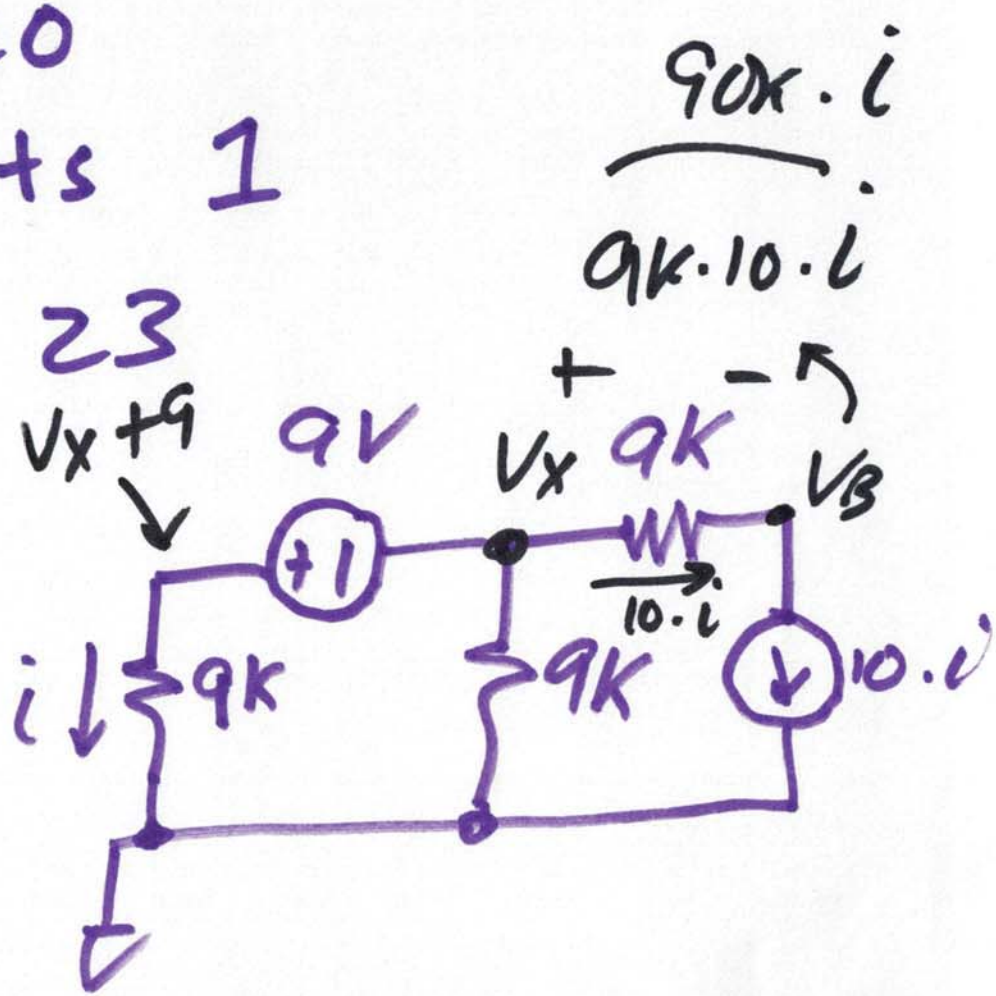
EE 220
circuits 1
Lecture 23



$$i = \frac{Vx + 9}{9K}$$

$$V_B = V_x - 90K \cdot i$$

$$i + \frac{V_x}{9K} + 10i = 0$$

$$V_B = V_x - 10V_x - 90 = \frac{-99}{12} + \frac{990}{12} - 90$$

$$\frac{V_x + 9}{9K} + \frac{V_x}{9K} + \frac{10(V_x + 9)}{9K} = 0$$

$$12V_x = -99 \qquad V_x = \frac{-99}{12}$$

Phasor $\Rightarrow M \angle\theta$ (polar)

