

# 電験革命

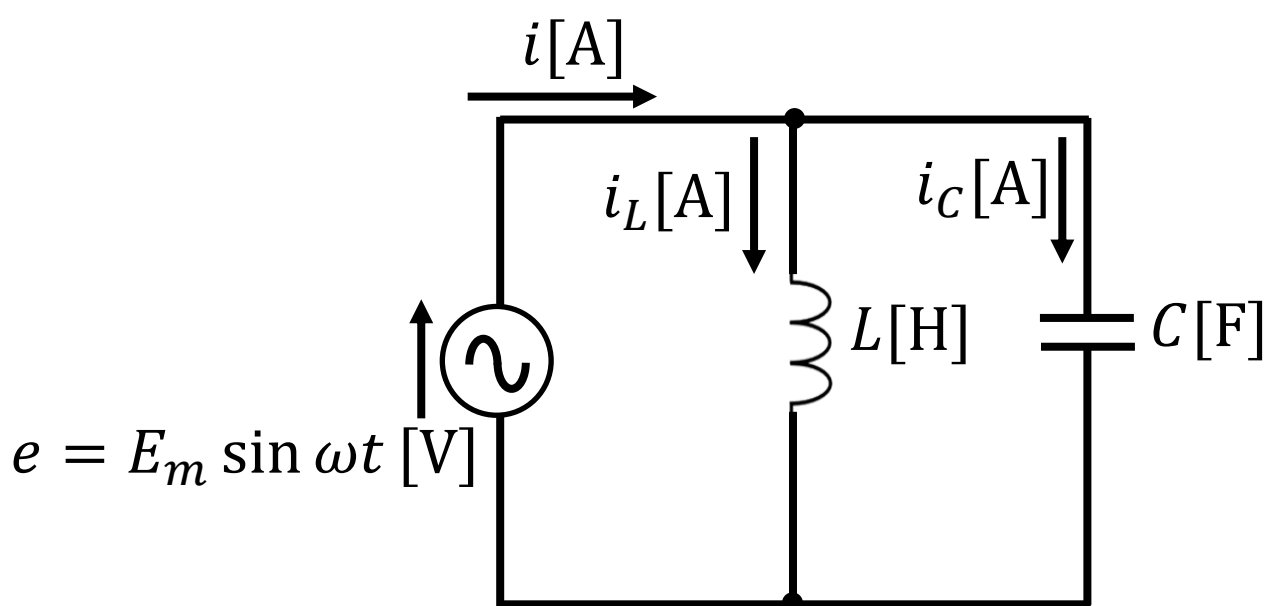
## 理論編

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## ■ HW(H20)

