BAZELE ELECTROTEHNICII

~ CURS 5 ~

CURSUL ANTERIOR

11. Metode sistematice de rezolvare a circuitelor.

II. Regim permanent sinusoidal

1. Mărimi sinusoidale;
2. Metoda analitică a reprezentării în complex.

CUPRINS CURS

II. Regim permanent sinusoidal

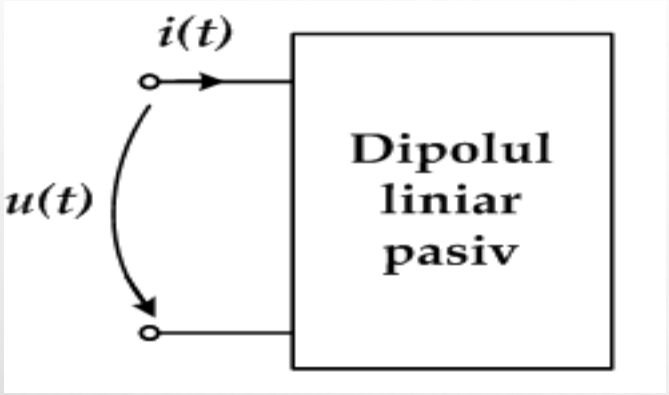
3. Imitanțe complexe;
4. Puteri în regim sinusoidal;
5. Elemente de circuit în regim sinusoidal.

CUPRINS CURS

II. Regim permanent sinusoidal

3. **Imitanțe complexe;**
4. Puteri în regim sinusoidal;
5. Elemente de circuit în regim sinusoidal.

3. Imitanțe complexe



$$i(t) = I\sqrt{2}\sin(\omega t + \alpha_I) \qquad \underline{I} = Ie^{j\alpha_I}$$

$$u(t) = U\sqrt{2}\sin(\omega t + \alpha_U) \longrightarrow \underline{U} = Ue^{j\alpha_U}$$

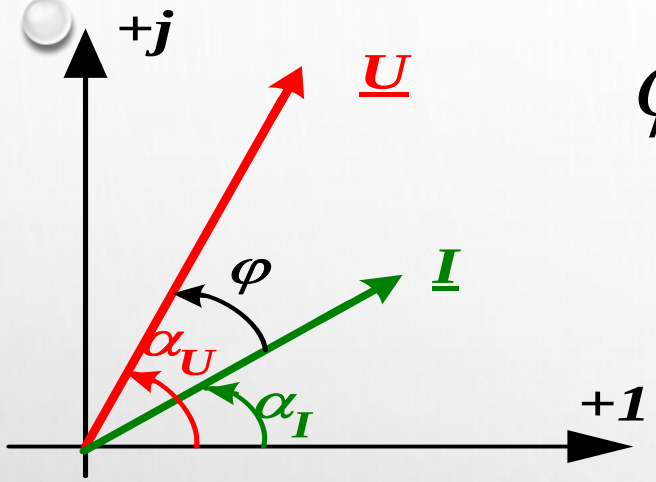
$$\underline{Z} \overset{d}{=} \frac{\underline{U}}{\underline{I}} = \frac{Ue^{j\alpha_U}}{Ie^{j\alpha_I}} = \frac{U}{I}e^{j(\alpha_U - \alpha_I)} = Ze^{j\varphi} = Z\cos\varphi + j\cdot Z\sin\varphi$$

impedanța complexă

R

X

3. Imitanțe complexe



$$\varphi = \alpha_U - \alpha_I = arctg\frac{X}{R}$$ **argumentul impedanței**

$$Z \overset{d}{=} \frac{U}{I} = \sqrt{R^2 + X^2}$$ **modulul impedanței**

$R = \mathrm{Re}\{\underline{Z}\}$ **rezistența** / $X = \mathrm{Im}\{\underline{Z}\}$ **reactanța** **[Ω]**

