March 19

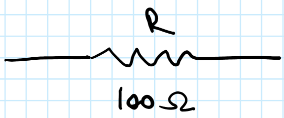
Friday, March 8, 2024 12:46 PM

Parallel AC Circuits

→ we introduce conductance G, susceptance B, and admittance Y.

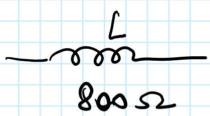
- $G = \frac{1}{R}$ conductance, in Siemens (S)

Ex: Calculate G.



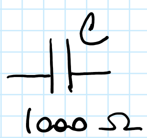
- $B_L = \frac{1}{X_L}$ inductive susceptance, in Siemens (S)

Ex: Calculate B.



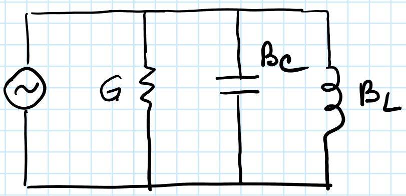
- $B_C = \frac{1}{X_C}$ capacitive susceptance, in Siemens (S)

Ex: Calculate B.



- $Y = G + j(B_C - B_L) = \frac{1}{Z}$, in Siemens (S)

Ex: Calculate Y for the circuit below. Use the previous components.



Power in AC Circuits

- **Case 1 – Purely Resistive Circuits**
  - In a circuit that only contains ***only*** resistive components, the dissipated power is found using the same relations we used explored earlier in this course:

$$P_{Ave} = I_{RMS}\, V_{RMS}$$

$$P_{Ave} = I_{RMS}^2\, R$$

$$P_{Ave} = \frac{V_{RMS}^2}{R}$$

- **Case 2 – RC, RL, and RLC Circuits**
  - Recall that reactive components (capacitors, and inductors) do not dissipate power like resistors do, but rather they only store energy and release energy again
  - In a circuit that contains a combination of resistance and reactive components, power is **only dissipated by the resistive component**

$$P_{Ave} = I_{RMS}\, V_{RMS}\, (\cos\theta)$$

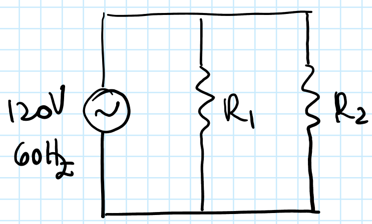
  Where (θ) is the circuit angle

  - The expression power can also be written in a form that is common to the electrical power industry

$$P_{Ave} = I_{RMS}\, V_{RMS}\, (pf)$$

  Where (pf) is the power factor equal to $\cos\theta$

Resistors in Parallel



$R_1 = 40\,\Omega$

$R_2 = 30\,\Omega$

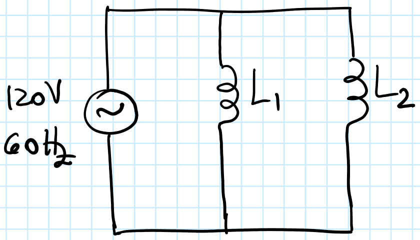
a) R_T , G_T

b) Z_T

c) I_T

d) phasor diagram

Inductors in Parallel



$L_1 = 0.2\,H$

$L_2 = 0.5\,H$

a) L_T

b) X_{LT} , B_T

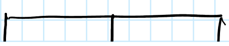
c) Z_T

d) I_T

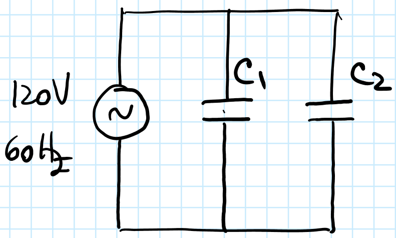
e) phasor diagram

Capacitors in Parallel

$C_1 = 8.0\,\mu F$



$C_2 = 22\,\mu F$



$C_1 = 8.0\mu F$

$C_2 = 22\mu F$

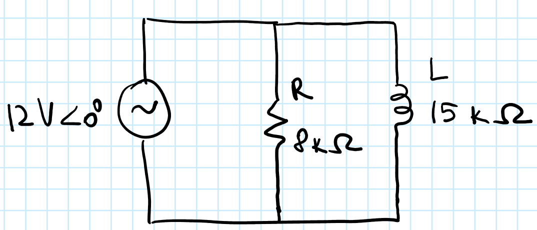
a) C_T , B_T

b) Z_T

c) I_T

d) phasor diagram

RL Circuit



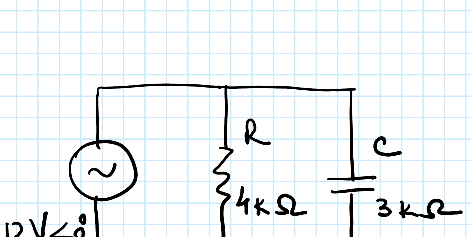
a) voltages V_R, V_L

b) currents I_R, I_L, I_T

c) phasor diagram

d) circuit phase

RC Circuit



a) voltages V_S, V_R, V_C

b) currents I_R, I_C, I_T

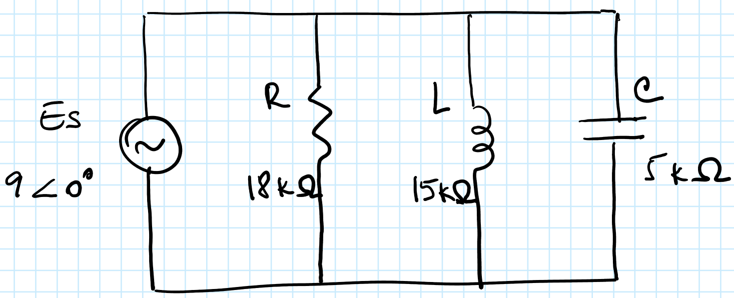
c) phasor diagram

d) circuit phase

c) phasor diagram

d) circuit phase

RLC Circuit



a) voltages

b) currents

c) phasor diagram

d) admittance diagram

e) circuit phase