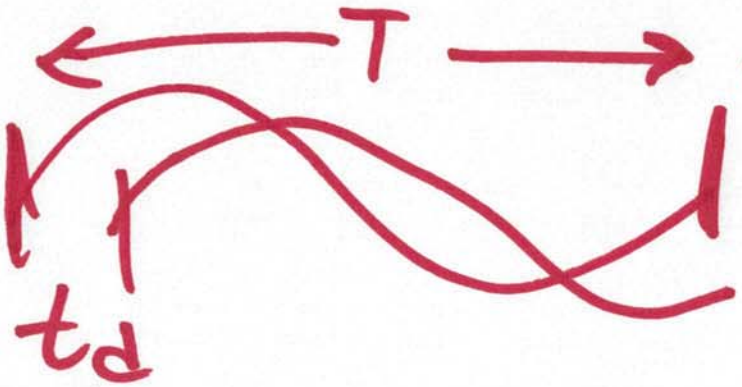
$x|_{Re} = M\cos\theta$

$y|_{Im} = M\sin\theta$

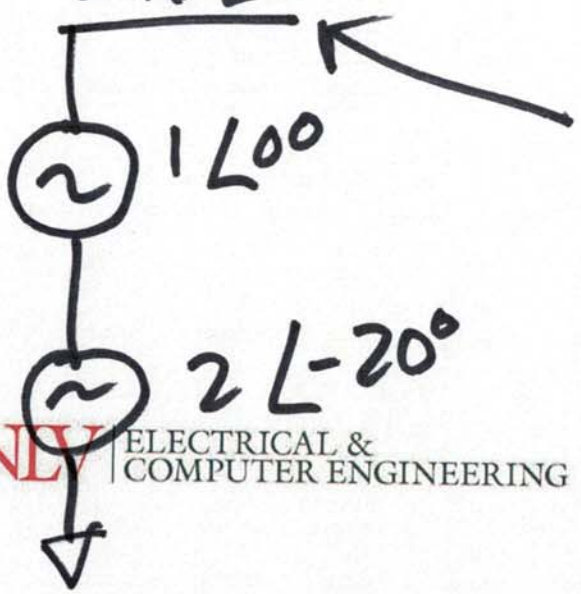
$x + jy$ (Rect)

