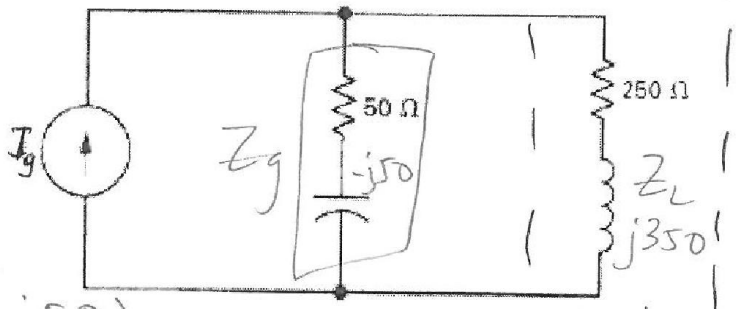
3. For the circuit to the right, $I_g = 20 \angle 0°$ mA(peak). The capacitor has impedance –j50 Ω and the inductor has impedance j350 Ω.



a) What is the complex power absorbed by the load (RL series? (10)

See A for alternative approach

$$I_L = I_g\left(\frac{Z_g}{Z_L+Z_g}\right) = (20\angle 0\ \text{mA})\left(\frac{50-j50}{300+j300}\right) = (0.02\ \text{A})\left(\frac{-j}{6}\right) = 3.33\times10^{-3}\angle -90°\ \text{A}$$

$$S = \frac{|I_L|^2 Z_L}{2} = 1.39\times10^{-3} + j\,1.94\times10^{-3}\ \text{VA}$$

OR

$$V_L = I_g(Z_g \| Z_L) = I_g\left(\frac{Z_L Z_g}{Z_L+Z_g}\right) = (2\times10^{-2}\ \text{A})\left(\frac{(50\sqrt{2}\angle -45°)(430.1\angle 54.5°)}{300\sqrt{2}\angle 45°}\right) = 1.44\angle -35.5°\ \text{V}$$

(Z_g ↖, Z_L ↗)

$$S = \frac{|V_L|^2}{2Z_L^*} = \frac{(1.44\ \text{V})^2}{2(430.1\angle -54.5°)} = 2.41\times10^{-3}\angle 54.5° = 1.4 + j\,1.96\ \text{mVA}$$

peak

b) What value of pure reactance added to the circuit in series with the load (RL series combination) would maximize power transfer to the load? (8)

See A solutions

End of Exam