図の回路に流れる電流 $i$ [A]が常に零となるための角周波数 $\omega$ [rad/s]の値を表す式として正しいのは次のうちどれか。



(1)  $\frac{1}{\sqrt{LC}}$

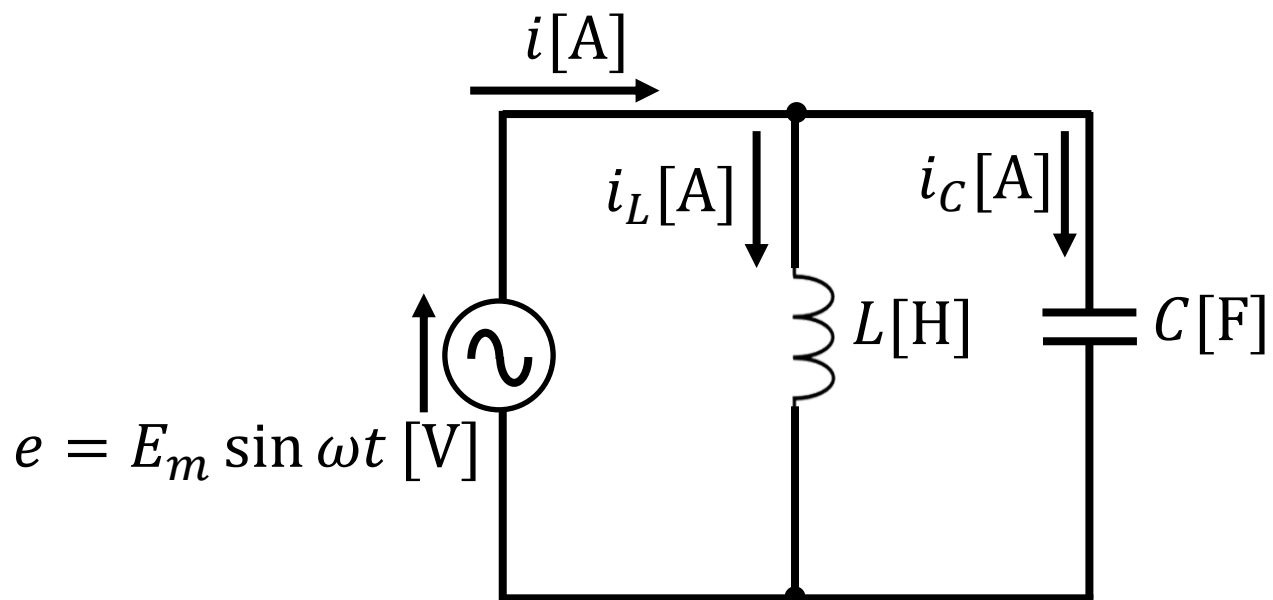
(2)  $\sqrt{LC}$

(3)  $\frac{1}{LC}$

(4)  $\sqrt{\frac{L}{C}}$

(5)  $\sqrt{\frac{C}{L}}$

## ■ HW(H20)



$$i_L = \frac{e}{j\omega L} = -j \frac{e}{\omega L}$$

$$i_C = \frac{e}{-j \frac{1}{\omega C}} = je\omega C$$

$$-j \frac{e}{\omega L} + je\omega C = 0$$

$$je\omega C = j \frac{e}{\omega L}$$

$$\omega C = \frac{1}{\omega L}$$

$$\omega^2 LC = 1$$

$$\omega = \frac{1}{\sqrt{LC}}$$

# 【交流回路】21. 交流の電力

## 【交流の電力】

**有効電力**・・・実際に仕事を**する**電力。Pで表され単位は[W]

**無効電力**・・・実際に仕事を**しない**電力。Qで表され単位は[var]

**皮相電力**・・・有効電力と無効電力のベクトル和。

Sで表され単位は[V・A]

$$P = VI \cos \theta$$

$$Q = VI \sin \theta$$

$$S = VI$$

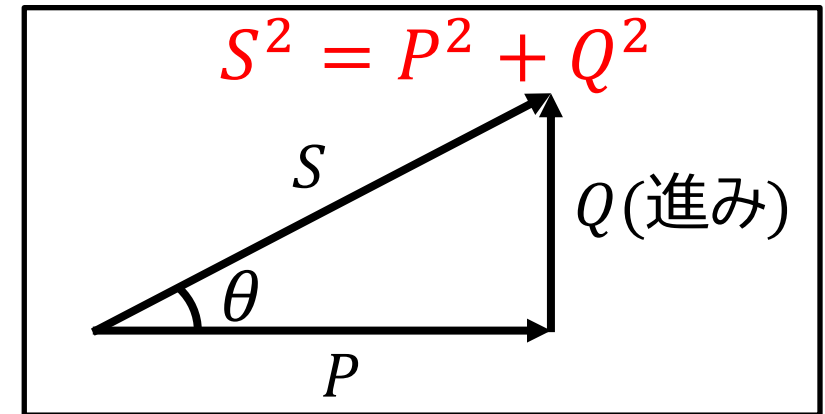
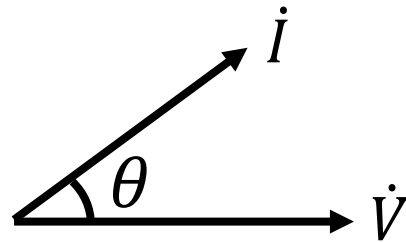
$$\sin^2 \theta + \cos^2 \theta = 1$$

