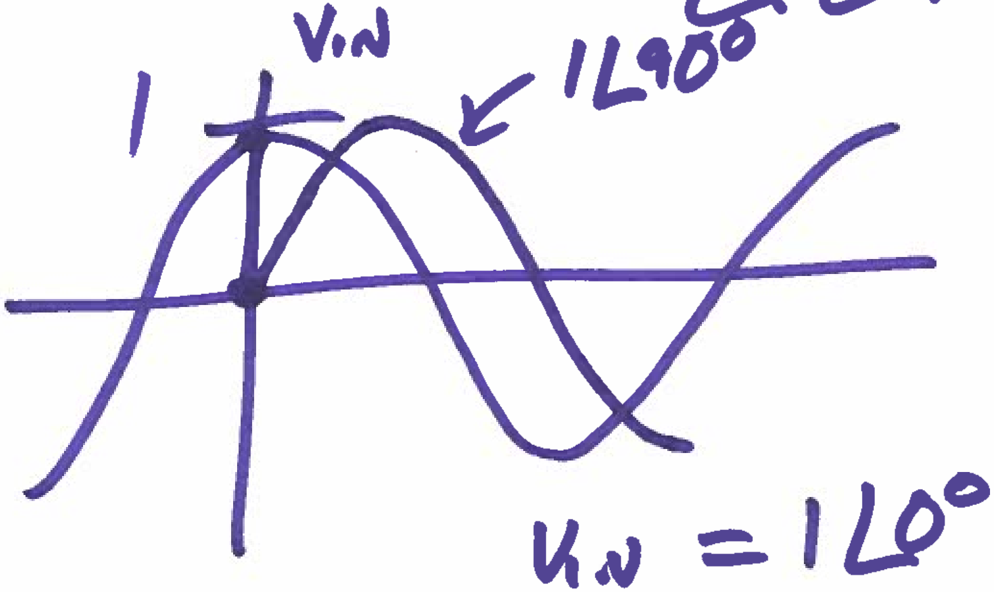
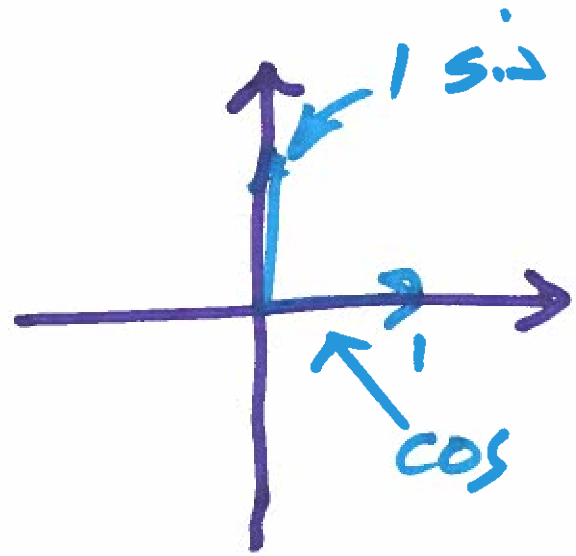
EE 220 Circuits 1

