Announcements: 1. Quiz 2 results released today

[Finish queries on Quiz by Sat (Nov 27)]

[Assume familiarity with everything taught in class]

2. Syllabus (B) for End Sem released today

3. Poll question results today. (5 out of 7)

4. End Sem : 15 marks (Part B) + Bonus

(B)

5. End sem logistics by Sat

- Part B: Upload seperately

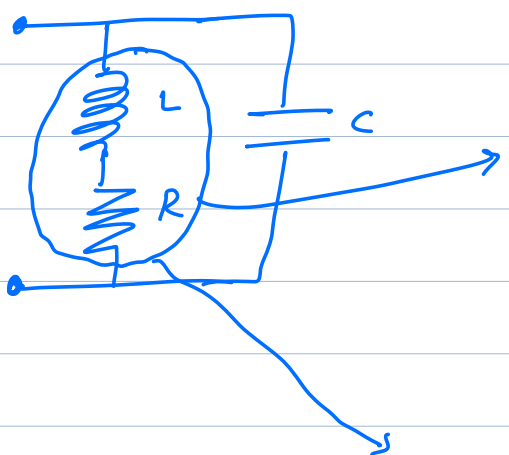
[Similar to Test 2]

Resonance

"High Q approximation"

General RLC → Series RLC

→ Parallel RLC



ω_0 : Resonant freq:

$Q_L = \frac{\omega L}{R}$

Freq of interest : Around ω_0

$Q_L >> 1$

> 10 , > 5

$$Y_L(j\omega) = \frac{1}{R + j\omega L}$$

$$= \frac{R - j\omega L}{R^2 + \omega^2 L^2}$$

$$= \frac{R - j\omega L}{\omega^2 L^2 \left(1 + \frac{R^2}{\omega^2 L^2}\right)}$$

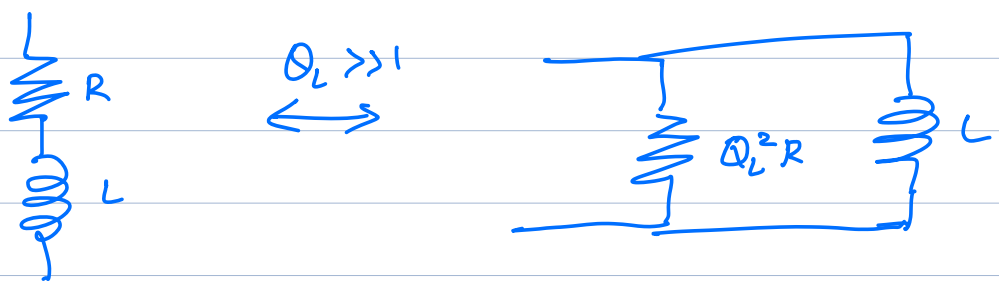
$\underbrace{\omega^2 L^2}_{\frac{1}{Q_L^2}} < 0.01$

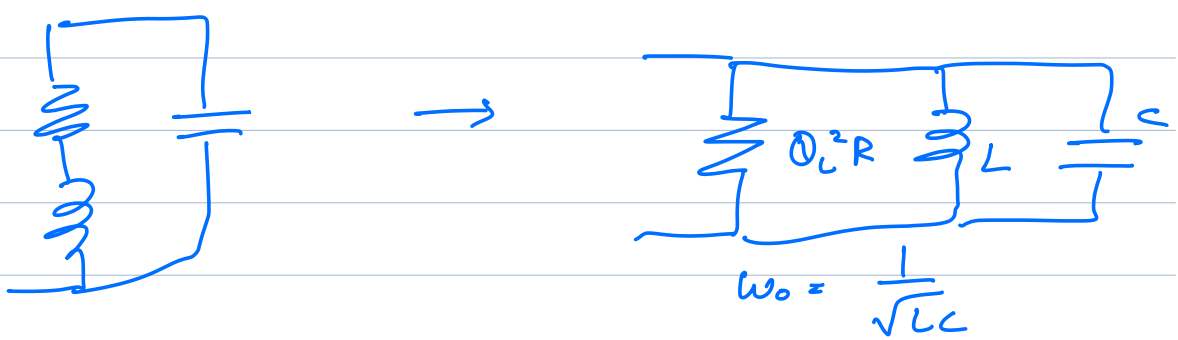
$$\approx \frac{R - j\omega L}{\omega^2 L^2}$$

$$= \frac{R}{\omega^2 L^2} - \frac{j}{\omega L}$$

$$= \frac{1}{\underbrace{\left(\frac{\omega^2 L^2}{R^2}\right)}_{Q_L^2} R} + \frac{1}{j\omega L}$$

