二種への複素数

$$v(t) = \sqrt{2} V \sin(\omega t + \phi)$$

$$\dot{V} = V \angle \phi$$ ⓐ

極

$$= V e^{j\phi}$$

指数

×÷

$$= V\cos\phi + jV\sin\phi$$

直交

+−

$$\sqrt{2} V \sin(\omega t + \phi) = \mathrm{Im}\left[\sqrt{2} V e^{j(\omega t + \phi)}\right] \rightarrow V e^{j\phi}$$

これを計算

$$(A\angle\theta)(B\angle\phi)$$

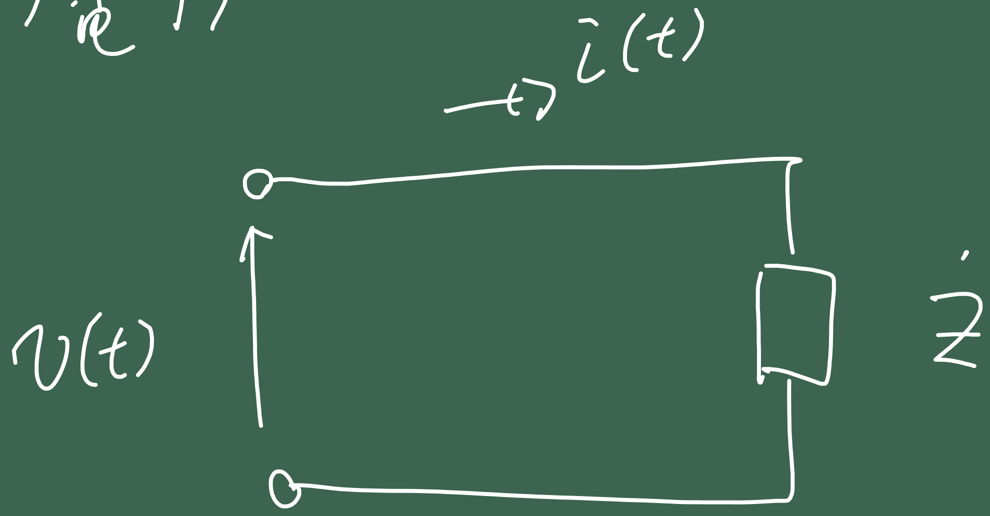
$$= AB\angle(\theta+\phi)$$

$$\frac{A\angle\theta}{B\angle\phi} = \frac{A}{B}\angle(\theta-\phi)$$

$$(Ae^{j\theta})(Be^{j\phi}) = ABe^{j(\theta+\phi)}$$

$$\frac{Ae^{j\theta}}{Be^{j\phi}} = \frac{A}{B}e^{j(\theta-\phi)}$$

電力



$$\begin{cases} v(t) = \sqrt{2}\, V \sin \omega t \\ i(t) = \sqrt{2}\, I \sin(\omega t - \theta) \end{cases}$$

← $\theta > 0$ で遅相, $\theta < 0$ で進相

$$\dot{V} = V\angle 0 = V$$

$$\dot{I} = I\angle(-\theta) = I e^{-j\theta}$$

$$p(t) = v(t)\, i(t)$$ ← 瞬時電力

$$\int_0^{2\pi/\omega} p(t)\, dt = VI \cos\theta$$ ← 有効電力

$$p(t) = v(t)\, i(t)$$

$$= 2VI \sin \omega t \, \sin(\omega t - \theta)$$

$$\sin \omega t \cos\theta - \cos \omega t \, ~~\cos\theta~~ \sin\theta$$

$$= VI\cos\theta \cdot 2\sin^2 \omega t$$ 縮

$$- VI\sin\theta \; 2\sin\omega t \cos \omega t$$

P

$$= VI\cos\theta \, (1 - \cos 2\omega t)$$

$$- VI\sin\theta \; \sin 2\omega t$$

Q

$$\int_0^{\omega/2\pi} \cos 2\omega t \, dt = 0 \qquad \int_0^{\omega/2\pi} \sin 2\omega t \, dt = 0$$