※ $\theta$ はVとIの位相差

$$\text{力率} = \cos \theta = \frac{P}{S}$$

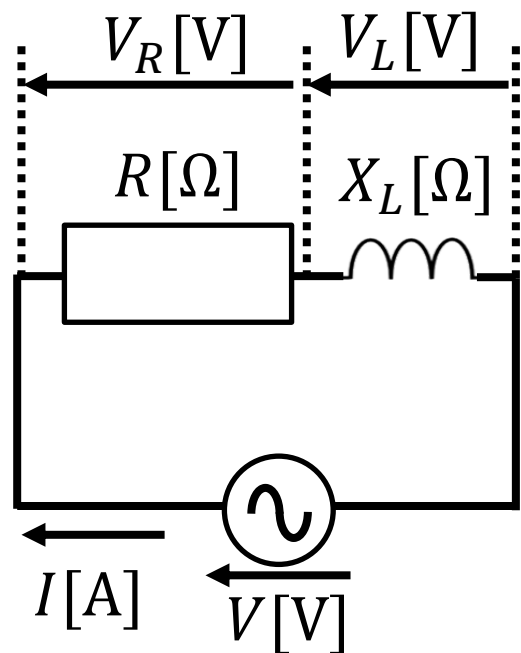
コイル・・・**遅れ**無効電力を消費

コンデンサ・・・**進み**無効電力を消費



電力の三角形

## 【直列回路】・・・電力や力率を求める



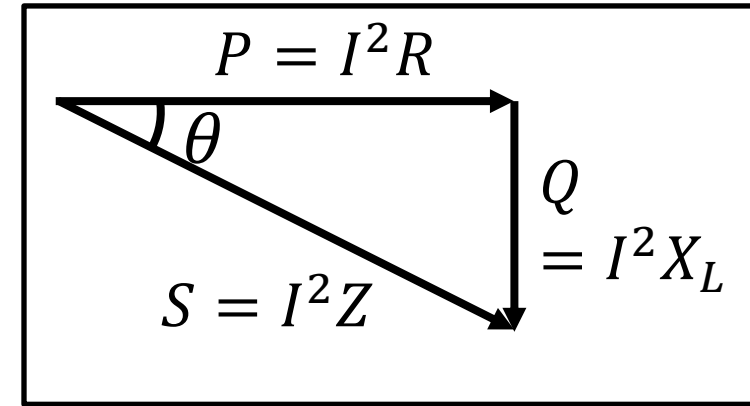
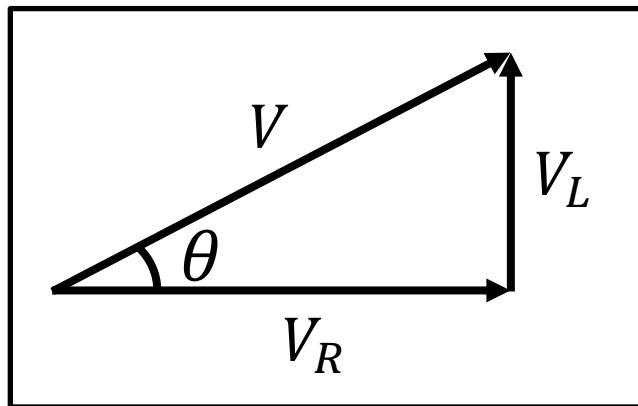
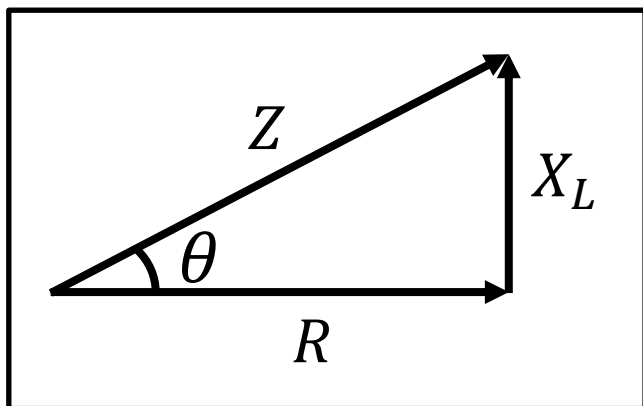
$$P = I^2 R$$

