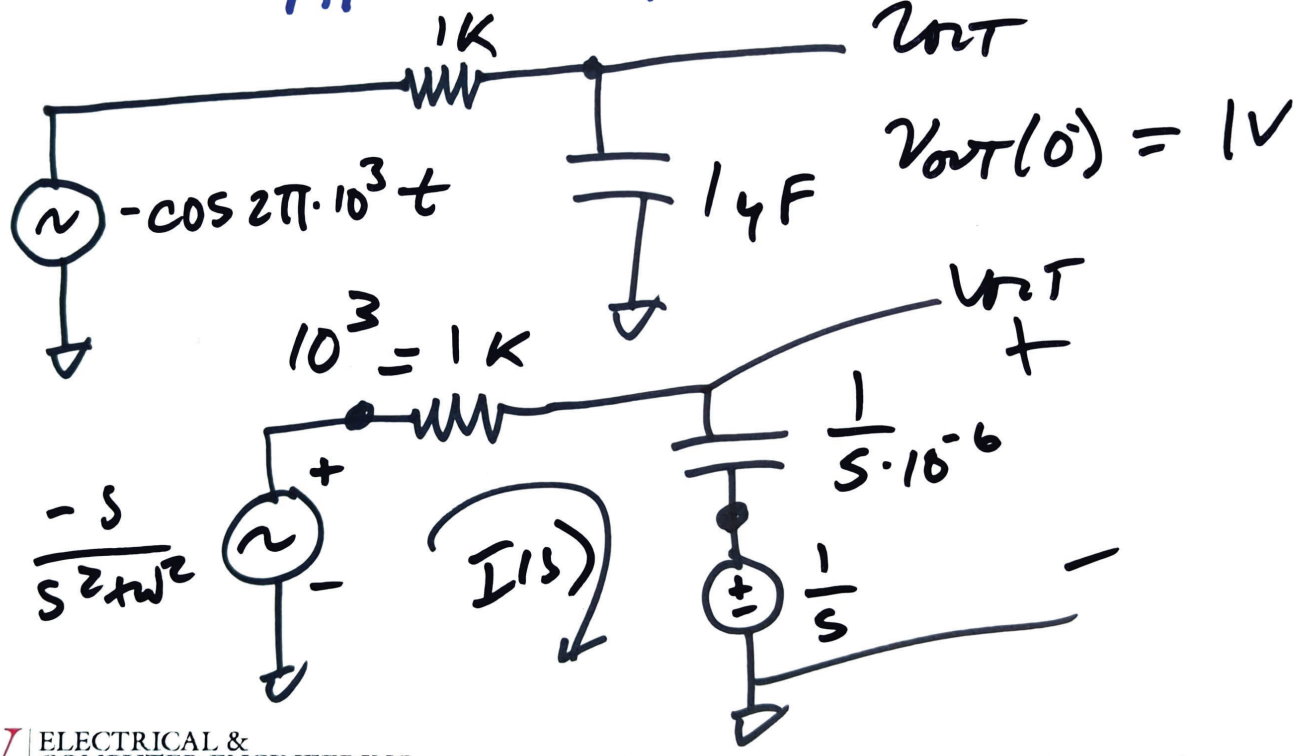
EE 221 Circuits II

Lecture 23

April 19, 2023



$$I(s) = \frac{\frac{-s}{s^2+w^2} - \frac{1}{s}}{10^3 + \frac{1}{s \cdot 10^{-6}}} \qquad w = 2\pi \cdot 10^3$$

$$= \frac{\left(-s - \frac{1}{s}(s^2+w^2)\right) s}{(s^2+w^2)\left(10^3 + \frac{1}{s \cdot 10^{-6}}\right) s}$$

$$= \frac{\left(-s^2 - (s^2+w^2)\right) \cdot 10^3}{(s+jw)(s-jw)\left(s \cdot 10^3 + \frac{1}{10^{-6}}\right) 10^{-3}}$$

$$= \frac{-10^{-3}\left(s^2 + (s^2+w^2)\right)}{(s+jw)(s-jw)\left(s + \frac{1}{10^{-3}}\right)}$$

$$I(s) = -10^{-3} \cdot \frac{(2s^2 + w^2)}{(s+jw)(s-jw)(s+\frac{1}{10^{-3}})}$$

$$\frac{A}{s+jw} + \frac{B}{s-jw} + \frac{C}{s+\frac{1}{10^{-3}}}$$

$$A = \frac{-10^{-3} \cdot (2(-jw)^2 + w^2)}{(-jw-jw)(-jw+\frac{1}{10^{-3}})} \quad \begin{cases} j^2(-w)^2 \\ -w^2 \end{cases}$$

$$= \frac{-10^{-3}(-2w^2 + w^2)}{-2jw(-jw+\frac{1}{10^{-3}})}$$

3)

$$= \frac{-10^{-3}(-\omega^2)}{-2\omega^2 + \frac{-2j\omega}{10^{-3}}}$$

$$= \frac{-10^{-3}(-\omega^2)}{-2\omega^2 - \frac{2j\omega}{10^{-3}}}$$

$$= \frac{10^{-3}\cdot(2\pi\cdot 10^3)^2}{-2(2\pi\cdot 10^3)^2 - \frac{2j2\pi\cdot 10^3}{10^{-3}}}$$

$$= \frac{(2\pi)^2\cdot 10^3}{-2(2\pi)^2\cdot 10^6 - j\,2\cdot 2\pi\cdot 10^6}$$

4)

$$= \frac{(2\pi)^2 \cdot 10^{-3}/(2\pi)^2}{\frac{-2(2\pi)^2}{(2\pi)^2} - \frac{j \cdot 2 \cdot 2\pi}{(2\pi)^2}}$$

$$= \frac{10^{-3}}{-2 - j2/2\pi}$$

$$= -\frac{1}{2}\left(\frac{10^{-3}}{1 + j/2\pi}\right)$$

$a + jb \rightarrow \sqrt{a^2+b^2} \angle \tan^{-1}\frac{b}{a}$

$1e^{j\theta} = \cos\theta + j\sin\theta$ $\qquad \sqrt{a^2+b^2}\, e^{j\tan^{-1}\frac{b}{a}}$

5)

$$= \frac{-10^{-3}}{2}\left(\frac{1}{1+\frac{1}{j2\pi}}\right)$$

$$= -\frac{10^{-3}}{2}\cdot\frac{1}{\sqrt{1^2+\left(\frac{1}{2\pi}\right)^2}}\, e^{-j\cdot\tan^{-1}\frac{1}{2\pi}}$$

$$\angle\frac{1}{a+jb} = -\tan^{-1}\frac{b}{a} \Rightarrow e^{-j\tan^{-1}\frac{b}{a}}$$

$$\theta = .16^\circ \simeq 0$$

$$\frac{10^{-3}}{.078} = -78.6$$

$$A = -\frac{78.6}{540\Omega}\, e^{-j.16}$$

$$B = -\frac{78.6}{540\Omega}\, e^{j..16}$$

$$\frac{\sqrt{49+144}}{\sqrt{324+36}} = \frac{13.9}{18.97} = .73$$

↖ from book

$$\mathcal{L}\{I(s)\} \Rightarrow A \cdot e^{-\frac{1}{2}\omega t} + B\, e^{-\frac{1}{10.3}t} + C\, e^{-j.16}$$

$$A = -540_m\, e^{-j(\omega t + \theta)} + 540\, e^{j(\omega t + \theta)}$$

12.70b

3)