EE 221 Circuits II

April 12, 2021

Lecture 20

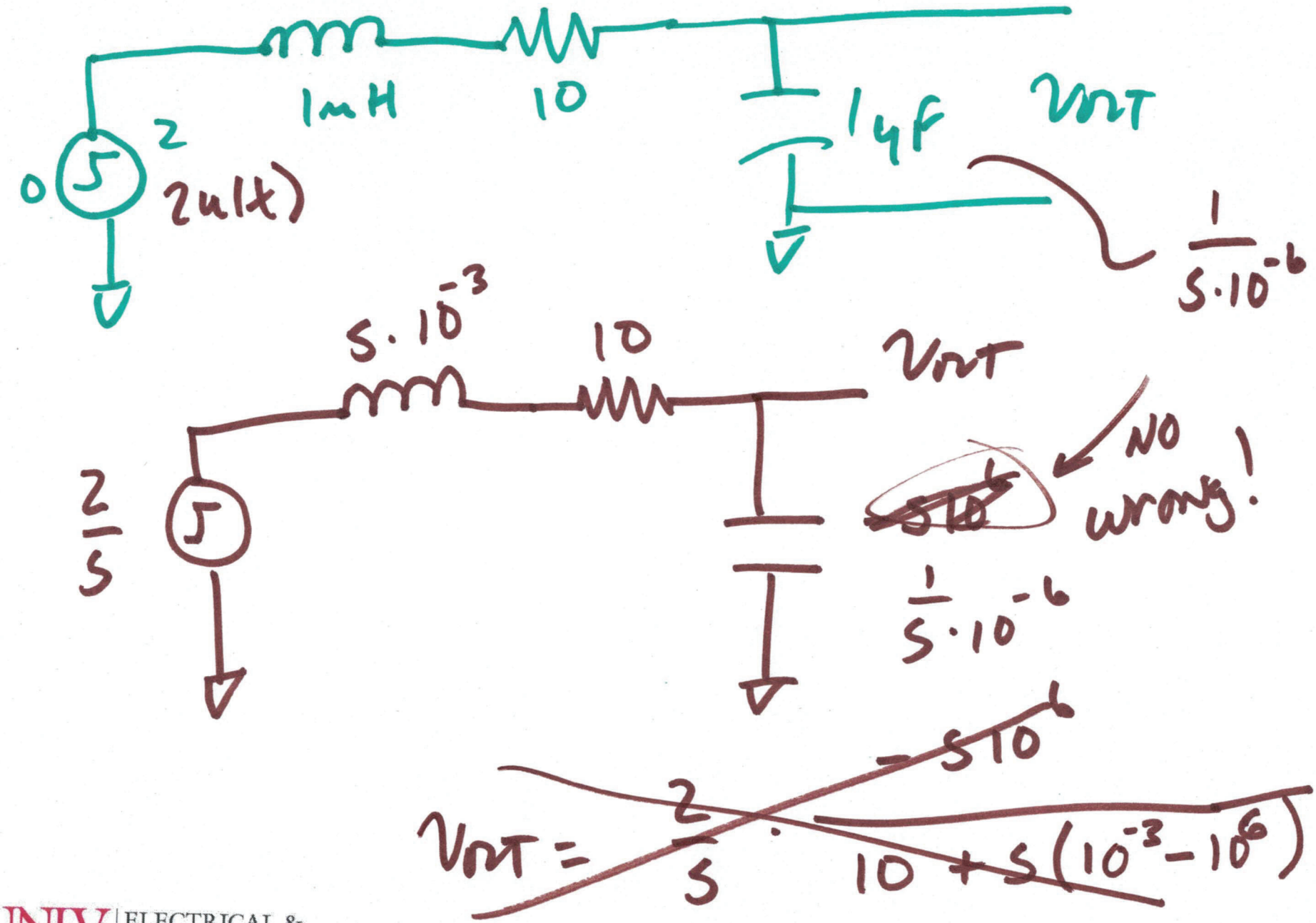
Problem solving

Tuesday

April 13

2:30 pm

TBE B-174


1mH
10
1μF
V_{OUT}
2u(t)
$\frac{1}{S \cdot 10^{-6}}$
$S \cdot 10^{-3}$
10
V_{OUT}
$\frac{2}{S}$
NO
wrong!
$\frac{1}{S \cdot 10^{-6}}$
$V_{OUT} = \frac{2}{S} \cdot \frac{S \cdot 10^{6}}{10 + S(10^{-3} - 10^{6})}$

