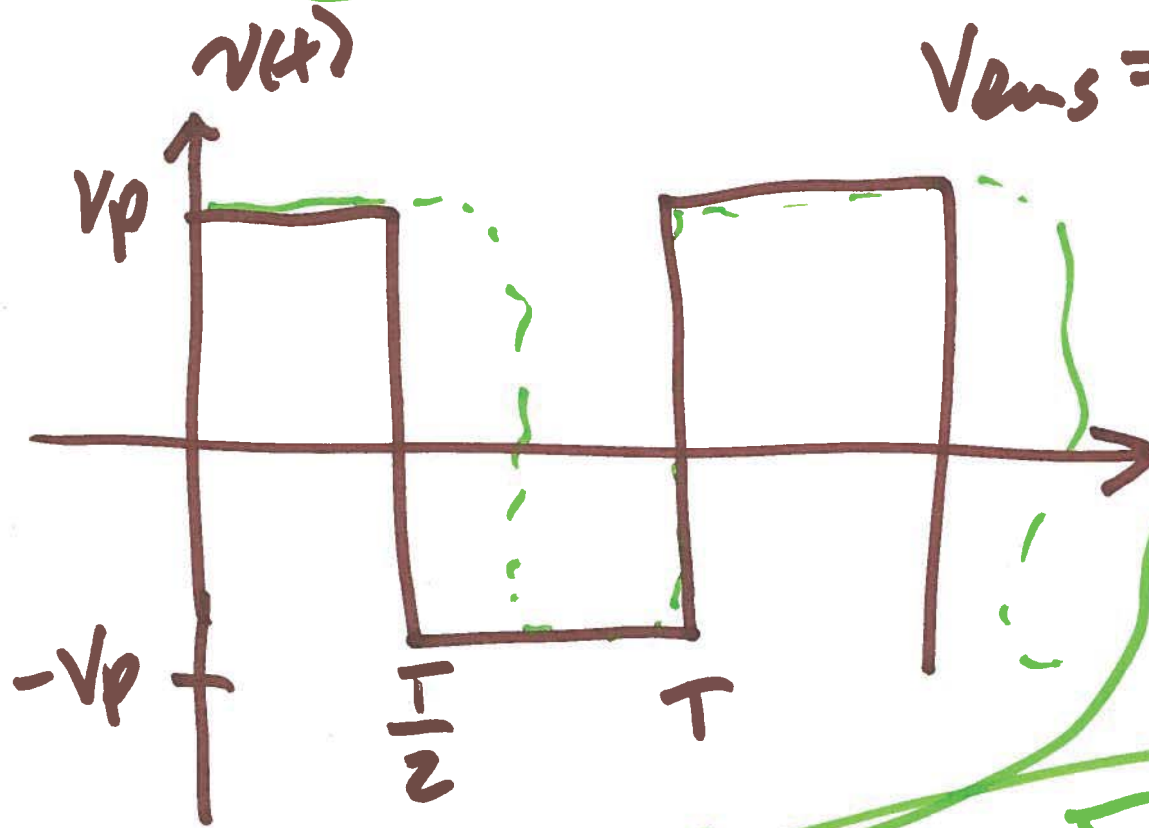


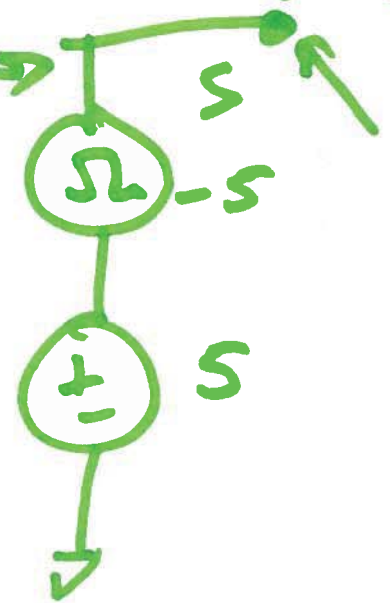
# EE 220 circuits I

## Lecture 22



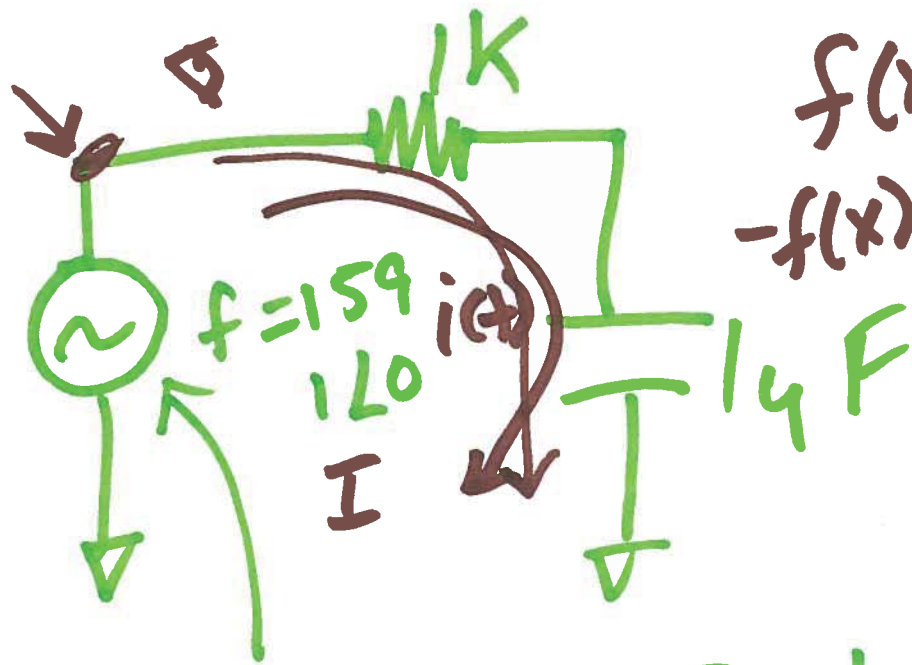
$$V_{rms} = \sqrt{\frac{1}{T} \int_0^T v(t)^2 dt}$$

*Rms?*



$$Rms \sqrt{25 + 25} = \sqrt{2} \cdot 5 = 7.07V$$

1)



$f(x) = f(-x)$  even  
 $-f(x) = f(-x)$  odd



$f = 159$   
 $120$   
 $I$   
 $14 F$   
