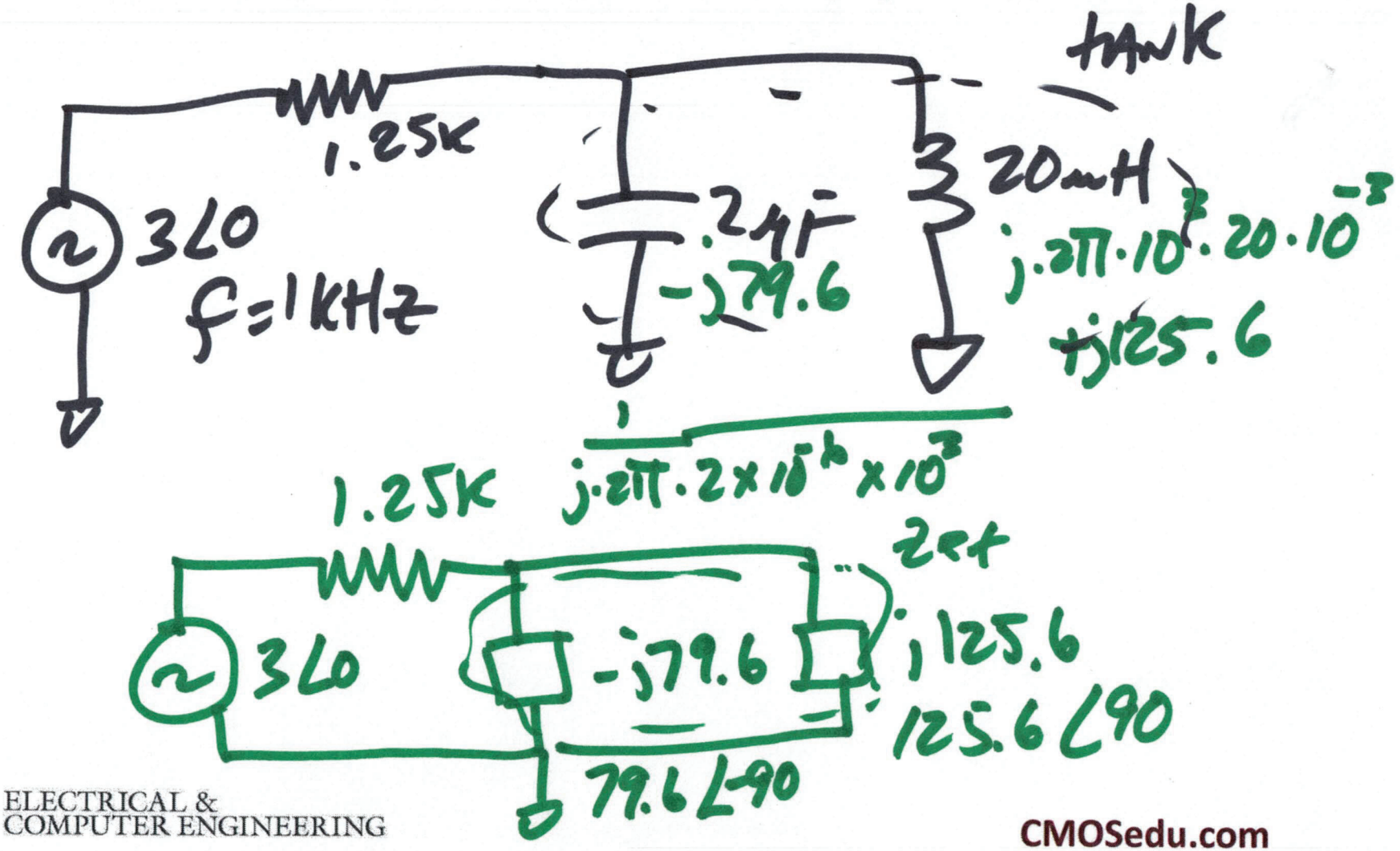
EE 220 Circuits I

Lecture 25

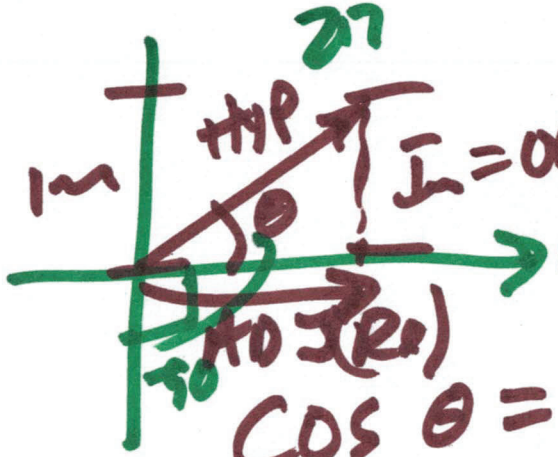
NOVEMBER 29, 2023



$$Z_{eq} = \frac{79.6\angle -90 \cdot 125.6\angle 90}{j(125.6 - 79.6)}$$

$$= \frac{10k\angle 0}{46\angle 90}$$