3. Imitanțe complexe

admitanța complexă

$$\underline{Y} = \frac{Ie^{j\alpha_I}}{Ue^{j\alpha_U}} = \frac{1}{\underline{Z}} = \frac{1}{Z}e^{-j\varphi} = Y\cos\varphi - j\cdot Y\sin\varphi = G - jB$$

$$G = \mathrm{Re}\{\underline{Y}\} \quad / \quad B = \mathrm{Im}\{\underline{Y}\} \quad [S]$$

conductanța — **susceptanța**

$$\underline{Y} = \frac{1}{\underline{Z}} = \frac{1}{R + jX} = \frac{R - jX}{R^2 + X^2} = \frac{R}{R^2 + X^2} - j\frac{X}{R^2 + X^2}$$

CUPRINS CURS

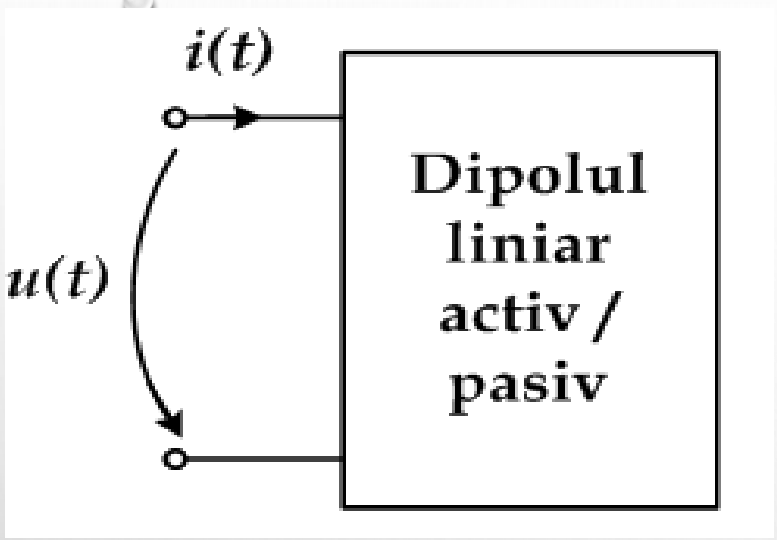
II. Regim permanent sinusoidal

3. Imitanțe complexe;

4. Puteri în regim sinusoidal;

5. Elemente de circuit în regim sinusoidal.

4. Puteri în regim sinusoidal



$$i(t) = I\sqrt{2}\sin(\omega t + \alpha_I)$$

$$u(t) = U\sqrt{2}\sin(\omega t + \alpha_U)$$

$$p(t) = u(t)\cdot i(t) = 2U\cdot I\sin(\omega t + \alpha_U)\sin(\omega t + \alpha_I)$$

$$= U\cdot I\cos(\alpha_U - \alpha_I) - U\cdot I\cos(2\omega t + \alpha_U + \alpha_I)$$

φ

puterea fluctuantă

4. Puteri în regim sinusoidal

$$\rightarrow pentru\,\varphi = 0 \Rightarrow P = U \cdot I$$

$$\rightarrow pentru\,\varphi = \frac{\pi}{2} \Rightarrow P = 0$$

a. Puterea activă

$$P \overset{d}{=} \frac{1}{T}\int_0^T p(t) \qquad [P]_{SI} = 1W$$

$$P = U \cdot I \cos\varphi$$

4. Puteri în regim sinusoidal

b. Puterea reactivă

$$Q \overset{d}{=} U \cdot I \sin\varphi \quad [Q]_{SI} = 1VAR$$

$\rightarrow$dacă: $0 < \varphi < \frac{\pi}{2}$ = regim inductiv $\Rightarrow Q > 0$

$\rightarrow$dacă: $-\frac{\pi}{2} < \varphi < 0$ = regim capacitiv $\Rightarrow Q < 0$

c. Puterea aparentă

$$S \overset{d}{=} U \cdot I = Z \cdot I^2 = Y \cdot U^2 \qquad [S]_{SI} = 1VA$$

4. Puteri în regim sinusoidal

d. Puterea aparentă complexă

$$\underline{S} \overset{d}{=} \underline{U} \cdot \underline{I}^{*} = U \cdot I \cdot e^{j(\alpha_U - \alpha_I)} = U \cdot I \cdot e^{j\varphi}$$

$$= U \cdot I(\cos\varphi + j\sin\varphi) = S\cos\varphi + jS\sin\varphi = P + jQ$$