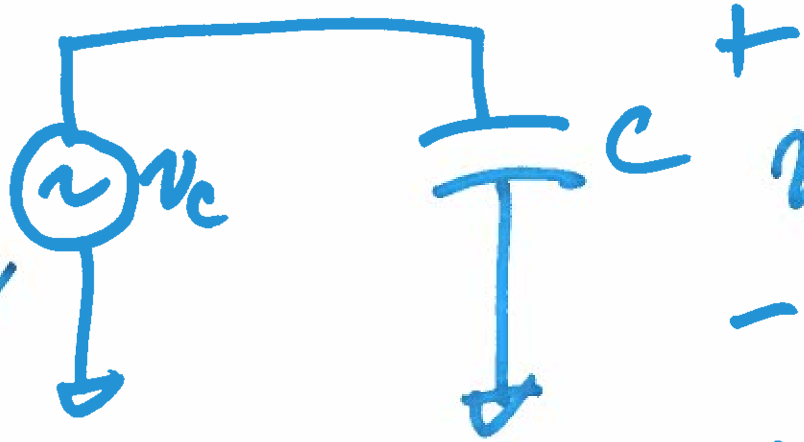
Nov. 18, 2019

Lecture 22





$$i_c(t) = C \cdot \frac{d\, v_c(t)}{dt} = C \cdot 2\pi f \cdot V_p \sin($$



$\sin(2\pi f t)$

$V_p \cdot \cos(2\pi f \cdot t)$

$V_p \angle 0°$

$$i_c(t) = 2\pi f \cdot C \cdot -V_p \sin$$

$w = 2\pi f$

omega

$$i_c = wC \cdot -V_p \sin(2\pi f t)$$

$$\frac{i_c}{wC} = -V_p \sin(2\pi f \cdot t)$$

$$= -V_p \overset{\cos}{\cancel{\sin}}(2\pi f \cdot t + 90^\circ)$$

$$\frac{i_c}{wC} = -V_p \cos(2\pi f \cdot t + 90^\circ)$$

$$\frac{1}{j} \cdot \frac{j}{j} = -j \qquad = V_p \angle -90^\circ$$

$$V_p \angle 0^\circ = \frac{i_c}{wC} \angle -90^\circ = i_c \cdot \frac{1}{jwC}$$