$$Z_{eq} = 217.4\angle -90^{\circ}$$



$$\cos\theta = \frac{Adj}{Hyp}$$

$$\sin\theta = \frac{Opp}{Hyp}$$

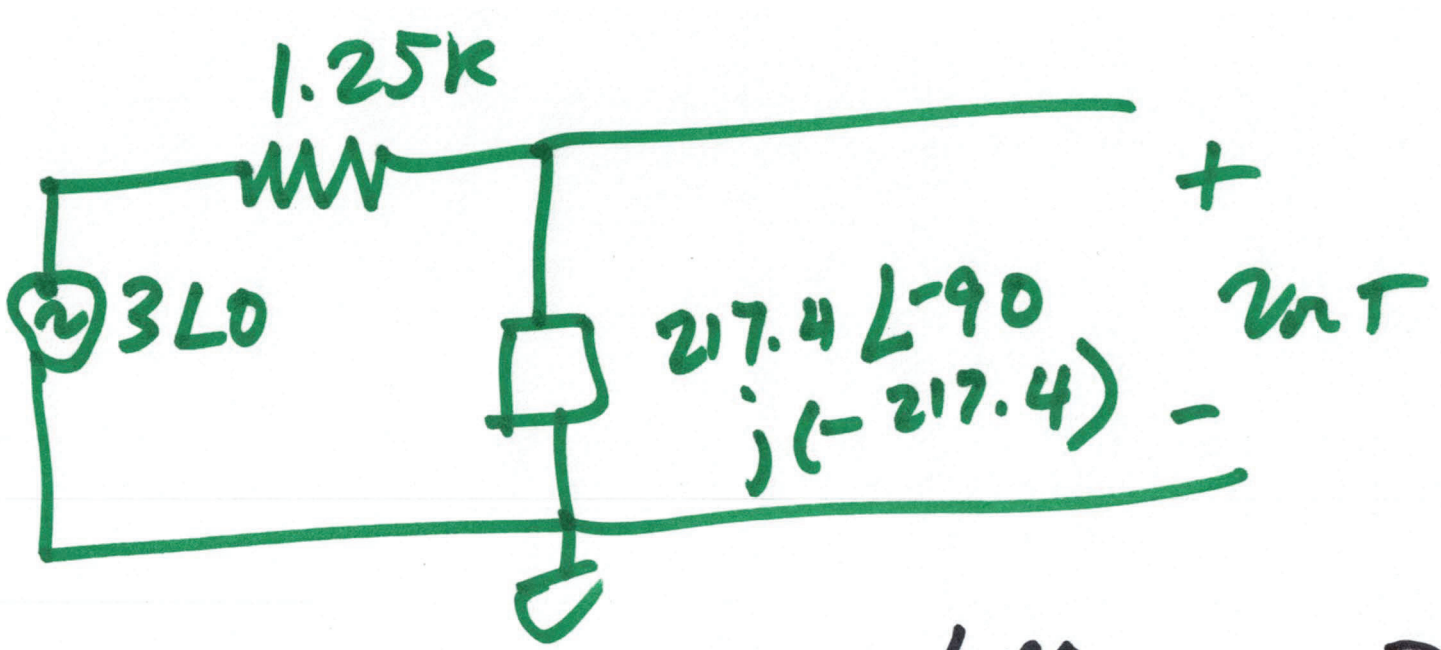
$$Re = 217.4\cos(-90)$$

$$Im = 217.4\sin(-90)$$

$$Im = -217.4$$

$$Z_{eq} = j(-217.4)$$

$$Re + j \cdot Im$$