2周期分

$$\int_0^{\omega/2\pi} p(t)\, dt = VI\cos\theta$$

有効電力

=

瞬時電力の1周期分の時間平均

$$p(t) = P\,(1 - \cos 2\omega t)$$

$$- \; Q \sin 2\omega t$$

$VI\sin\theta$

無効電力

$- \; Q \sin 2\omega t$

$$p(t) = VI\cos\theta\,(1 - \cos 2\omega t) - VI\sin 2\omega t$$

2ω

2ω

$$\int p(t)\,dt = VI\cos\theta$$

1周期A (W)

$p(t)$ $W/4\pi$

$$\begin{cases} P = VI\cos\theta \\ Q = VI\sin\theta \end{cases} \qquad \begin{cases} Q > 0 \text{ 遅} \\ Q < 0 \text{ 進} \end{cases}$$

$$\dot{V} = V, \quad \dot{I} = Ie^{-j\theta} \quad \left(\begin{matrix} \theta > 0 \text{ 遅} \\ \theta < 0 \text{ 進} \end{matrix}\right)$$

複素電力 複素共役

$$\dot{S} = \dot{V}\bar{\dot{I}}$$

(多) 電験

$\theta > 0$, $Q > 0$ (遅)

$$\dot{S}' = \bar{\dot{V}}\dot{I} \leftarrow \text{(少)}$$

$$\bar{\dot{S}} = \dot{S}'$$

Q を 由

$$\overline{\dot{V}\bar{\dot{I}}} = \bar{\dot{V}}\,\bar{\bar{\dot{I}}} = \bar{\dot{V}}\dot{I} = \dot{S}'$$

$$\dot{V} = V, \quad \dot{I} = I e^{-j\theta}$$

$$\dot{S} = \dot{V}\overline{\dot{I}}$$

$$= V \cdot \overline{I e^{-j\theta}}$$

前のやったよ

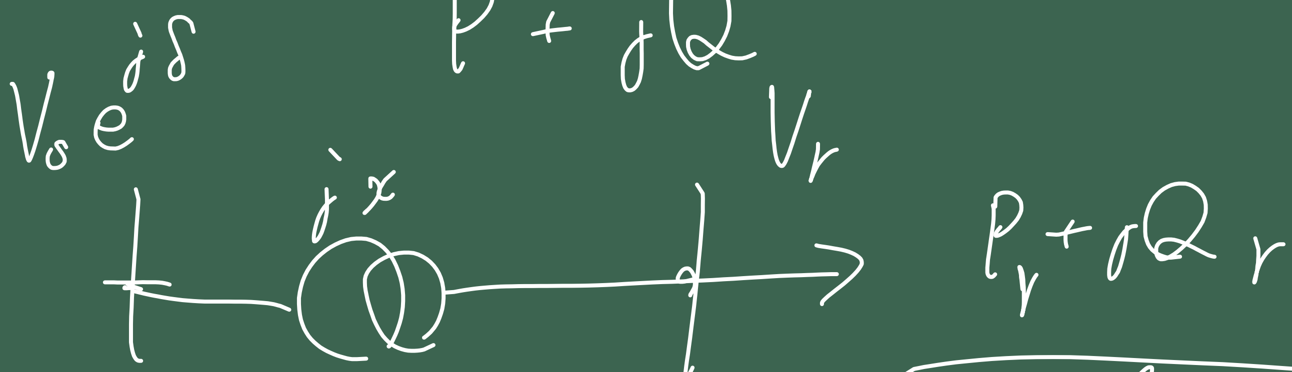
$$= V I e^{+j\theta}$$

オイラーの公式

$$= VI(\cos\theta + j\sin\theta)$$

$$= VI\cos\theta + jVI\sin\theta$$

$$= P + jQ$$



$$P_r + jQ_r = V_r \overline{\left(\frac{V_s e^{j\delta} - V_r}{jx}\right)}$$