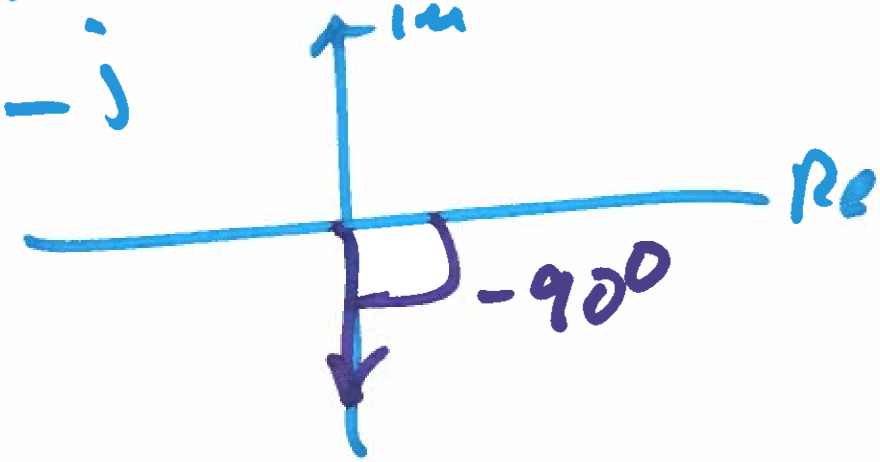
impedance of a cap

$$\boxed{Z_C = \frac{1}{j\omega C}} = \frac{1}{\omega C}\angle -90$$

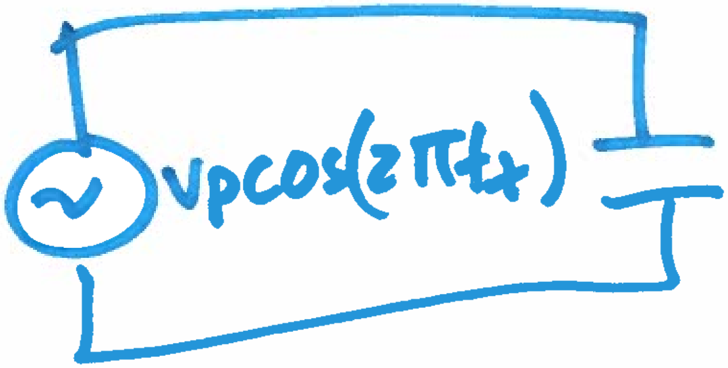
impedance of a inductor

$$\boxed{Z_L = j\omega L}$$

$$\frac{1}{j}\cdot\frac{j}{j} = -j$$



$$i_c = C \cdot \frac{dv_c}{dt}$$



$$v_c = V_p \cos(2\pi f \cdot t)$$

$$i_c = C \cdot 2\pi f \cdot (-V_p) \sin(2\pi f \cdot t)$$

$$= C \cdot w \cancel{-} V_p \cdot \cos(2\pi f t + 90)$$