4. Puteri în regim sinusoidal

$$S = \sqrt{P^2 + Q^2}$$

$$P = S\cos\varphi$$

$$Q = S\sin\varphi$$

$$\Rightarrow$$

$$K \overset{d}{=} \frac{P}{S} = \frac{P}{\sqrt{P^2 + Q^2}} = \cos\varphi$$

Factorul de putere

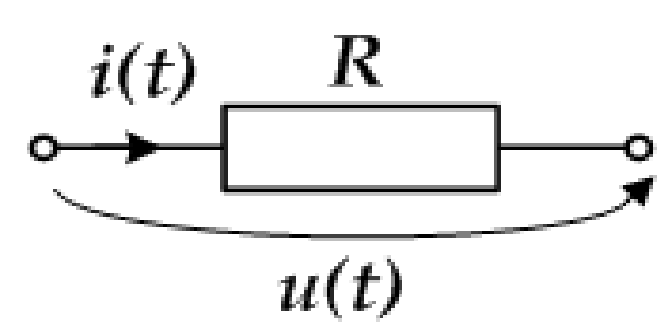
CUPRINS CURS

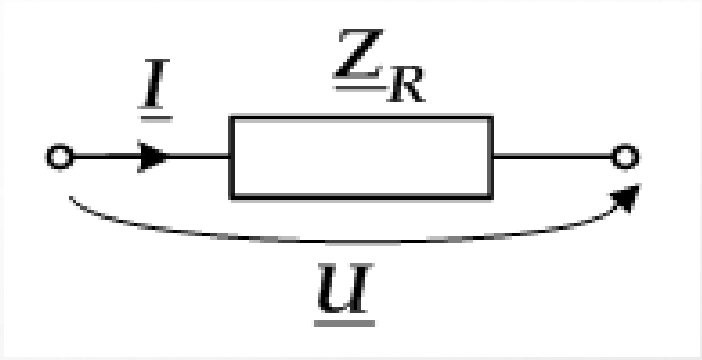
II. Regim permanent sinusoidal

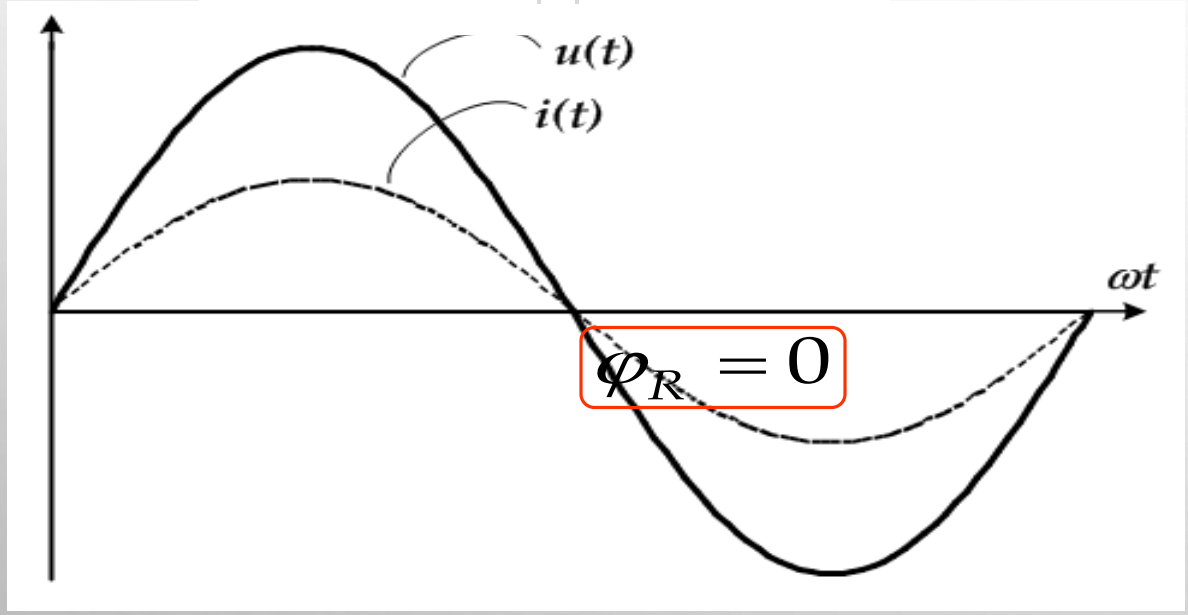
3. Imitanțe complexe;
4. Puteri în regim sinusoidal;
5. **Elemente de circuit în regim sinusoidal.**

