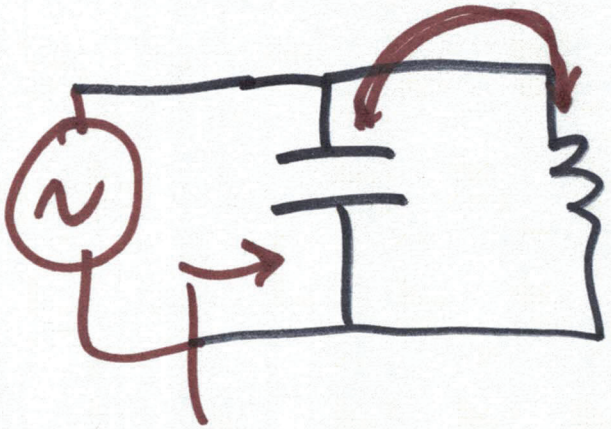
EE 221 CIRCUITS II

Lecture 21

April 12, 2023



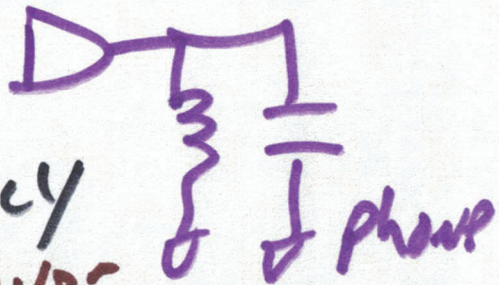
$Z|_{RES} = \infty$

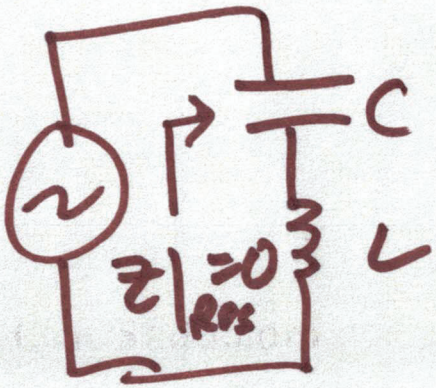
$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$j\omega L$