$$V_{OUT}(s) = \frac{2}{s} \cdot \frac{\frac{1}{s \cdot 10^{-6}}}{\frac{1}{s \cdot 10^{-6}} + 10 + s \cdot 10^{-3}}$$

$$= \frac{2}{s} \cdot \frac{1}{1 + s \cdot 10^{-5} + s^2 10^{-9}}$$

$$s_{1,2} = \frac{-10^{-5} - \sqrt{-4 \cdot 10^{-9} \cdot 1 + (10^{-5})^2}}{2 \cdot 10^{-9}}$$

$$\rightarrow \frac{10^9}{s^2 + s \cdot 10^4 + 10^9}$$

$$s = \frac{-10^4 \pm \sqrt{(10^4)^2 - 4 \cdot 10^9}}{2}$$

$$V_{OUT}(s) = \frac{2}{s} \cdot \frac{10^9}{\frac{1}{2}\left(-10^4 \pm \sqrt{10^8 - 4 \cdot 10^9}\right)}$$

$$\frac{1}{2}\left(-10^4 \pm j\,62.5k\right)$$

$$V_{OUT}(s) = \frac{2}{s} \cdot \frac{10^9}{\left(s + \left(\frac{1}{2}(-10^4 + j62.5k)\right)\right) \cdot \left(s + \left(\frac{1}{2}(-10^4 - j62.5k)\right)\right)}$$

$$\frac{A}{s} + \frac{B}{s - \frac{1}{2}(-10^4 + j62.5k)} + \frac{C}{s - \frac{1}{2}(-10^4 - j62.5k)}$$

$$A = \frac{2 \cdot 10^9}{\frac{1}{2}(-10^4 + j62.5k)\left(\frac{1}{2}(-10^4 - j62.5k)\right)}$$

$$= \frac{2 \cdot 10^9}{\frac{-1}{4} - 10^8 - j10^4 \cdot 62.5k + j10^4 62.5k - (62.5k)^2}$$

$$A = \frac{2 \cdot 10^9}{-\frac{1}{4} - 10^8 - (62.5k)^2} = -\frac{1}{2}$$

$$B = \frac{2}{s} \cdot \frac{10^9}{s - \left(\frac{1}{2}(10^4 + j62.5k)\right)}$$

$$s = +\frac{1}{2}(-10^4 + j62.5k) - \frac{1}{2}(10^4 + j62.5k)$$

$$B = \frac{2}{s} \cdot \frac{10^9}{\frac{1}{2}(-10^4 + j62.5k) - \frac{1}{2}(10^4 + j62.5k)}$$

$$B = \frac{10^9}{-10^4} = -10^5 = B$$

6)

$$B = \frac{2}{\frac{1}{2}\left(-10^4 + j67.5k\right)} \cdot \frac{10^9}{-10^4}$$

$$= \frac{-4\ 10^5}{\frac{1}{2} \cdot \left(-10^4 + j67.5k\right)}$$

$$C = \frac{-4 \cdot 10^5}{\frac{1}{2}\left(-10^4 - j67.5k\right)}$$

$$A = -\frac{1}{2}$$

$$V_{out}(s) = \frac{-\frac{1}{2}}{s} + \frac{-4.10^5}{(-10^4 + j62.5k)\left(s - \frac{1}{2}(-10^4 + j62.5k\right.}$$

$$+ \frac{-4.10^5}{(-10^4 - j62.5k)\cdot s - \frac{1}{2}(10^{-4} + j62.5k}$$

$$= -\frac{1}{2}\cdot\frac{1}{s} + \frac{-4.10^5}{625.10^6\angle -81}\cdot\frac{1}{s - \frac{1}{2}(-10^4 + j62.5k)}$$

$$+ \frac{-4.10^5}{625.10^6\angle 81}\cdot\frac{1}{s - \frac{1}{2}(-10^4$$

$$V_{out}(s) = -\frac{1}{2}\cdot\frac{1}{s} + \frac{-6.4\times10^{-4}\angle 81}{s-\frac{1}{2}(-10^4+j67.5k)} + \frac{-6.4\times10^{-4}\angle -81}{s-\frac{1}{2}(-10^4-j67.5k)}$$

$$v_{out}(t) = -\frac{1}{2}u(t) - 6.4\times10^{-4}\left(e^{j81}\cdot e^{\frac{1}{2}(-10^4-j67.5k)} + e^{\frac{1}{2}(10^4+j67.5k)}\right)$$