$$v_{out} = \frac{217.4\angle -90 \cdot 3\angle 0}{1.25k + j(-217.4)}$$

$$v_{out} = \frac{217.4\angle -90}{1268.7\angle -9.8}$$

$$v_{out} = .51\angle -80.2$$

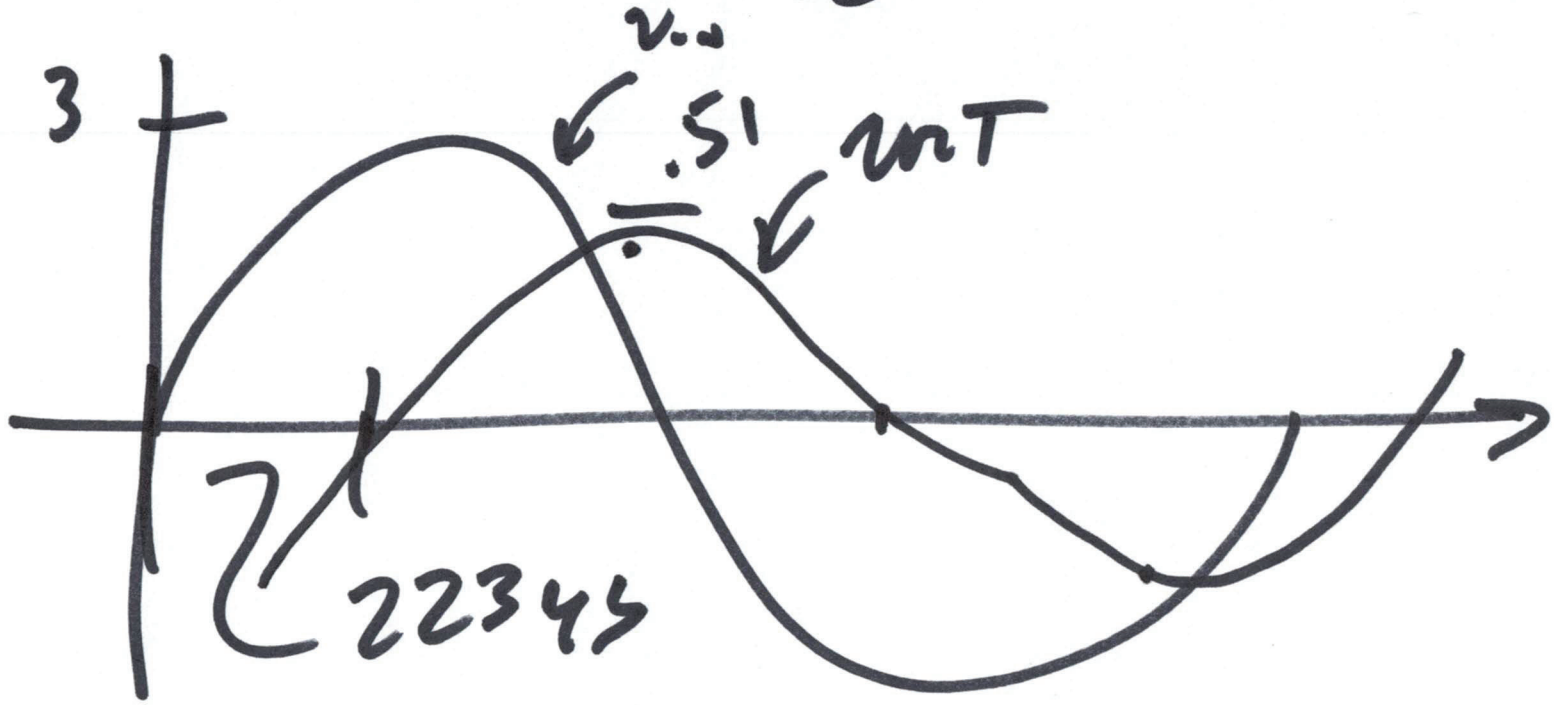
$$v_{out} = .51\sin(2\pi 10^3 t - 80.2)$$