 $1 \cdot \sin 2\pi \cdot 159 \cdot t$

PHASOR

$T = \frac{1}{159} = 6.29 \mu s$

$i = \frac{120}{1000 + j(-1000)} = \frac{120}{\sqrt{2} \cdot 1000 \angle 45^\circ} = \frac{1000 \cdot j}{j \cdot j} = -j \cdot 1000$

$\rightarrow |i| = \sqrt{(1000)^2 + (-1000)^2} = \sqrt{2} \cdot 1000$

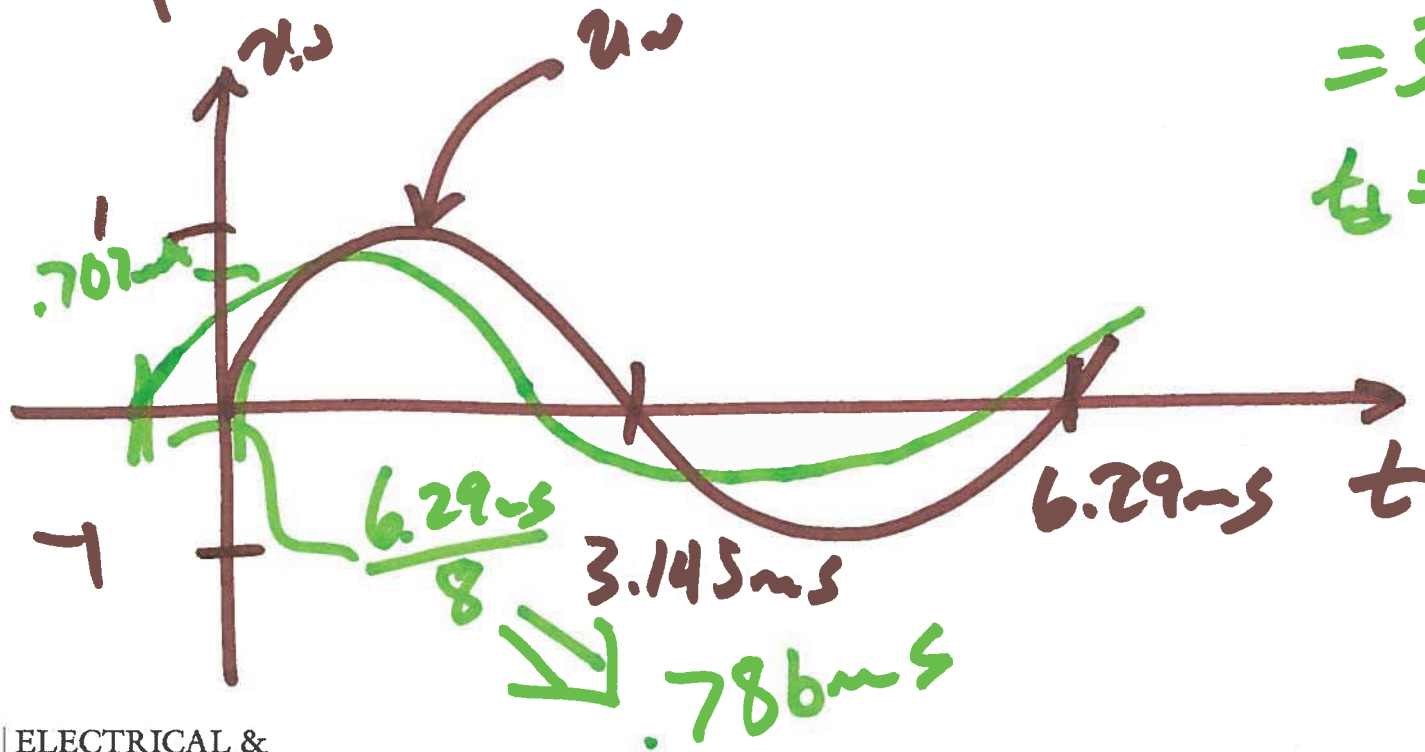
$\angle \tan^{-1} \frac{-1000}{1000} = -45^\circ$

