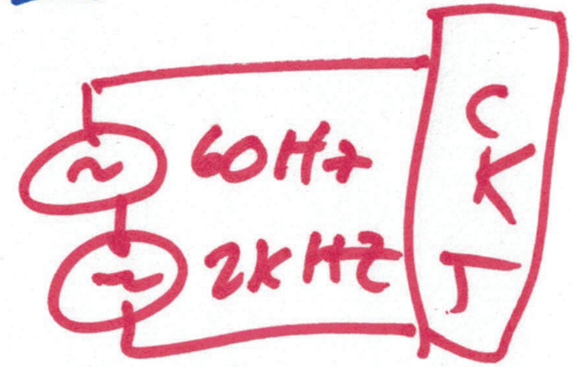
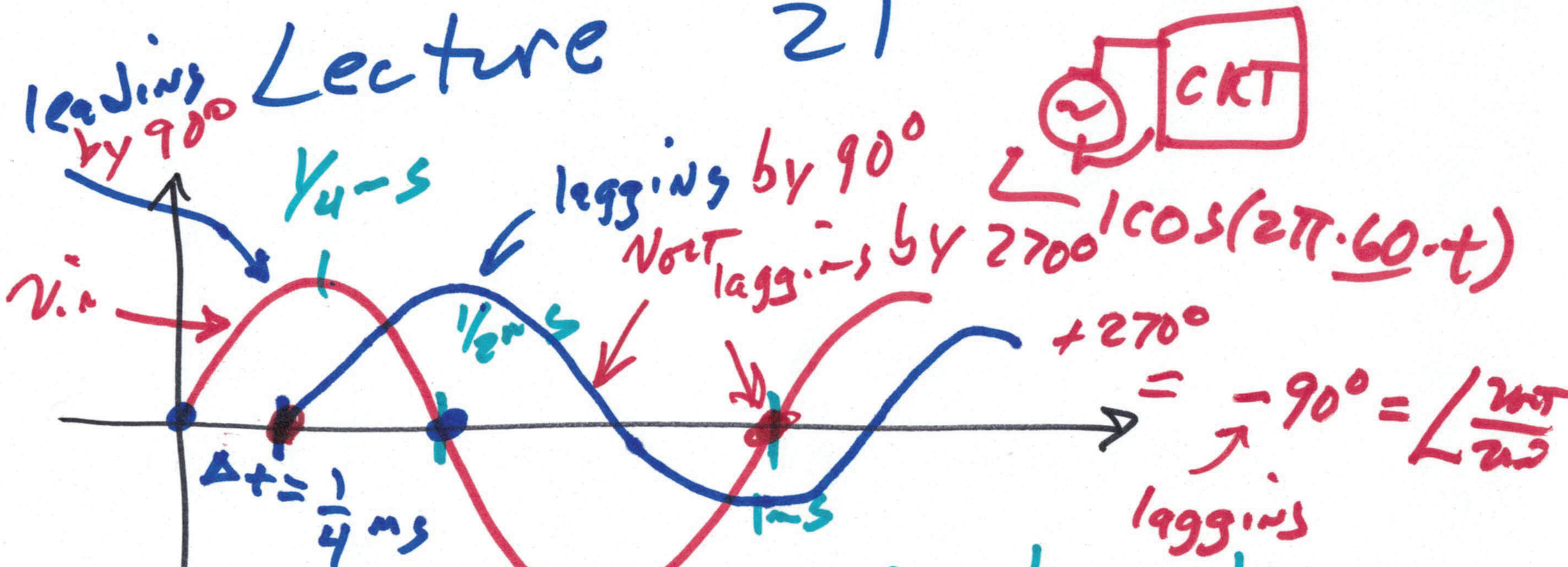
EE 220 Circuits 1