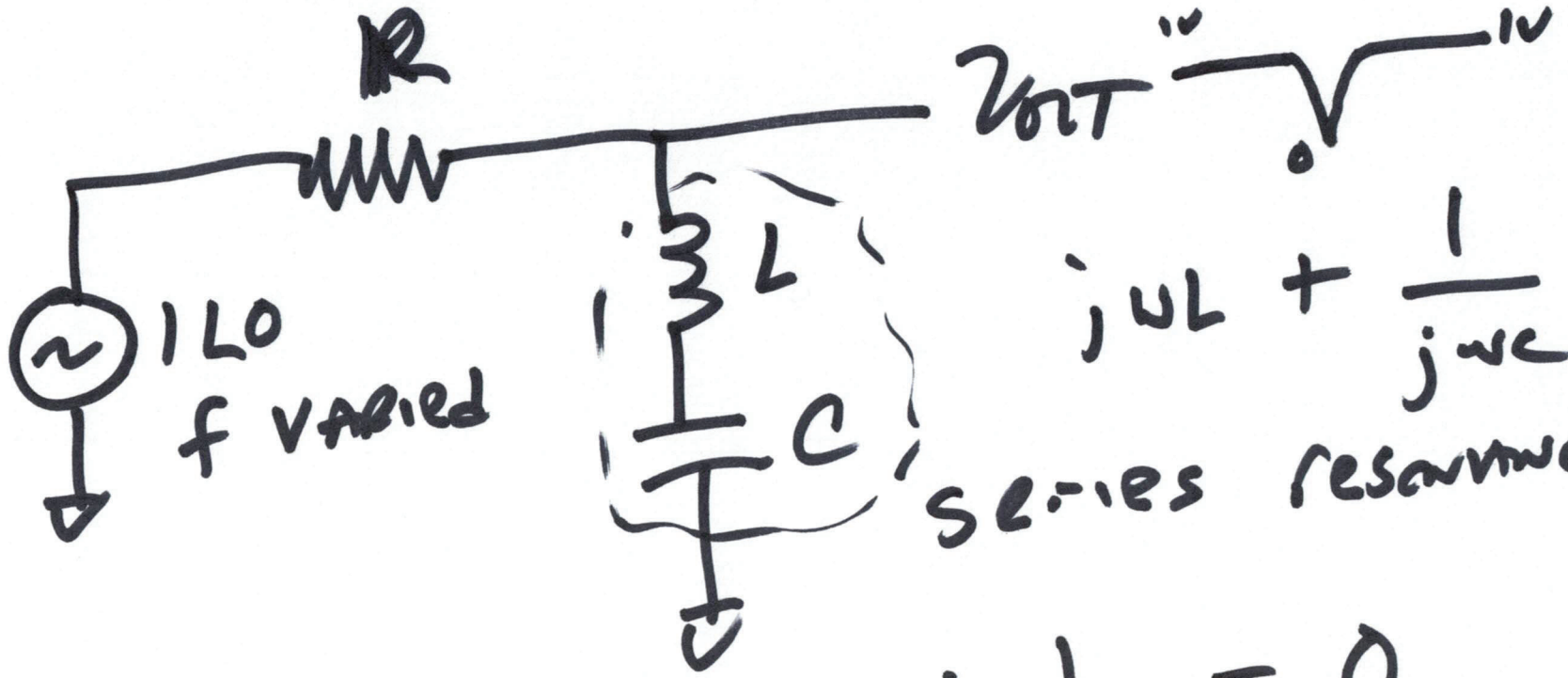
$$v_{in} = 3\sin(2\pi 10^3 t)$$

3)