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

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



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

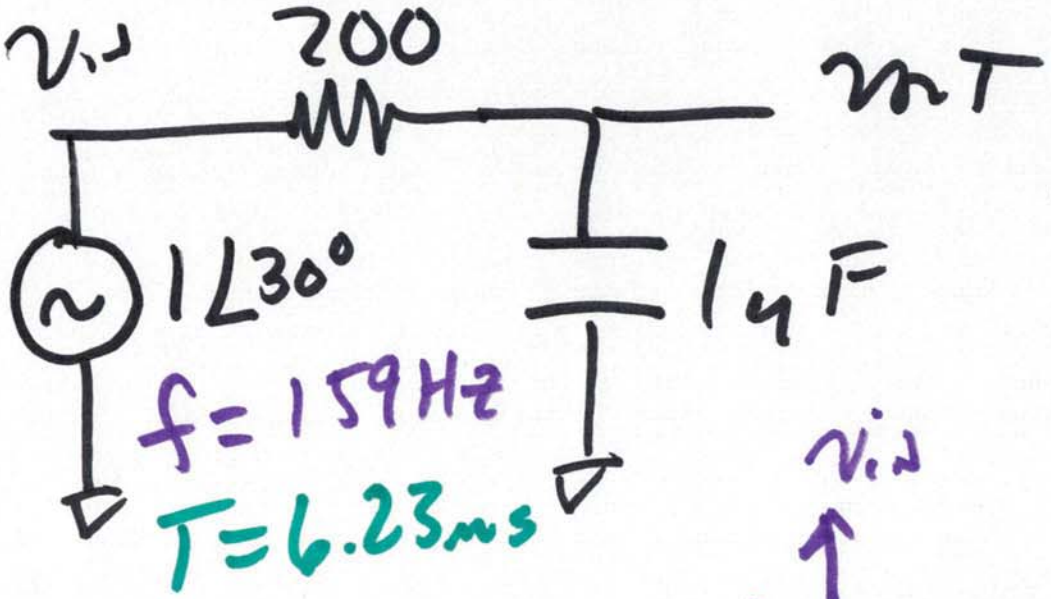


$1\angle 0° + 2\angle -20°$

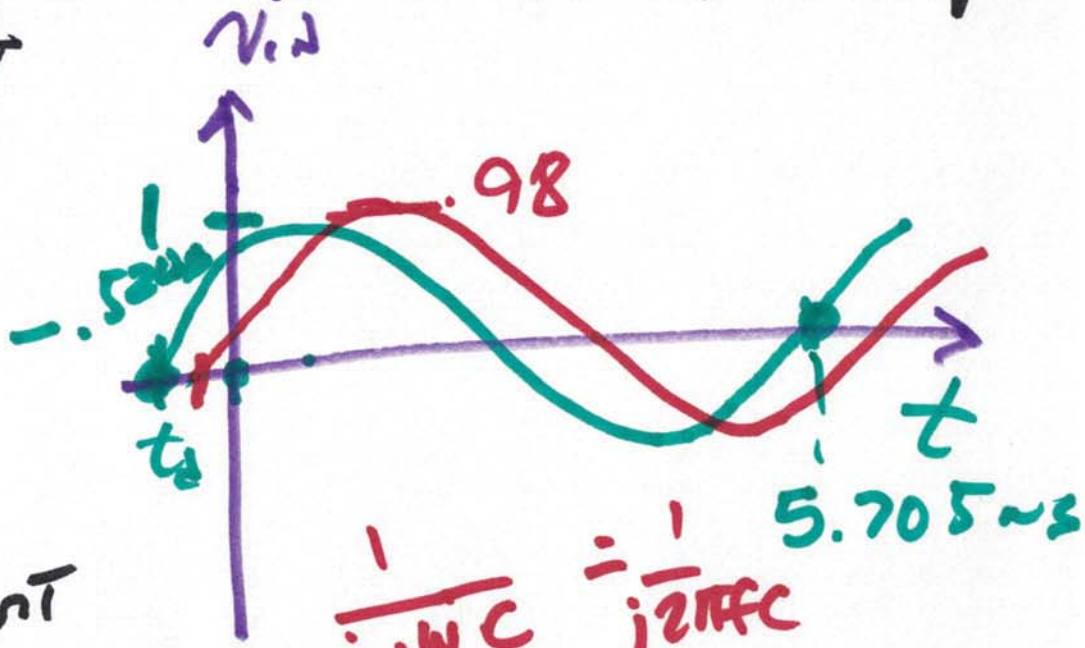
$2\cdot\cos(-20) \quad 2\cdot\sin(-20)$

$1 + j0 + 1.88 + j(-.68)$

$2.88 + j(-.68)$

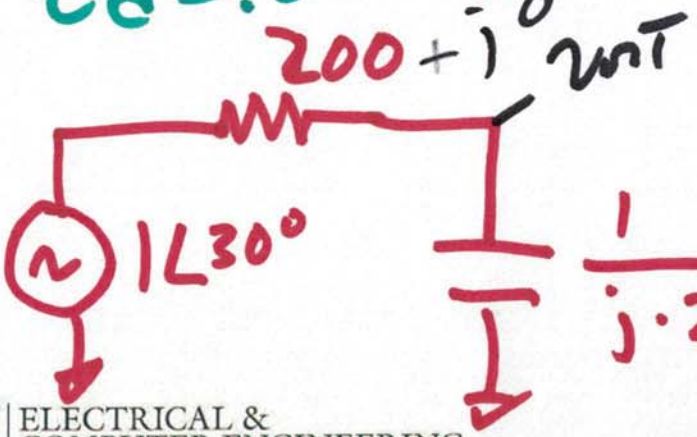


Sketch v_{out} & v_{in} on same plot



$$30^\circ = \frac{t_d}{6.23\,ms} \cdot 360$$

$t_d = .524\,ms$



$$\frac{1}{j\cdot\omega C} = \frac{1}{j2\pi fC}$$

$$= \frac{1}{j\cdot 2\pi\cdot 159\cdot 10^{-6}} = -j10^{3} + 0$$

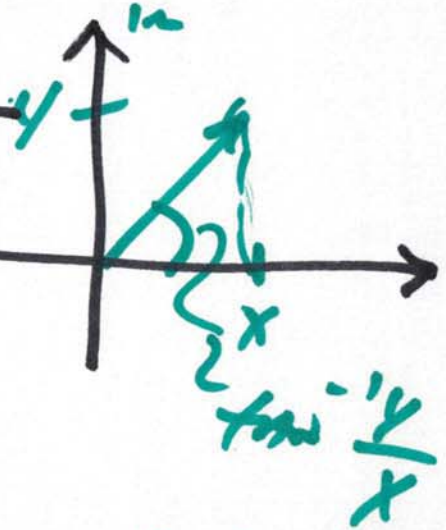
$\tan^{-1}\frac{-10^3}{0}$ $V_{OT} = 1\angle 30^\circ \cdot \frac{0 - j\cdot 10^3}{-j\cdot 10^3 + 200}$

$= -\tan^{-1}\frac{10^3}{0}$ $0 + j(-10^3) = 10^3\angle -90^\circ$

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

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

$V_{OT} = \frac{1\angle 30^\circ \cdot 10^3\angle -90^\circ}{1019\angle -78.7^\circ}$