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

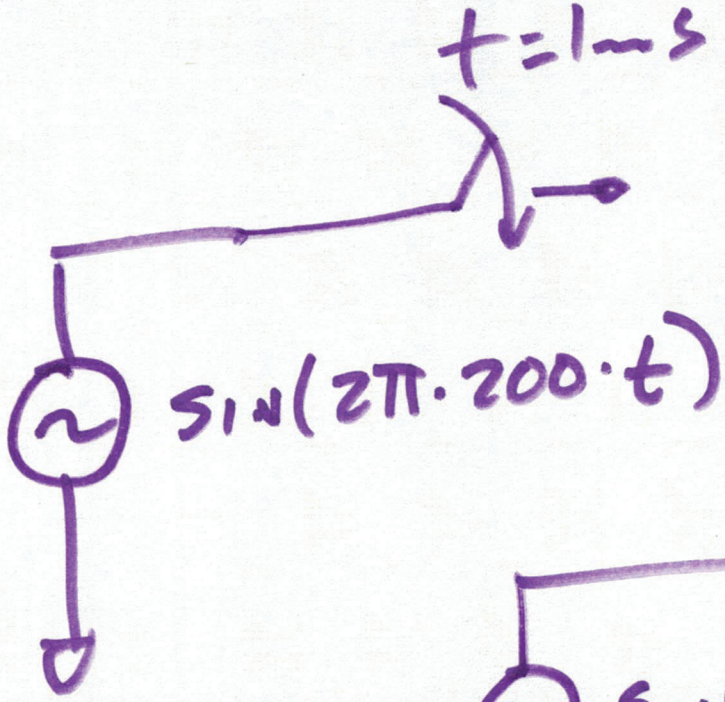
resonance frequency





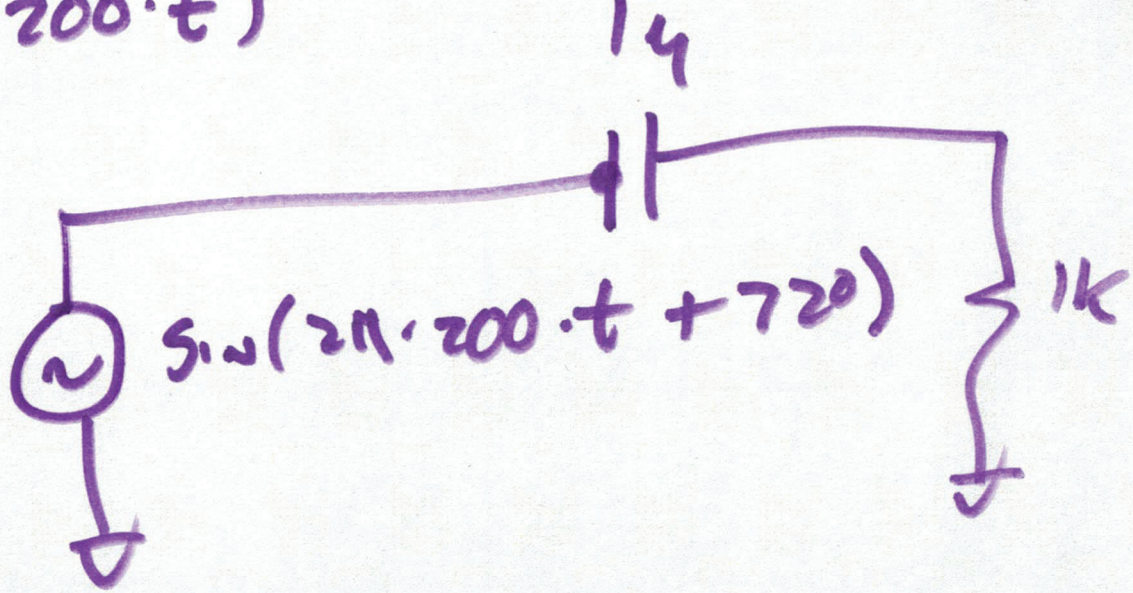
$$\frac{360}{5} = 72^\circ$$

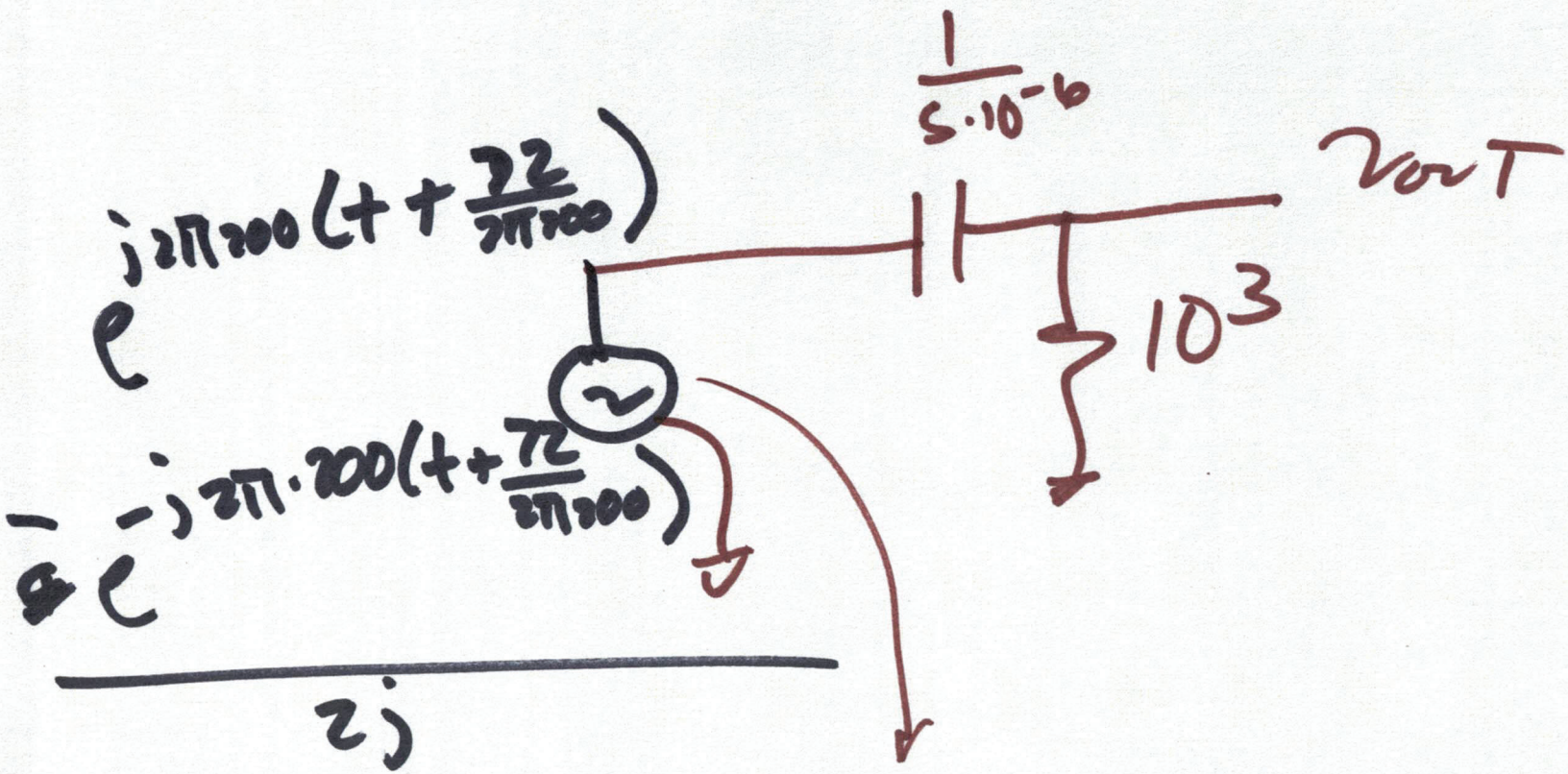
$$\sin X = \frac{e^{jX} - e^{-jX}}{2j}$$