odd

$-f(x) = f(-x)$

even

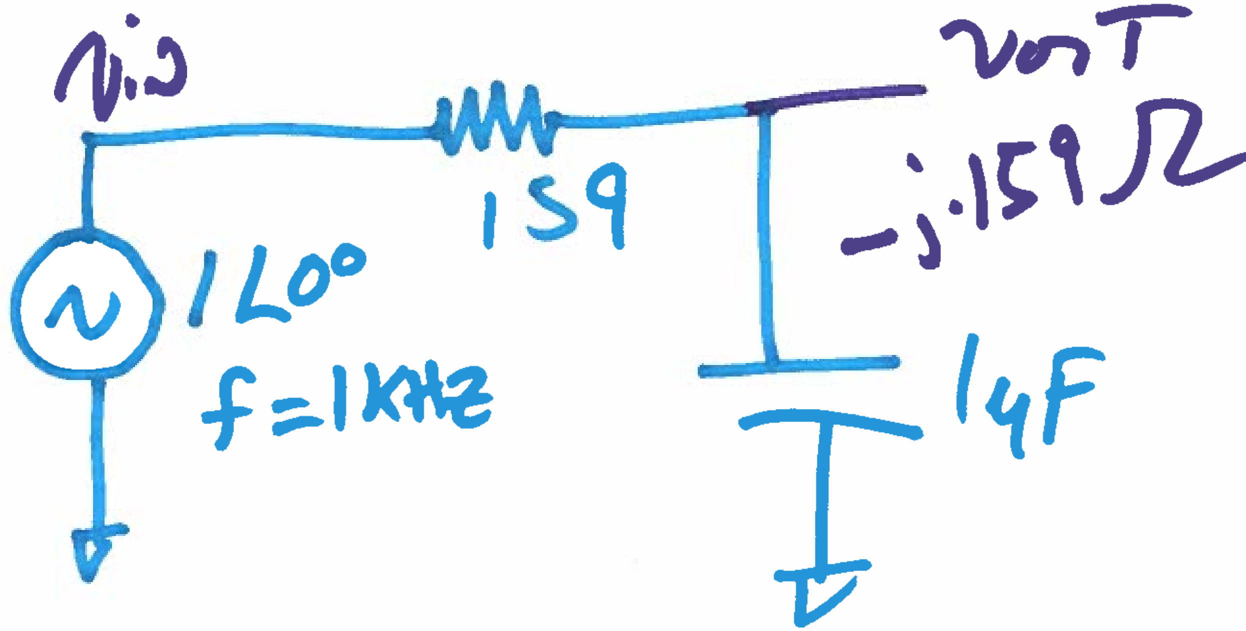
$f(x) = f(-x)$

$$i_c = C \cdot w \cdot V_p \angle 90 \cdot 1 \angle 180$$

$$A\angle\theta_1 \cdot B\angle\theta_2 = AB\angle\theta_1+\theta_2$$

$$-j = \frac{1}{j}$$

$$V_p\angle 0 = i_c \angle 0 \cdot \frac{1}{jwC}$$



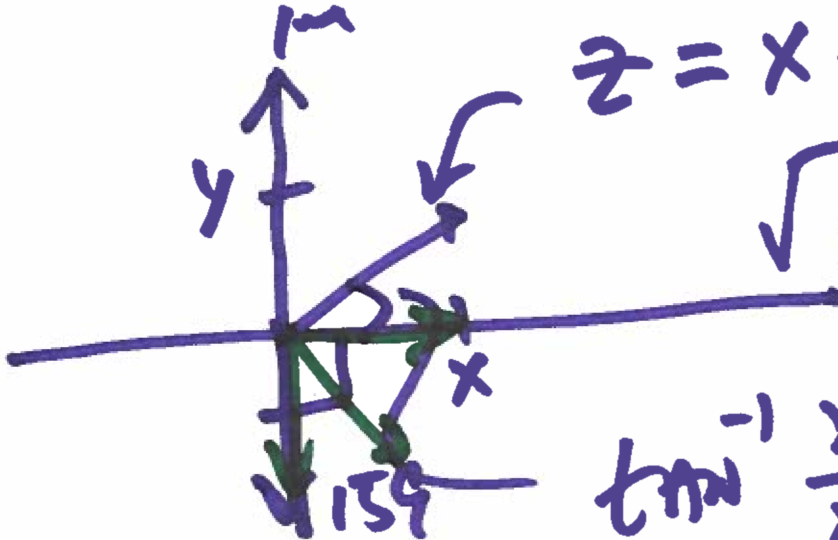
$$Z_C = \frac{1}{j\cdot 2\pi\cdot 10^{3}\cdot 10^{-6}} = \frac{159}{j} = -j159$$

