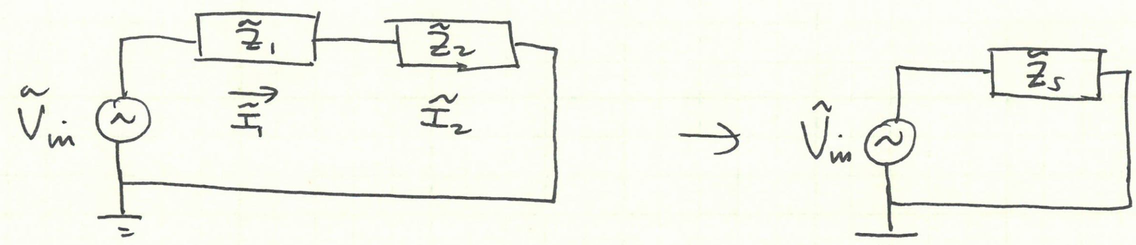
# SERIES IMPEDANCE




$$v_{in}(t) = v_1(t) + v_2(t) \quad (1)$$

$$v_{in}\cos(\omega t + \phi_{in}) = v_1\cos(\omega t + \phi_1) + v_2\cos(\omega t + \phi_2) \quad (2)$$

$$\mathrm{Re}\Big[\underbrace{v_{in} e^{j\phi_{in}}}_{\tilde{V}_{in}} \cancel{e^{j\omega t}} = \underbrace{v_1 e^{j\phi_1}}_{\tilde{V}_1} \cancel{e^{j\omega t}} + \underbrace{v_2 e^{j\phi_2}}_{\tilde{V}_2} \cancel{e^{j\omega t}}\Big] \quad (3)$$

$$\tilde{V}_{in} = \tilde{V}_1 + \tilde{V}_2 \quad (4)$$

$$= \tilde{I}_1 \tilde{Z}_1 + \tilde{I}_2 \tilde{Z}_2 \quad (5)$$

$$i_1(t) = i_2(t) \quad \text{[KCL]}$$

$$\therefore \tilde{I}_1 = \tilde{I}_2 = \tilde{I} \quad (6)$$

$$\tilde{V}_{in} = \tilde{I}\underbrace{(\tilde{Z}_1 + \tilde{Z}_2)}_{\equiv \tilde{Z}_s} . \quad (7)$$

$\equiv \tilde{Z}_s$ series equiv. impedance

$$\boxed{\tilde{Z}_s = \tilde{Z}_1 + \tilde{Z}_2} \quad (8)$$