$$e^{j(2\pi \cdot 200 \cdot t + 72)}$$

$$e^{j2\pi \cdot 200\left(t + \frac{72}{2\pi \cdot 200}\right)}$$




$\frac{1}{5\cdot10^{-6}}$
$j2\pi 200\left(t+\frac{72}{2\pi 200}\right)$
e
$-j2\pi\cdot200\left(t+\frac{72}{2\pi200}\right)$
$-e$
$2j$
10^3
V_{out}

$$\sin(2\pi \cdot 200 \cdot t + 72)$$

$$\sin x = \frac{e^{jx} - e^{-jx}}{2j}$$

$$\sin\left(2\pi \cdot 200\left(t + \frac{72}{2\pi \cdot 200}\right)\right)$$

$$\frac{e^{-j\left(2\pi \cdot 200\left(t + \frac{72}{2\pi \cdot 200}\right)\right)} - e^{-j\left(2\pi 200\left(t + \frac{72}{2\pi 200}\right)\right)}}{2j}$$

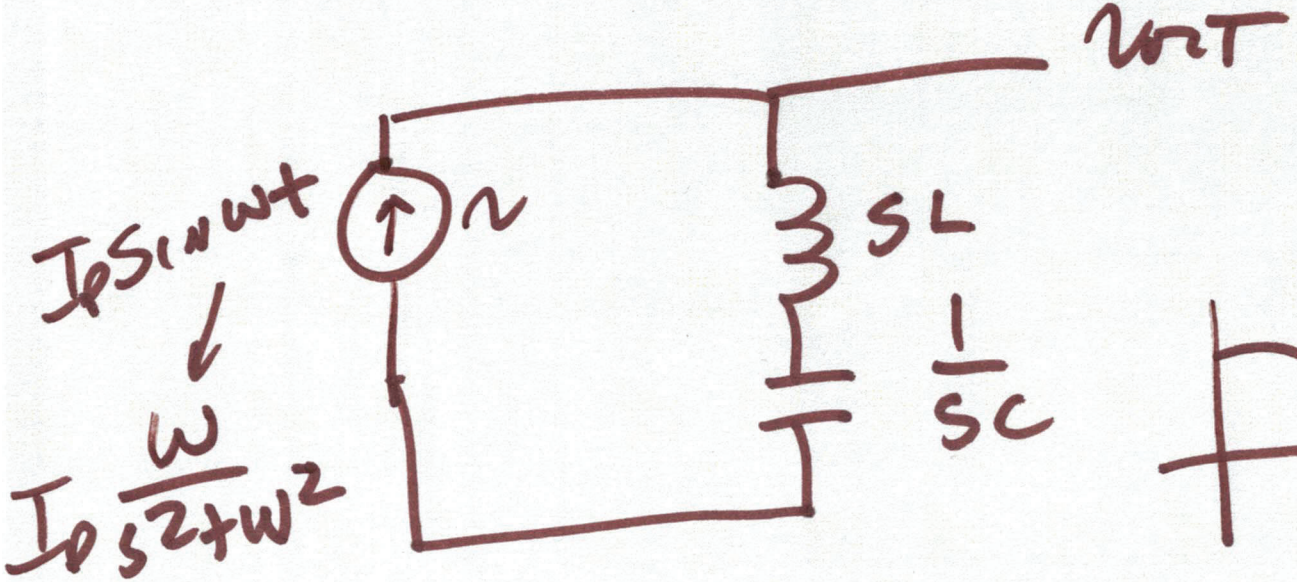
4)