Reactance impedance

$$v_{OUT} = v_{in}\cdot\frac{-j159}{-j159+159}$$

$$V_{OUT} = 1\angle 0^\circ \cdot \frac{0 + j(-159)}{159 + j(-159)}$$

$\tan^{-1}\frac{-159}{0}$



$z = x + jy$

$\sqrt{x^2+y^2} = M$

$\tan^{-1}\frac{y}{x} = \theta$

$M\angle\theta$

$-\tan^{-1}\infty$

$= -90^\circ$

$$V_{OUT} = \frac{1\angle 0^\circ \cdot \cancel{159}\angle -90^\circ}{\sqrt{2}\cdot\cancel{159}\angle -45^\circ}$$

$\sqrt{(159)^2+(159)^2}$

$\sqrt{2\cdot(159)^2}$

224.85

$$\theta = \frac{t_d}{T} \cdot 360$$

$$\frac{A\angle\theta_1 \cdot B\angle\theta_2}{C\angle\theta_3} = \frac{AB}{C}\angle\theta_1+\theta_2-\theta_3$$

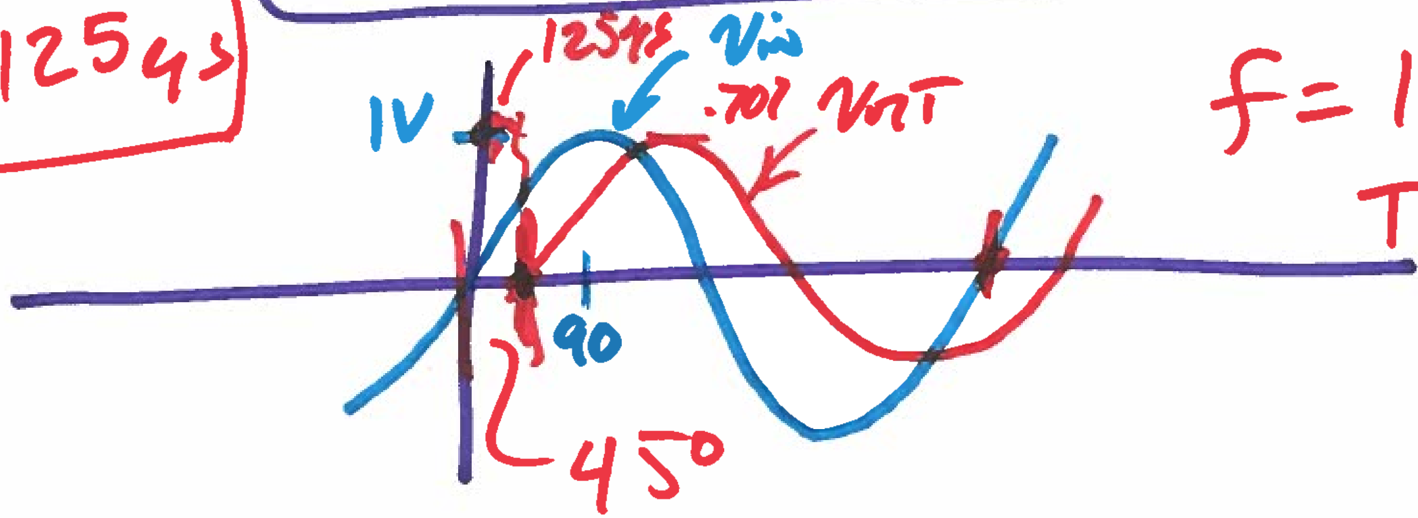
$$45 = \frac{t_d}{1ms} \cdot 360$$

$$V_{OUT} = .707\angle{-45^\circ}$$

$$\frac{1}{8} \cdot 1ms = t_d$$

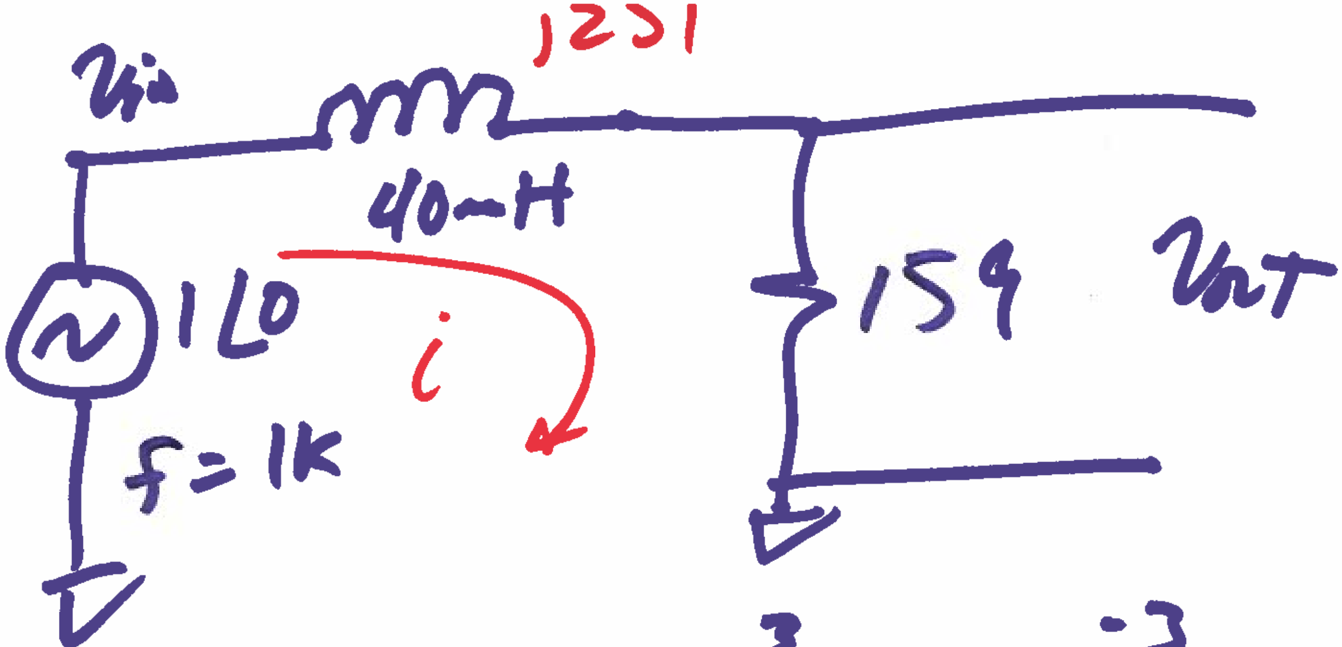
$$\boxed{V_{OUT} = 0.707\cos(2\pi \cdot 10^3 \cdot t - 45^\circ)}$$

$$\boxed{t_d = 125\mu s}$$



$f = 1KHz$

$T = 1ms$



$$Z_L = j\omega L = j \cdot 2\pi \cdot 10^{3} \cdot 40 \cdot 10^{-3}$$

$$= j \cdot 251$$

$$i = \frac{1\angle 0}{159 + j \cdot 251} = \frac{1\angle 0}{\sqrt{(159)^2 + (251)^2}\ \angle \tan^{-1}\frac{251}{159}}$$