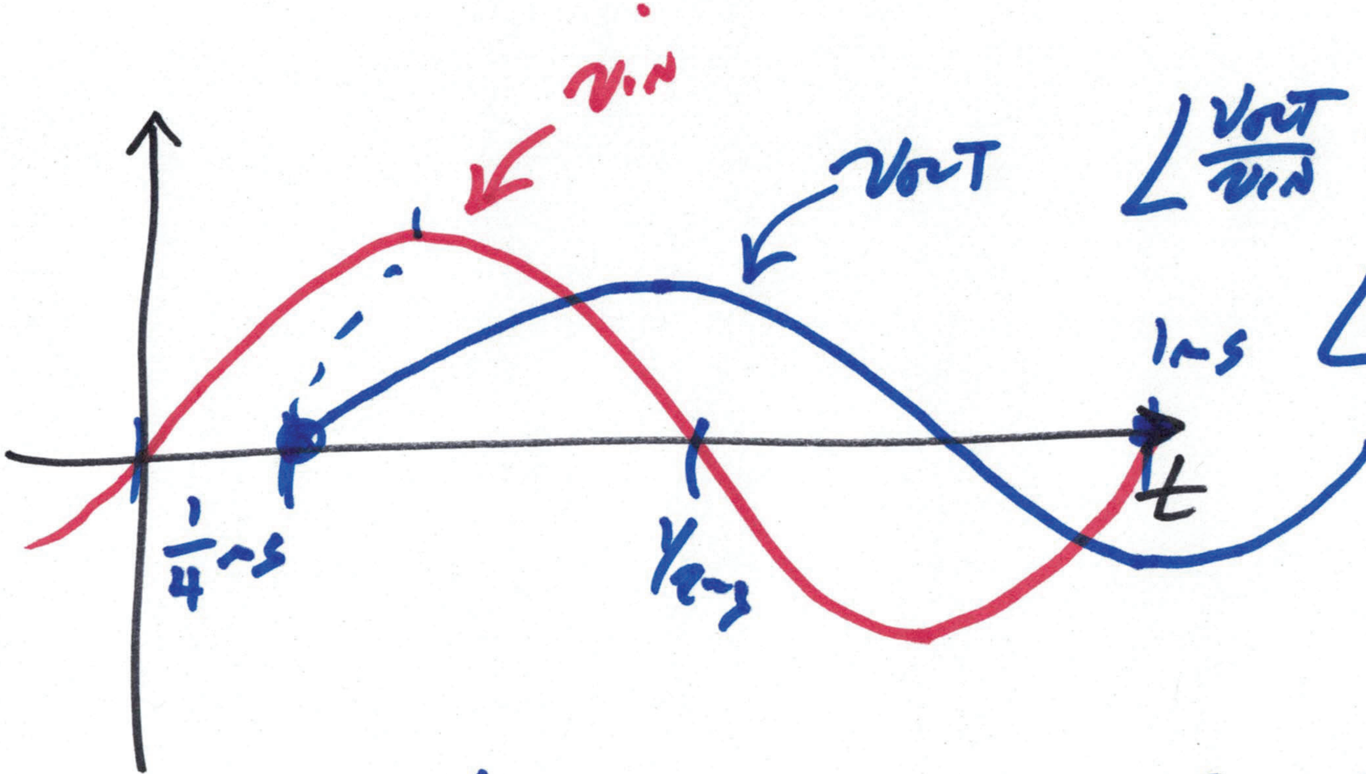
Nov. 9, 2020

Lecture 21





$$f = \frac{1}{1ms} = 1kHz$$



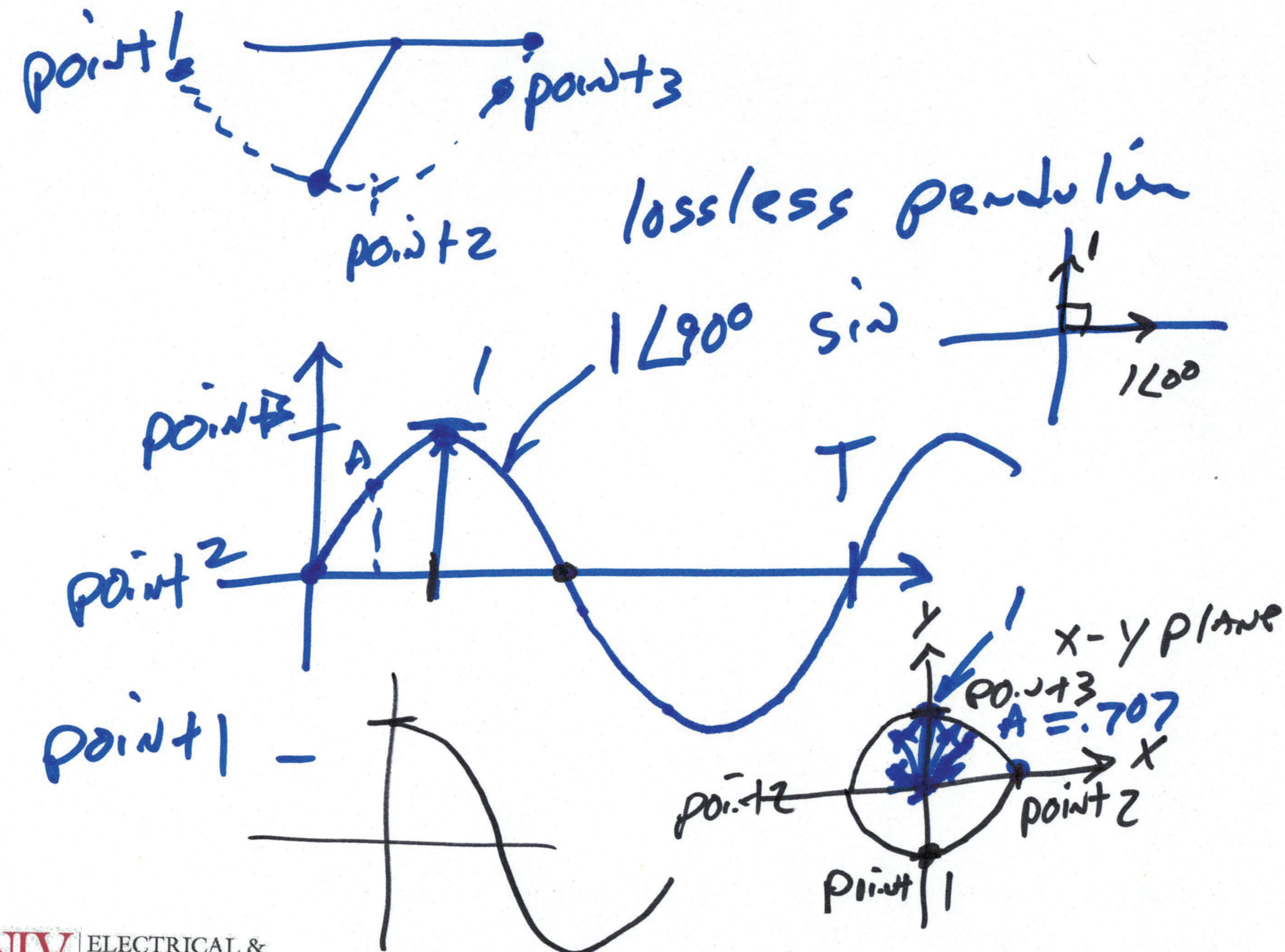
$$\angle \frac{v_{OUT}}{v_{IN}} = -90^\circ$$