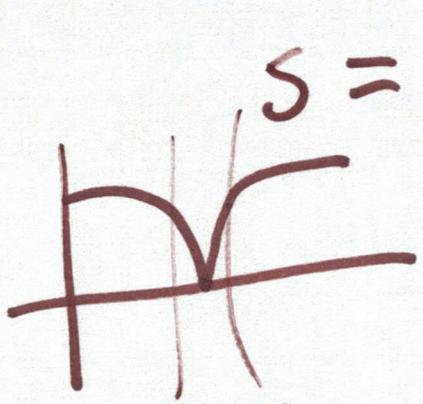
$$\mathcal{L}\{e^{-a(t-T)}\} = \frac{e^{-T\cdot s}}{s+a}$$

$$\frac{1}{2j}\left(\frac{e^{j\frac{72}{200\pi}\cdot s}}{s-j2\pi\cdot 200} - \frac{e^{-j\frac{72}{2\pi\cdot 200}\cdot s}}{s+j2\pi\cdot 200}\right)$$

$$\cdot \frac{10^3}{\frac{1}{s\cdot 10^{-6}} + 10^3} = V_0(s)$$

5)





$$v_{OUT}(s) = I_p \cdot \frac{\omega}{s^2+\omega^2} \cdot \left(sL + \frac{1}{sC}\right)$$

$$\frac{sL \cdot sC + 1}{sC} \qquad \omega^2 = \frac{1}{LC}$$

$$\frac{1}{\sqrt{LC}} = \omega|_{Res} \qquad v_{OUT} = 0$$

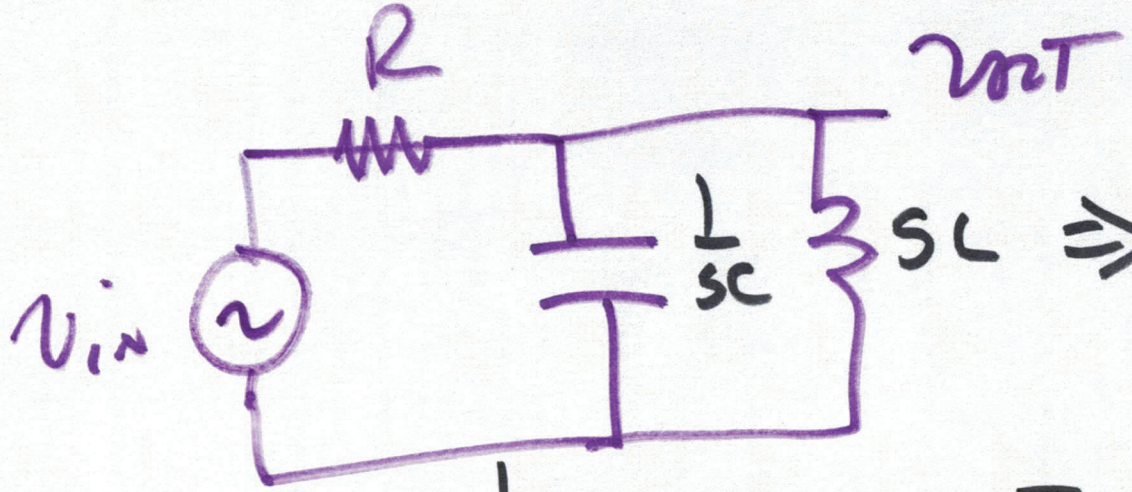
$$f_{Res} = \frac{1}{2\pi\sqrt{LC}}$$

$$\frac{s^2 LC + 1}{sC} = \frac{-\omega^2 LC + 1}{sC}$$

$$f = \frac{1}{2\pi\sqrt{LC}}$$

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

$$2\pi f = \omega = \frac{1}{\sqrt{LC}}$$



$$\Rightarrow \frac{sL \cdot \frac{1}{sC}}{sL + \frac{1}{sC}} = \frac{sL}{s^2LC + 1}$$