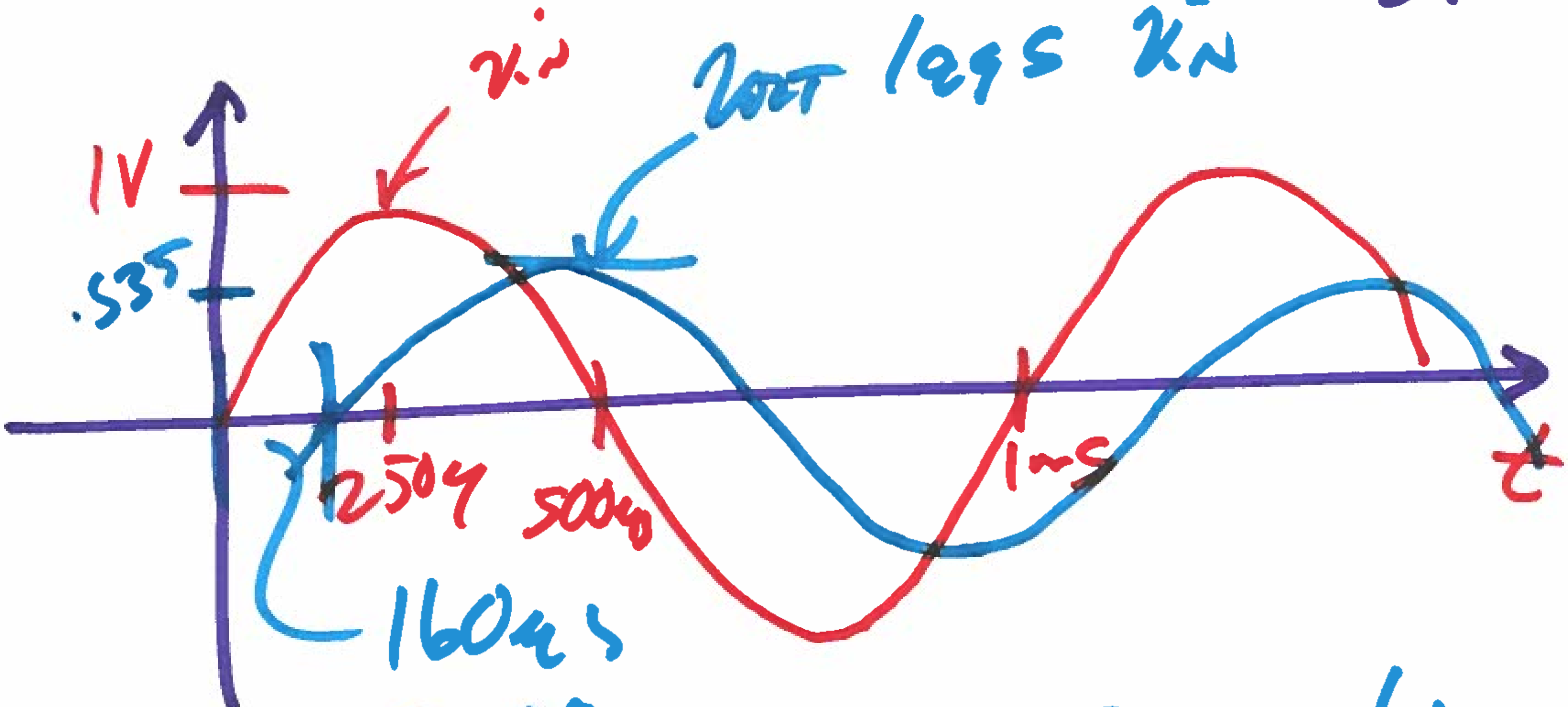
$$v_{NT} = 1\angle 0 \cdot \frac{159 + j0}{159 + j251} = 159 \cdot i$$

$$= \frac{1\angle 0 \cdot 159\angle 0}{297\angle 57.6^\circ} = .535\angle -57.6^\circ$$

$$\sqrt{(159)^2 + (251)^2}$$

$$\tan^{-1}\frac{251}{159} =$$

$$v_{OUT}(t) = 535\,\text{mV} \cdot \sin(2\pi \cdot 10^3 \cdot t - 57.6°)$$



$= 57.6°$

$$\theta = 57.6 = 360 \cdot \frac{t_d}{1\,\text{ms}}$$

$$\boxed{t_d = 160\,\mu\text{s}}$$