$$\frac{t_d}{1\,ns} \cdot 360 = 80.2$$

$$t_d = 223\,ps$$





$$j\omega L + \frac{1}{j\omega C}$$

series resonance

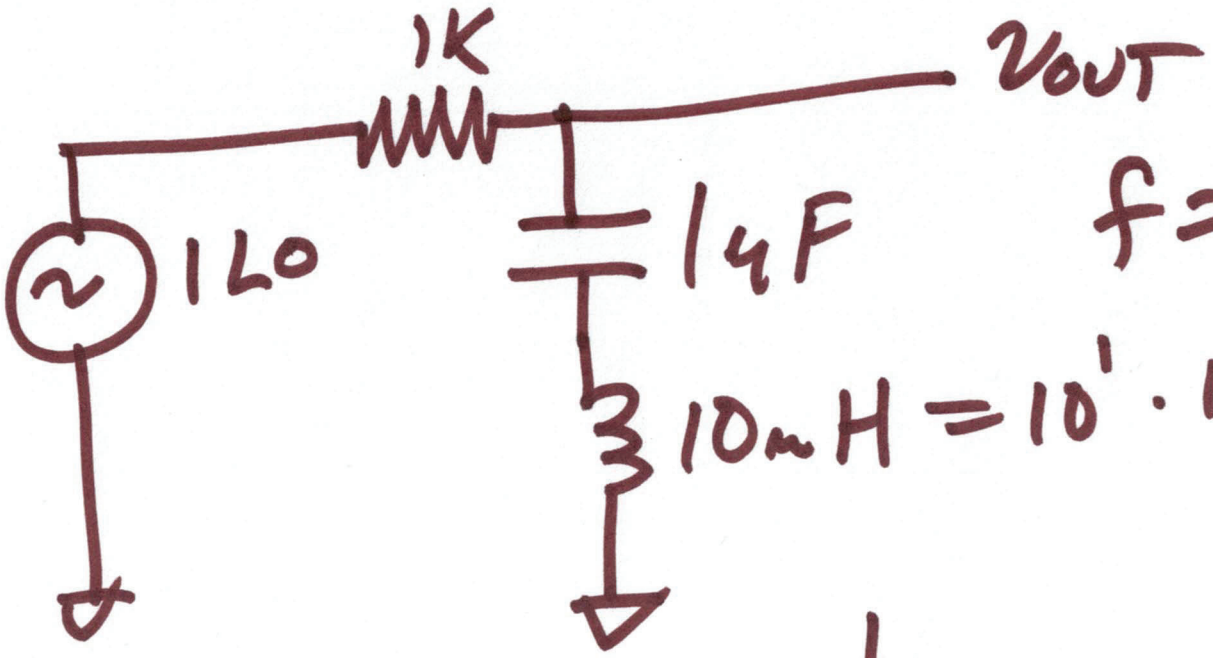
$$j\omega L - j\frac{1}{\omega C} = 0$$

$$f_{res} = \frac{1}{2\pi\sqrt{LC}}$$

$$\omega L = \frac{1}{\omega C}$$

$$\omega^2 = \frac{1}{LC}$$

$$\omega^2 = (2\pi f_{RES})^2 = \frac{1}{LC}$$



$f = ?$

$10mH = 10^{1} \cdot 10^{-3} = 10^{-2}$

$$f_{res} = \frac{1}{2\pi\sqrt{10^{-6} \cdot 10^{-2}}} = \frac{1}{2\pi\sqrt{10^{-8}}}$$

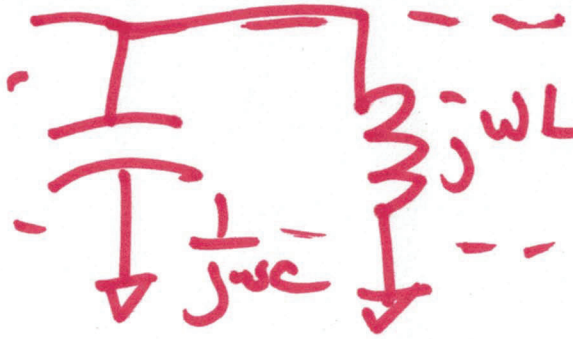
$f_{res} = 1592.4\ Hz$

$20 \log V$

$V = 1$

$20 \log 1 = 0\ dB$

$20 \log \frac{1}{10} = 20 \log 10^{-1} = -20\ dB$



parallel resonance

$$Z_{eq} = \frac{jwL \cdot \frac{1}{jwC}}{\left(\frac{1}{jwC} + jwL\right) \to 0} = \frac{\frac{L}{C}}{\frac{1}{jwC} + jwL}$$

$$f_{res} = \frac{1}{2\pi\sqrt{LC}}$$

$Z_{eq} \to \infty$