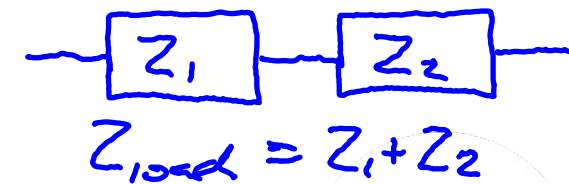




The current flowing into a load is given by



$$i(t) = 2 \cos(2500t) \text{ A}$$

$$I(2500j) = 2e^0 = 2 \angle 0^\circ$$

If the load is known to consist of a series of two passive elements, and

complex power

$$S = (10 - j8) \text{ VA}$$

determine the identities of the elements and their values.



$Z_1$  or  $Z_2$  is a resistor

$$Z_{load} = Z_R + Z_C$$

$$Z_R = 5 \Omega$$

$$Z_C = \frac{-j}{\omega C} = -4j = \frac{-j}{2500 C}$$

$$4 = \frac{1}{2500 C} \quad C = \frac{1}{2500(4)} = 10 \mu\text{F} = Z_C$$

$$S = \frac{Z_{load} \cdot I_m^2}{2}$$

$$10 - 8j = \frac{Z_{load} (2)^2}{2}$$

$$Z_{load} = \frac{10 - 8j}{2} = 5 - 4j$$

$Z_1$  or  $Z_2$  is a capacitor  
(because  $-j$ )



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# AC Power (Examples)

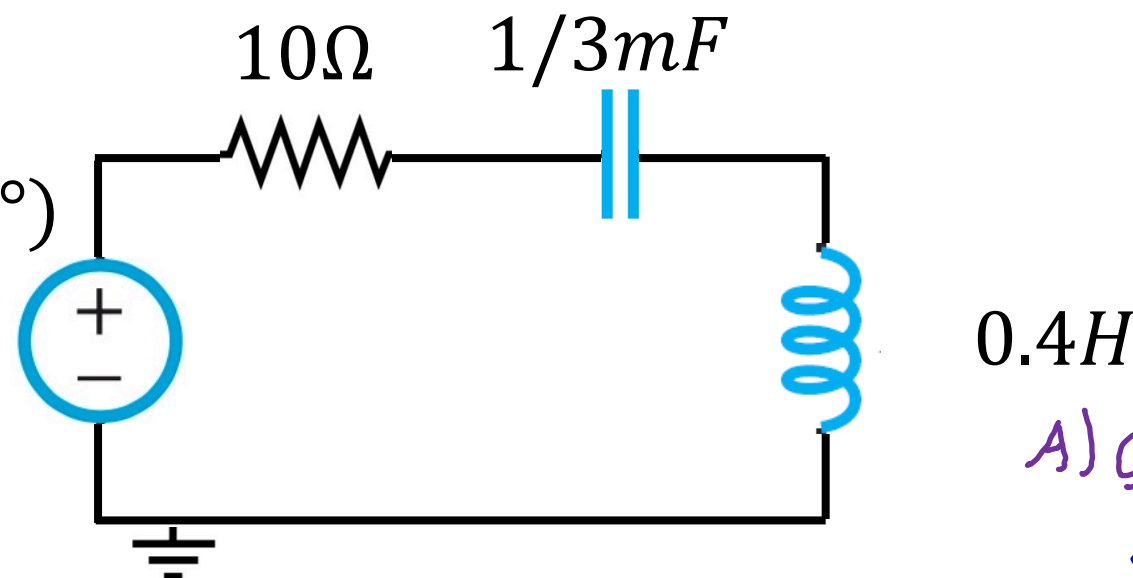


- Learning Objectives:
  - Determine the complex power, average real power, and reactive power for any complex load with known input voltage or current.





Find the complex power generated by the source  $V_s$ .



$$141 \sin(100t + 120^\circ)$$

$$141 \cos(100t + 30^\circ)$$

$$V_s(100j) = 141e^{30j}$$

$$Z_R = 10$$

$$Z_L = j\omega L = 100(0.4)j = 40j$$

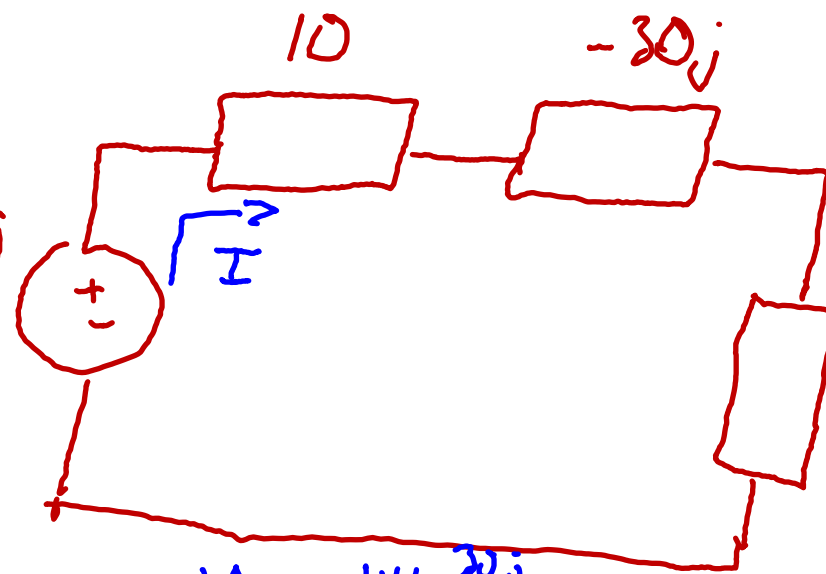
$$Z_C = \frac{1}{j\omega C} = \frac{-j}{100(\frac{1}{3} \times 10^{-3})} = -30j$$

$$0.4H$$

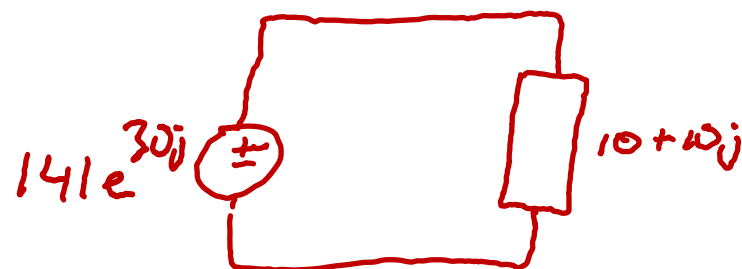
A) Complex Power

$$S = \frac{VI^*}{2}$$

$$\begin{aligned} Z_{eq} &= Z_R + Z_C + Z_L \\ &= 10 + 40j - 30j \\ &= 10 + 10j \end{aligned}$$



$$I = \frac{V_s}{Z_{eq}} = \frac{141e^{30j}}{10 + 10j} = 9.97e^{-15j} = 9.63 - 2.58j$$



conjugate  $\rightarrow$

$$S = \frac{VI^*}{2} = \frac{(141e^{30j})(9.63 + 2.58j)}{2} = 497 + 497j \text{ VA} = 702.85e^{45j}$$

$P + Qj$

B) Average Power

$$P = 497 \text{ W}$$

D) Apparent Power

$$|S| = 702.85$$

C) Reactive Power

$$Q = 497 \text{ VAR}$$

E. Power Factor

$$PF = \frac{P}{|S|} = \frac{497}{702.85} = 0.707$$

$$PF = \cos(\theta_s) = \cos(45) = 0.707$$



- Find the complex power between A and B.