2)

$$i = \frac{1}{\sqrt{2} \cdot 1000} \angle 45$$

$$i(t) = .707 \text{ mA} \sin(2\pi \cdot 159 \cdot t + 45^\circ)$$

Plot  $V_{in} \angle V_{out}$



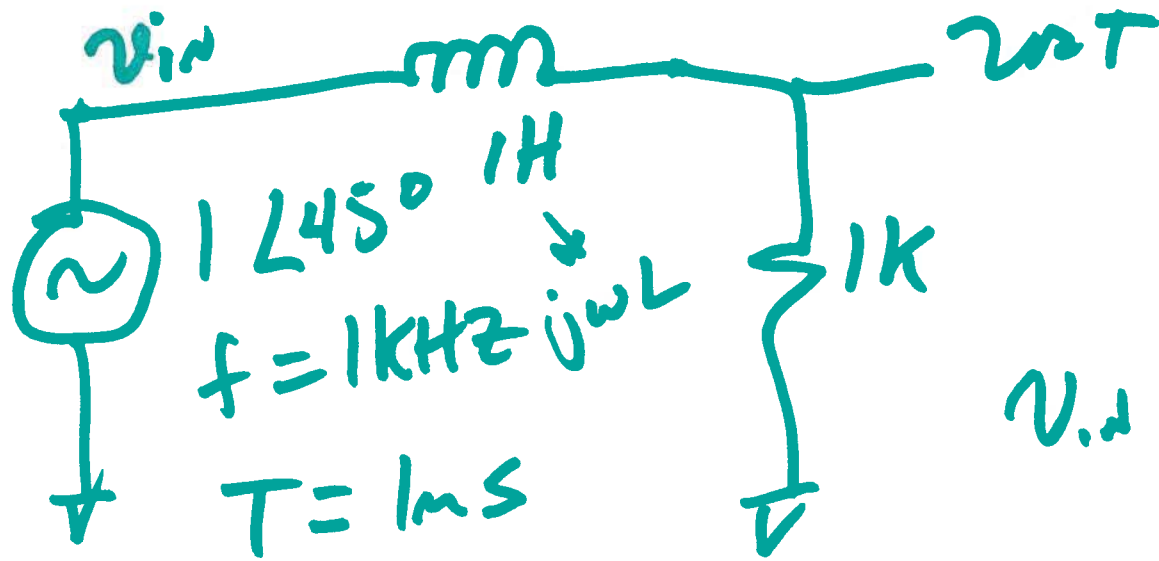
$$\theta = 360 \cdot \frac{t_d}{T}$$

$$= 360 \cdot t_d \cdot f$$

$$t_d = \frac{45}{360} \cdot .6.29$$

$$\frac{1}{8} = \frac{T}{8}$$

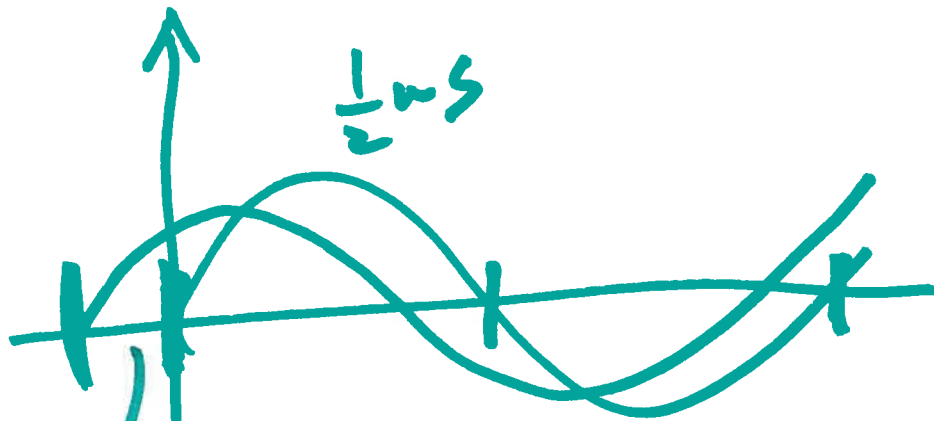
3)