$$= \frac{1}{Q_L^2 R} + \frac{1}{j\omega L}$$



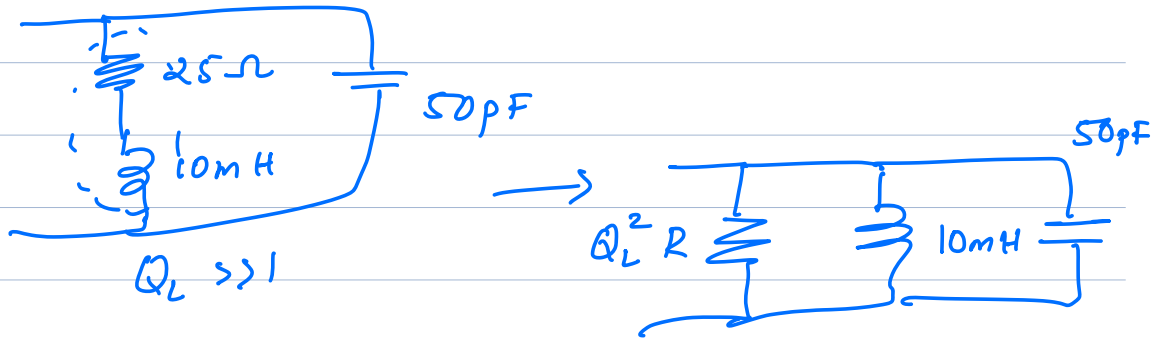


$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$Z_0(j\omega) = Q_L^2 R_L$

"Impedance at resonance"

Example:



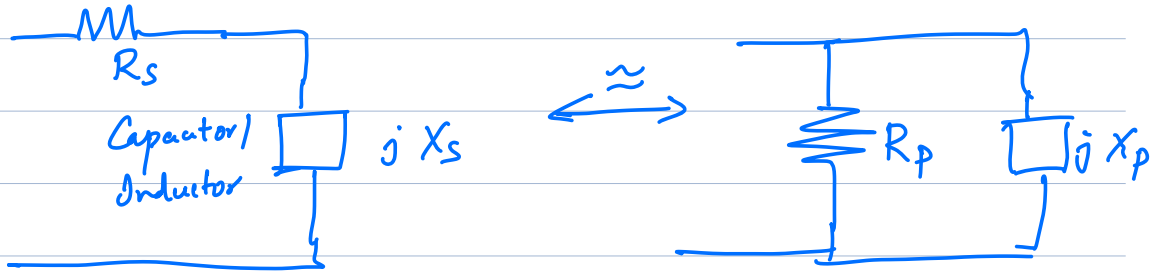
$$\omega_0 = \frac{1}{\sqrt{LC}} = \sqrt{2} \times 10^6$$

$$Q_L = \frac{\omega_0 \cdot L}{R}$$

$$= \sqrt{2} \times 10^6 \times \frac{10m}{25}$$

$$= \sqrt{2} \times 400 >> 1$$

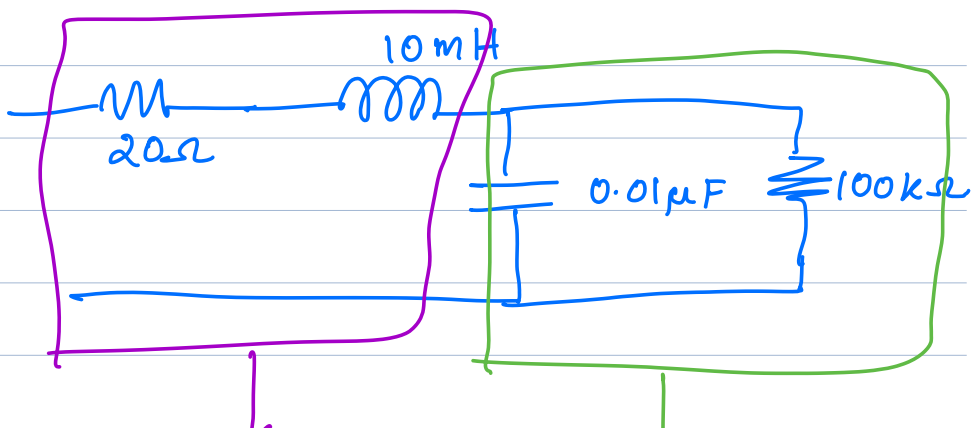
Generalization (Hayt) [$Q >> 1$]

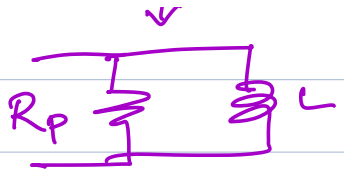


$$R_p = Q^2 \cdot R_s$$

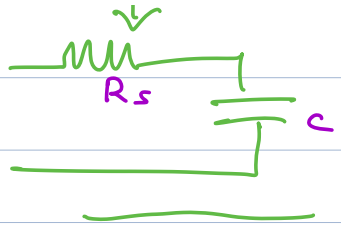
$$X_p = X_s$$

Exercise:





Parallel RLC



Series RLC