$$\angle \frac{v_{OUT}}{v_{IN}} = +270^\circ$$

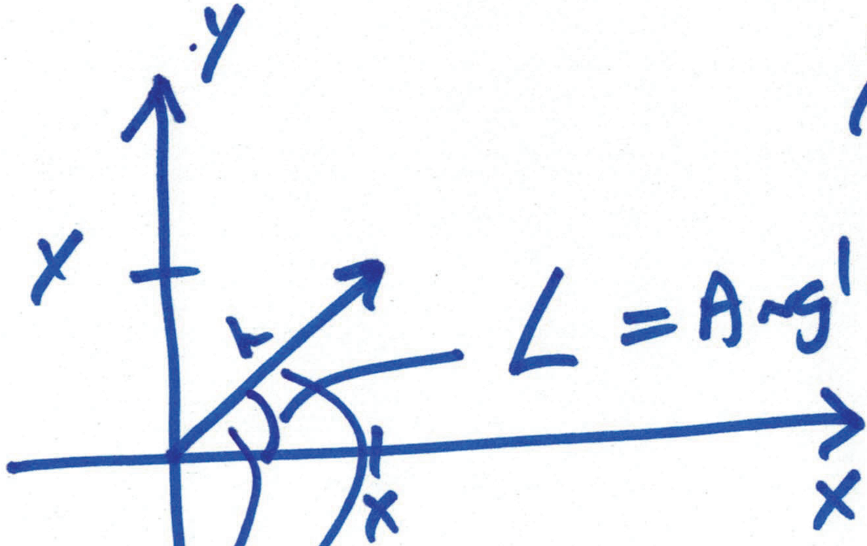
$$\theta = \frac{t_d}{T} \cdot 360 = t_d \cdot f \cdot 360$$

$$= \frac{\frac{1}{4}\,ns}{1\,ns} \cdot 360 = 90^\circ$$

$$\infty$$



point1
point3
point2
lossless pendulim
1∠90° sin
1∠0°
1
point3
A
T
point2
point1
y
x
1
x-y plane
point3
A = .707
point2
point2
point1



$i = \sqrt{-1} = j$

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

Magnitude = $| \; |$ = $\sqrt{x^2+y^2}$

$\cos\theta = \frac{\text{Adjeient}}{\text{hypotenues}} = \frac{y}{h}$

~~cos~~ $\sin\theta = \frac{\text{opposite}}{h} = \frac{x}{h}$

$\frac{\cos\theta}{\sin\theta} = \frac{y}{x} = \tan\theta$

$$s_{IQ}(t) = A_I \cos 2\pi f \cdot t + A_Q \sin 2\pi f \cdot t$$

$$= \sqrt{A_I^2 + A_Q^2} \cdot \cos\left(2\pi f_0 \cdot t + \tan^{-1}\frac{A_Q}{A_I}\right)$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