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

$$v_{out} = v_{in} \cdot \frac{\frac{sL}{s^2LC+1}}{\frac{sL}{s^2LC+1} + R} = v_{in} \cdot \frac{sL}{sL + R(s^2LC+1)}$$

$$j\omega = s = \sqrt{\frac{-1}{LC}} = j\frac{1}{\sqrt{LC}}$$

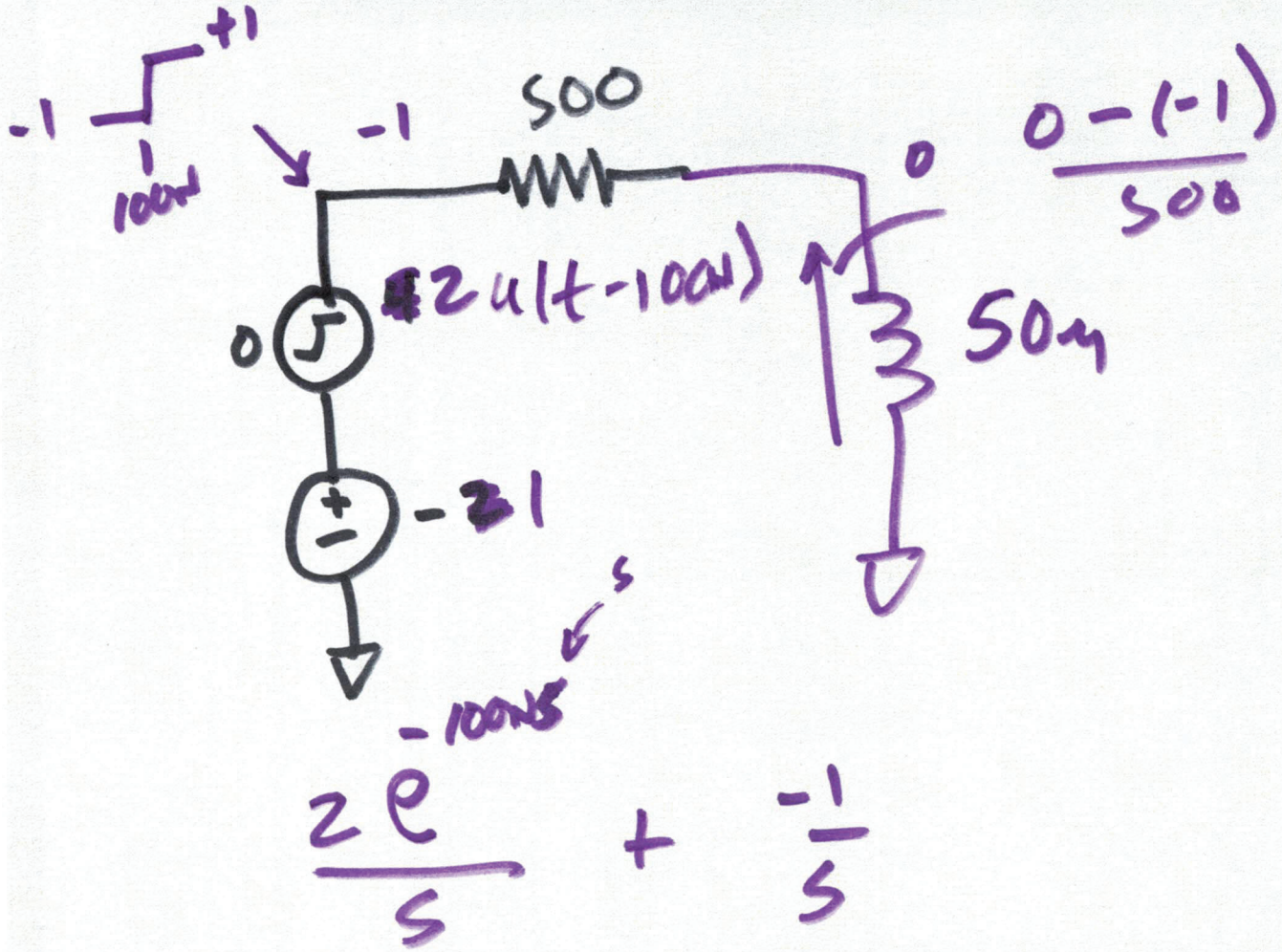
$$s^2LC + 1 = 0$$

$$s^2LC = -1$$

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

$$\omega_{Res} = \frac{1}{\sqrt{LC}}$$

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



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