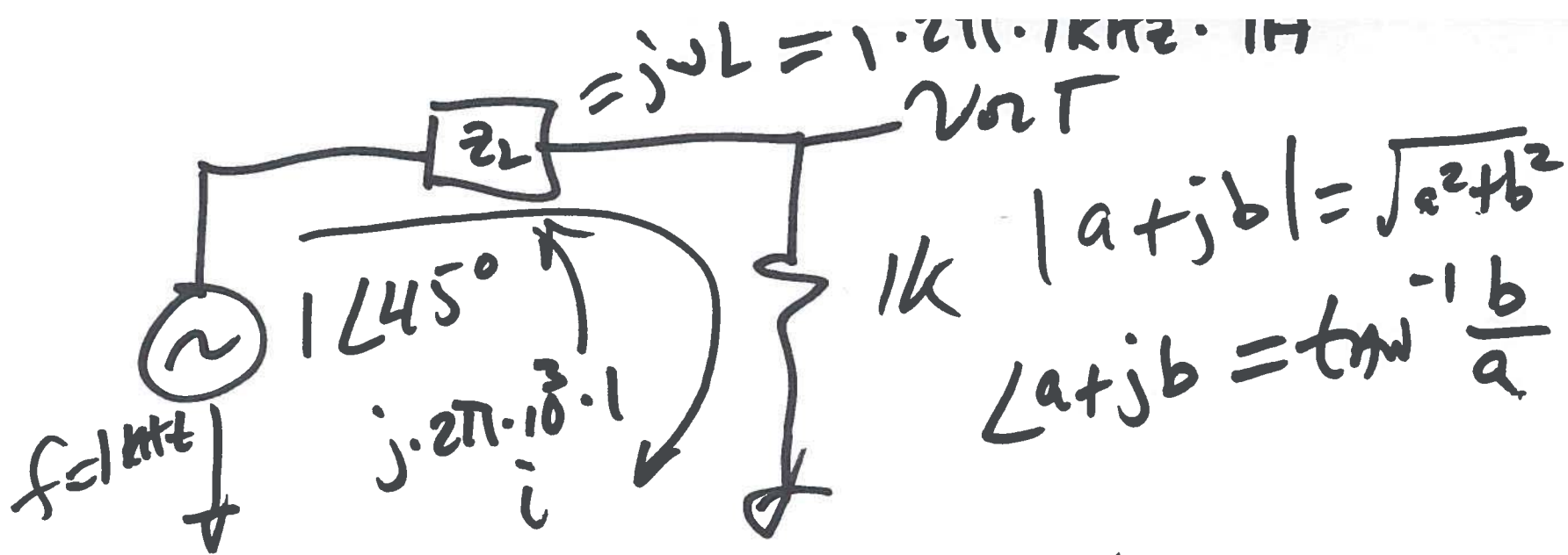
$$v_{out} = 1 \cdot \sin\left(2\pi \cdot 1kHz \cdot t + \frac{\pi}{4}\right)$$

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

$$\theta = 2\pi \cdot \frac{t_d}{T}$$



$$45^\circ = \frac{\pi}{4} = 125 \mu s$$



$$|a + jb| = \sqrt{a^2 + b^2}$$

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

$$V_{out} = \frac{1 \angle 45^\circ \cdot 1K}{1K + j \cdot 2\pi \cdot 1K} = \frac{1 \angle 45^\circ}{1 + j2\pi}$$

$$i = \frac{1 \angle 45^\circ}{j \cdot 2\pi \cdot 1K + 1K} = \frac{1 \angle 45^\circ}{1 + j2\pi}$$

$$\frac{1}{1K}$$

5)

$$V_{out} = \frac{1 \angle 45}{\sqrt{12 + (2\pi)^2} \angle \tan^{-1} \frac{2\pi}{1}}$$

$$i = \frac{1 \mu A \angle 45}{\sqrt{12 + (2\pi)^2} \angle \tan^{-1} \frac{2\pi}{1}}$$

$5 + j0$

$$V_{out} = \frac{1 \angle 45}{6.36 \angle 90^\circ} = .157 \angle -45^\circ$$

$$i = \frac{1 \mu A \angle 45}{6.36 \angle 90^\circ} = 157 \mu A \angle -45^\circ$$

b)

$$v_{in}(t) = 1 \cdot \sin(2\pi \cdot 1\text{kHz} \cdot t + 45^\circ)$$

$$v_{out}(t) = .157 \text{ V} \sin(2\pi \cdot 1\text{kHz} \cdot t - 45^\circ)$$

$$i(t) = 157 \mu\text{A} \sin(2\pi \cdot 1\text{kHz} \cdot t - 45^\circ)$$