$\sqrt{200^2 + 10^3{}^2} = 1019$

$\angle \tan^{-1}\frac{-10^3}{200} = -78.7^\circ$

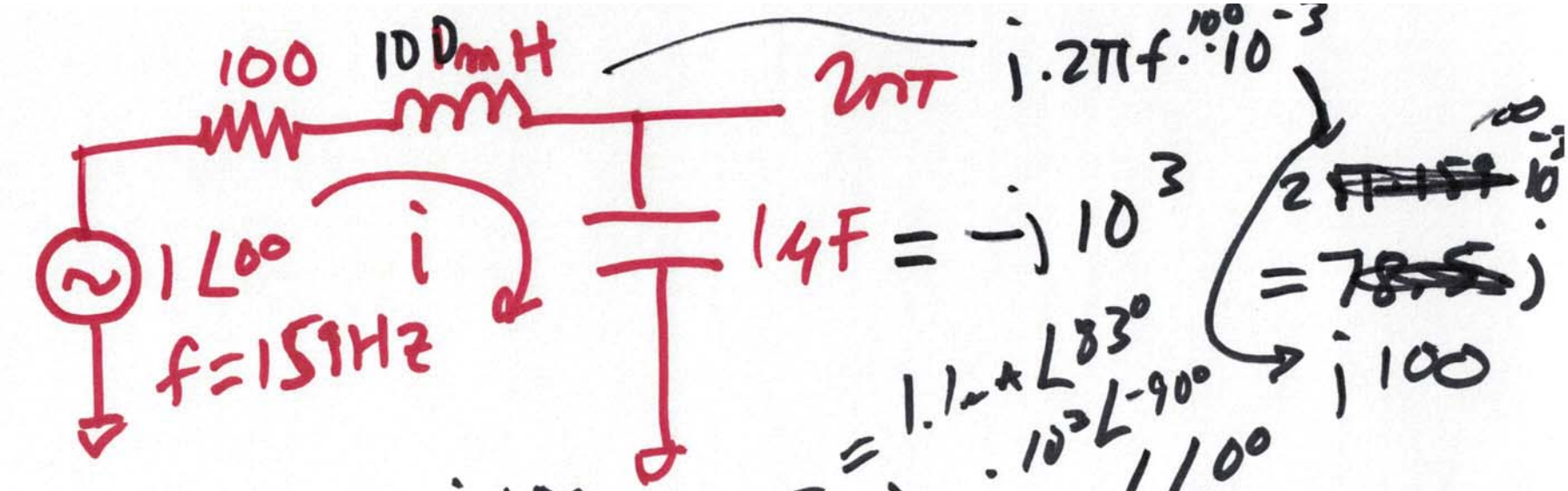
$V_{OT} = \frac{1\cdot 10^3\angle 18.7}{1019}$

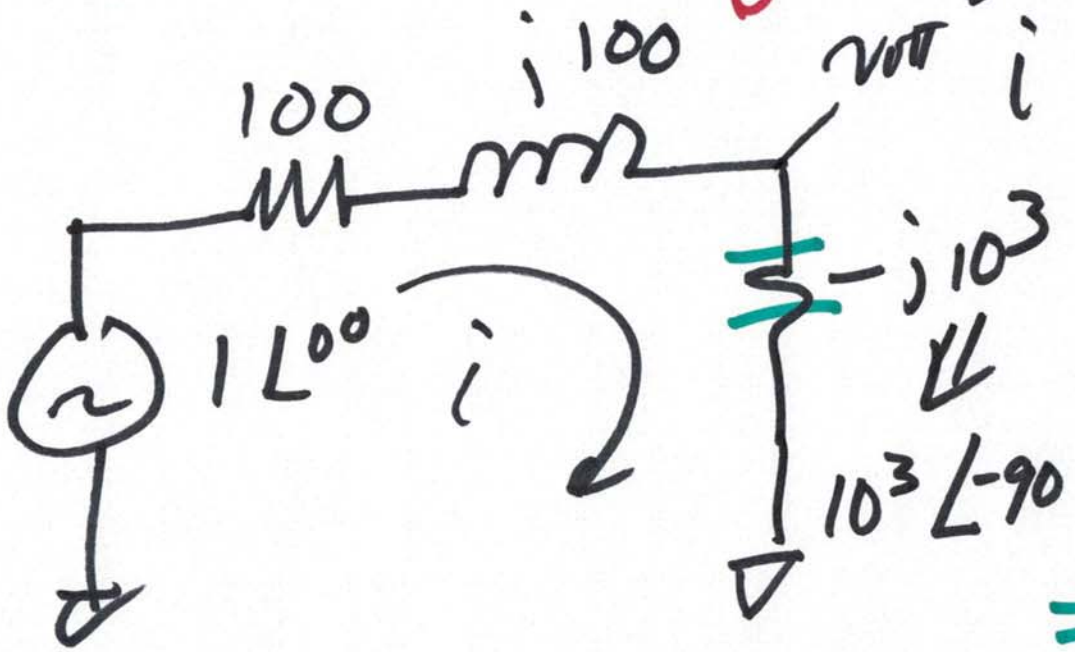
$\frac{A\angle\theta_1 \cdot B \cdot \angle\theta_2}{C\angle\theta_3} = \frac{A\cdot B\angle\theta_1+\theta_2}{C\angle\theta_3}$

$= .98\angle 18.7^\circ$

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

4)





$$2\pi f = 1.1\text{m} \angle 83^\circ$$

$$i = \frac{1\angle 0^\circ}{100 + j100 + j(-10^3)}$$

$$= \frac{1\angle 0^\circ}{100 + j(-900)}$$

$$= \frac{1\angle 0^\circ}{905\angle -83^\circ}$$

$$i = 1.1\text{mA}\angle 83^\circ$$