$$Q = I^2 X_L \text{ (遅れ)}$$

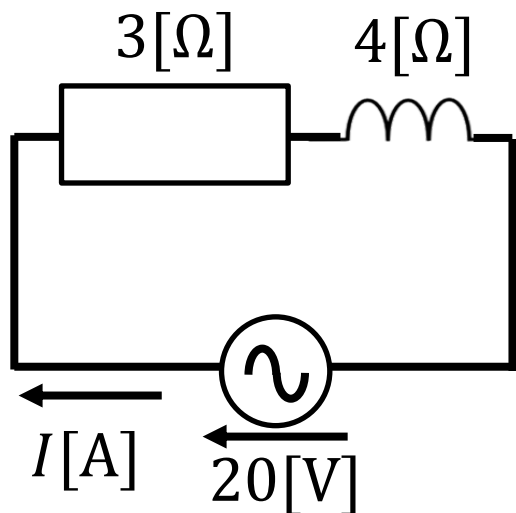
$$S = I^2 Z$$

→  $i$

$$\text{力率} = \cos\theta = \frac{P}{S} = \frac{V_R}{V} = \frac{R}{Z}$$



【例題1】  $P \cdot Q \cdot S \cdot \cos\theta$  を求める



$$Z = \sqrt{3^2 + 4^2} \\ = 5$$

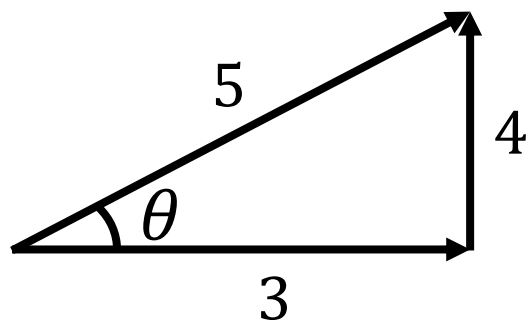
$$I = 20 \div 5 = 4[\text{A}]$$

$$P = 4^2 \times 3 = 48[\text{W}]$$

$$Q = 4^2 \times 4 = 64[\text{var}]$$

$$S = 4^2 \times 5 = 80[\text{V} \cdot \text{A}]$$

$$\cos\theta = \frac{48}{80} = 0.6$$



$$S = 4 \times 20 = 80[\text{V} \cdot \text{A}]$$

$$P = 80 \times 0.6 = 48[\text{W}]$$

$$Q = 80 \times 0.8 = 64[\text{var}]$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sin^2 \theta + 0.6^2 = 1$$

