$, $\boxed{Z_C = \dfrac{-j}{\omega C}}$, and $\boxed{Z_L = j\omega L}$

Complex form of Ohm's Law: $\boxed{V = I\,Z}$