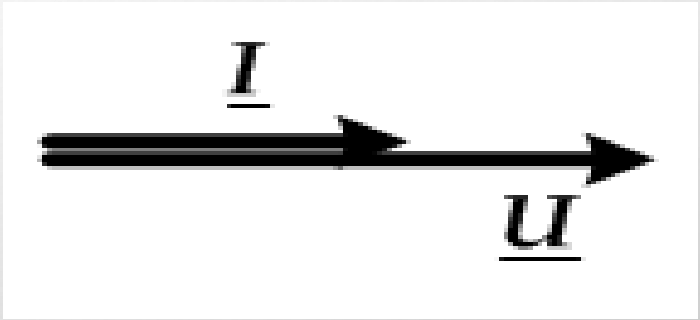
5. Elemente de circuit în regim sinusoidal

1. Rezistorul ideal









$$\underline{U}_R = \underline{Z}_R \cdot \underline{I}_R = R \cdot \underline{I}_R$$

5. Elemente de circuit în regim sinusoidal

1. Rezistorul ideal

$$u_R = R \cdot i_R$$

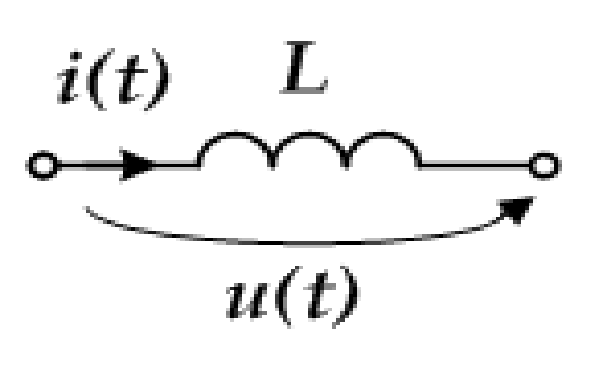
$$R_R = R; \quad X_R = 0; \quad G_R = \frac{1}{R}; \quad B_R = 0.$$