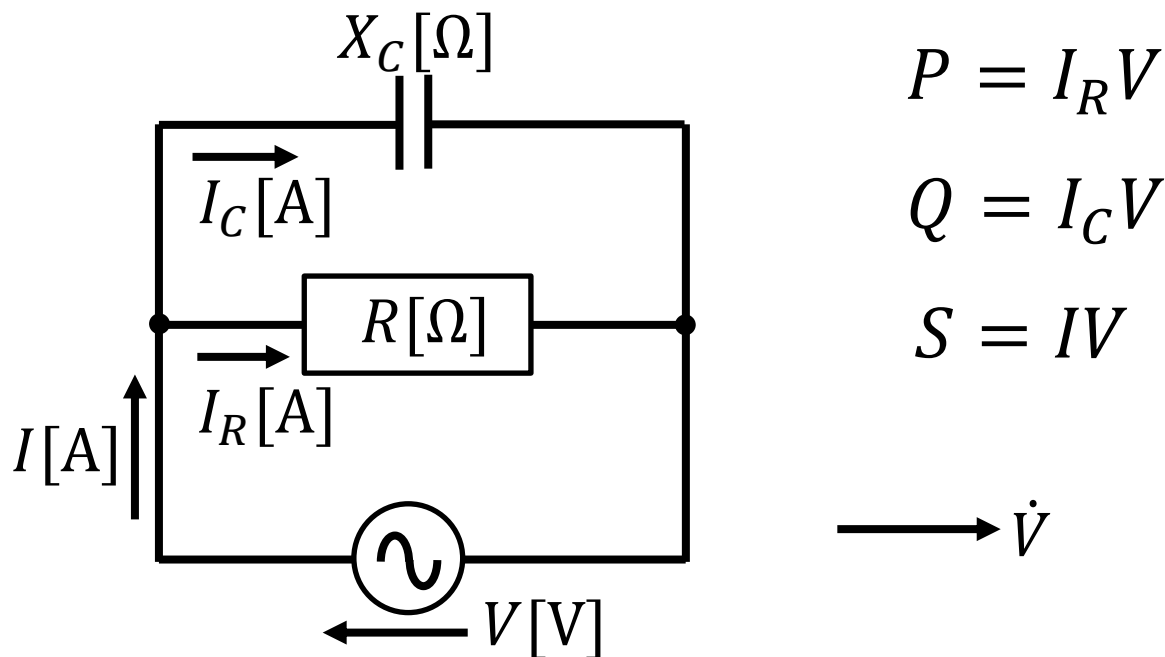
$$\cos^2 \theta = 0.64$$

$$\cos\theta = 0.8$$

# 【交流回路】21. 交流の電力



【並列回路】・・・電力や力率を求める

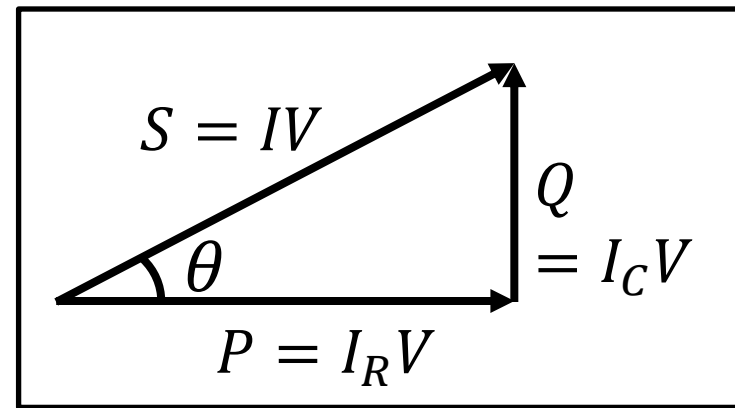
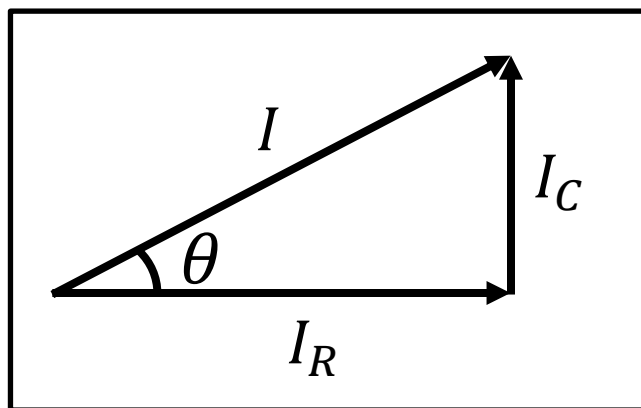


$$P = I_R V$$

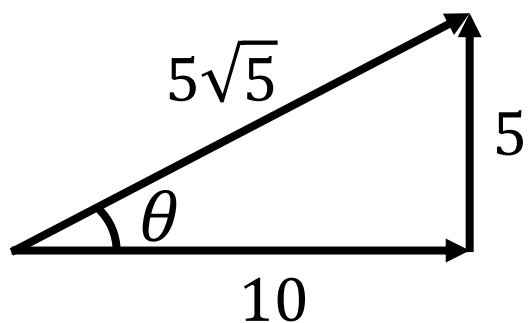
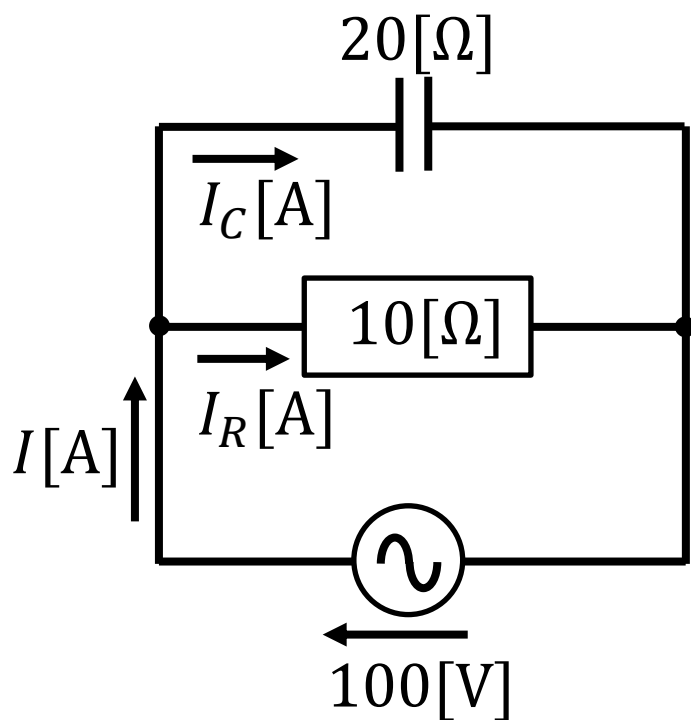
$$Q = I_C V (\text{進み})$$

$$S = IV$$

$$\text{力率} = \cos\theta = \frac{P}{S} = \frac{I_R}{I} = \frac{R}{Z}$$



【例題2】  $P \cdot Q \cdot S \cdot \cos\theta$  を求める



$$\dot{I}_C = \frac{100}{-j20}$$

$$= j5[\text{A}]$$

$$\dot{I}_R = \frac{100}{10}$$

$$\dot{I}_R = 10[\text{A}]$$

$$\dot{I} = \dot{I}_C + \dot{I}_R$$

$$\dot{I} = 10 + j5$$

$$I = \sqrt{10^2 + 5^2}$$

$$I = 5\sqrt{5}$$

$$P = 10^2 \times 10 = 1000[\text{W}]$$

$$Q = 5^2 \times 20 = 500[\text{var}]$$

$$S = \sqrt{1000^2 + 500^2} = 500\sqrt{5}[\text{VA}]$$

$$\cos\theta = \frac{1000}{500\sqrt{5}} = \frac{2\sqrt{5}}{5}$$



# 【交流回路】21. 交流の電力



【HW】H16 回路全体での消費電力 $P$ [W]と $E$ [V]を求めよ。