$$\cos k = 1 - \frac{k^2}{2!} + \frac{k^4}{4!} - \frac{k^6}{6!}$$

$$j \sin k = k - \frac{k^3}{3!} + \frac{k^5}{5!} - \frac{k^7}{7!}$$

$$e^{K} = \cos K + j \sin K = 1 + jK - \frac{K^2}{2!} + j\frac{K^3}{3!}$$

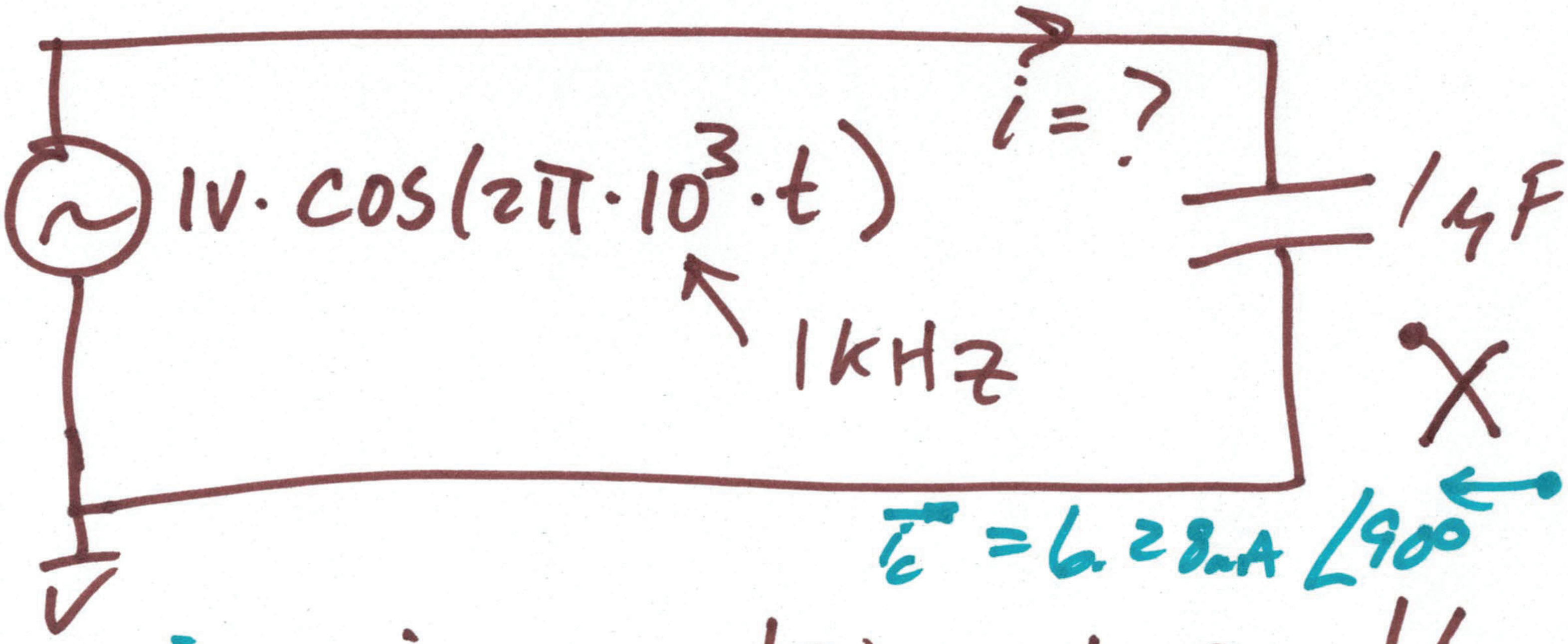
$$e^{jK} = 1 + jK - \frac{K^2}{2!} - j\frac{K^3}{3!} + \frac{K^4}{4!} + \cdots$$

$$\boxed{e^{jK} = \cos K + j \sin K}$$

Euler's

In-phase ($\cos K$)

Quadrature-phase ($\sin K$)



$$v_c = Z_c \cdot i_c$$

$$i_c = \frac{1}{C \cdot 2\pi f} \cdot v_c$$

$$i_c = C \cdot \frac{dv}{dt} = 1\mu f \cdot \frac{d(\cos 2\pi 1k \cdot t)}{dt}$$

$$i_c = 10^{-6} \cdot \sin(2\pi \cdot 1k \cdot t) \cdot (2\pi \cdot 1k) \quad (1k \to 10^3)$$

$$= 6.28\,mA \cdot \sin(2\pi \cdot 1k \cdot t)$$

$$\frac{10}{C}$$

$$Z_c = \frac{1}{C \cdot 2\pi f} = \frac{1}{\omega C} = Z$$

$$\omega = 2\pi f$$