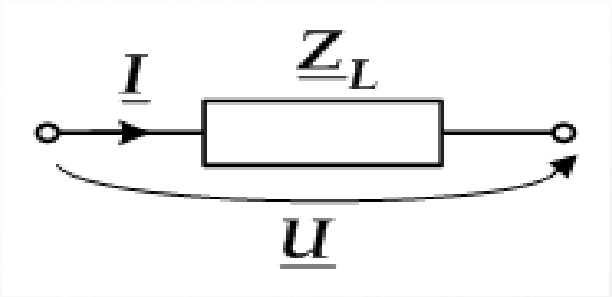
$$P_R = R \cdot I^2 = G \cdot U^2$$

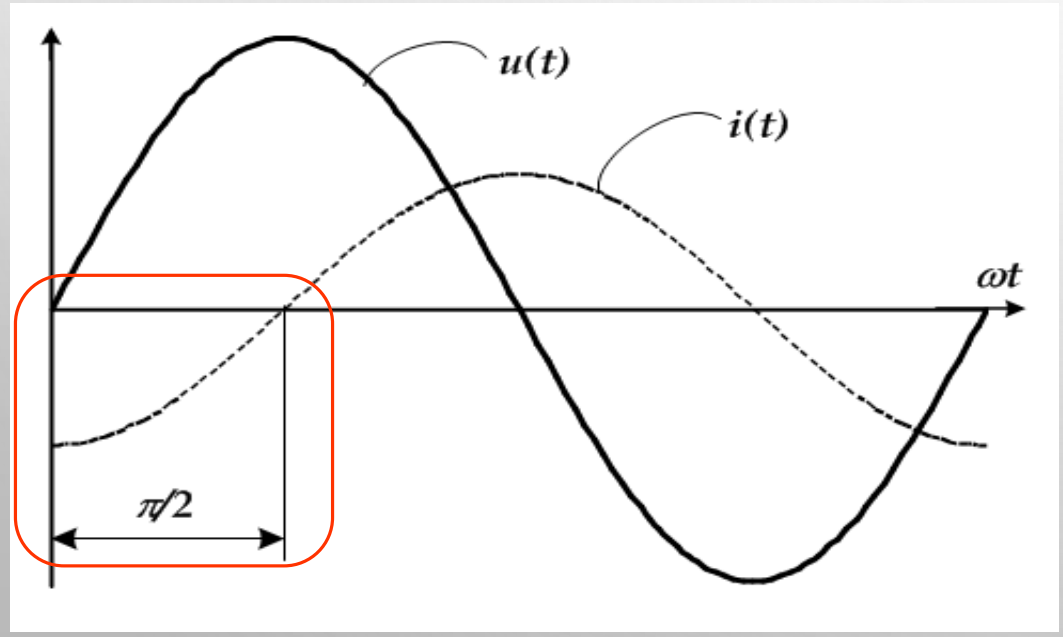
$$Q_R = 0; \quad S_R = U \cdot I = R \cdot I^2 = G \cdot U^2$$

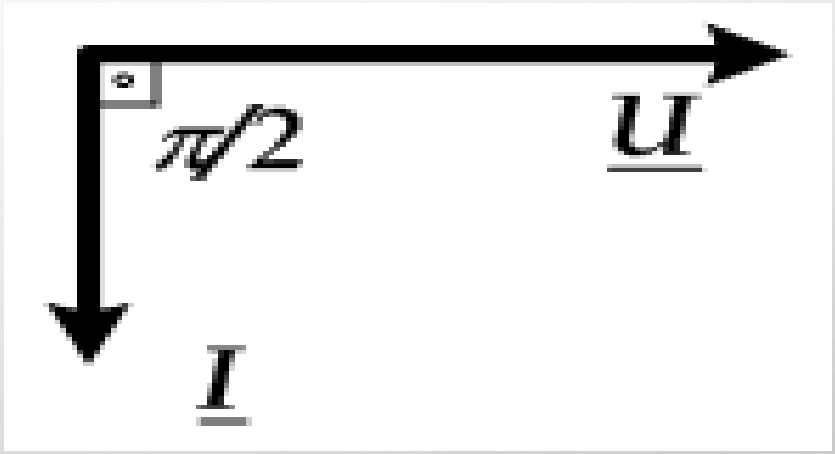
5. Elemente de circuit în regim sinusoidal

2. Bobina ideală









$$\underline{U}_L = \underline{Z}_L \cdot \underline{I}_L = j\omega L \cdot \underline{I}_L$$

2. Bobina ideală

$$u_L = L\frac{di_L}{dt}$$

$$R_L = 0;\ X_L = \omega L;\ G_L = 0;\quad B_L = \frac{1}{\omega L}.$$

$$P_L = 0 \qquad Q_L = \omega \cdot L \cdot I^2 = \frac{1}{\omega L}U^2;$$

$$S_L = \omega \cdot L \cdot I^2 = \frac{1}{\omega L}U^2$$

VĂ MULȚUMESC PENTRU ATENȚIE !!