Class 17: Phasor analysis for AC circuits

The effect of resistors, inductors, and capacitors upon phasors is handled with a concept known as **impedance.** Impedance (Z) basically acts like a complex resistance. $V = I \cdot Z$

| Element | Time Domain | Phasor Domain | Z (impedance) |
|---|---|---|---|
| Resistor | $v(t) = Ri(t)$ | $\boldsymbol{V} = \boldsymbol{I}R$ | $R$ |
| Inductor | $v(t) = L\frac{di(t)}{dt}$ | $\boldsymbol{V} = j\omega L\boldsymbol{I}$ | $j\omega L$ |
| Capacitor | $i(t) = C\frac{dv(t)}{dt}$ | $\boldsymbol{V} = \frac{1}{j\omega C}\boldsymbol{I}$ | $\frac{1}{j\omega C}$ |

The impedance of inductors and capacitors depends on frequency $\omega = 2\pi f$. Almost all of the resistive circuit analysis methods you learned for DC apply.

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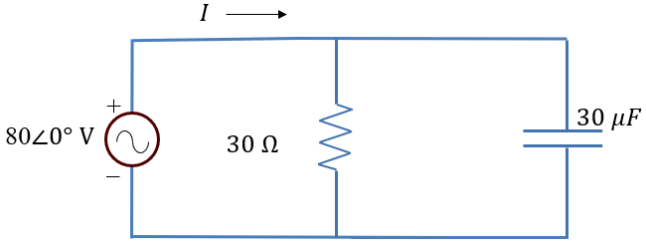
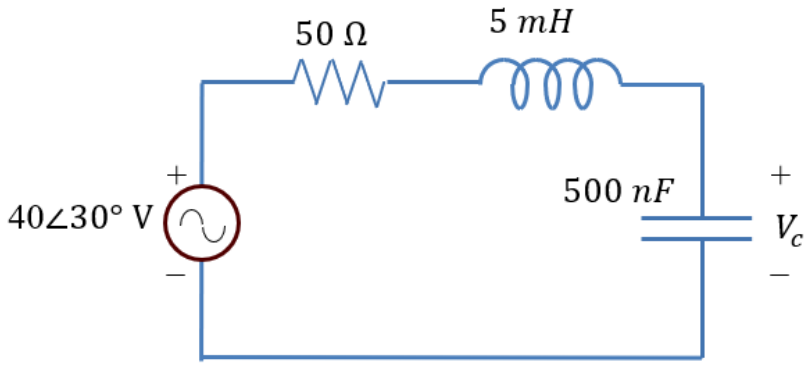
Example 1: Find the current phasor I for this 1 kHz circuit



Example 2: Solve for the phasor $V_c$ for this circuit if it is operated at 400 Hz

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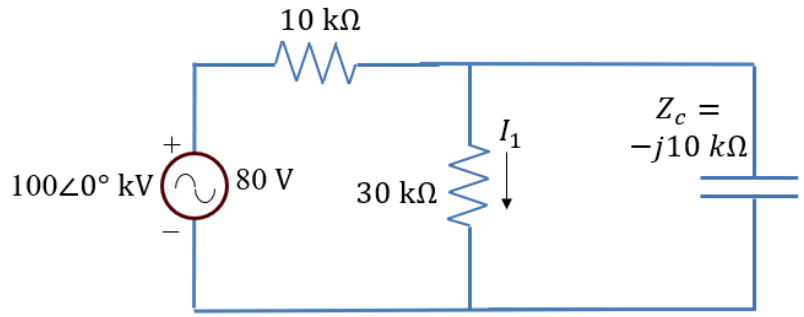
Example 3: Solve for the phasor $I_1$. The impedance for $Z_c$ is given so you don't need the frequency.



Example 4:

$$i_s(t) = 7.1\cos(1256t - 10°)\ A$$
$$v_s(t) = 113.1\cos(1256t + 45°)\ \text{V}$$

Find the time signal $v_1(t)$. (Try using mesh-current analysis and node-voltage analysis.)