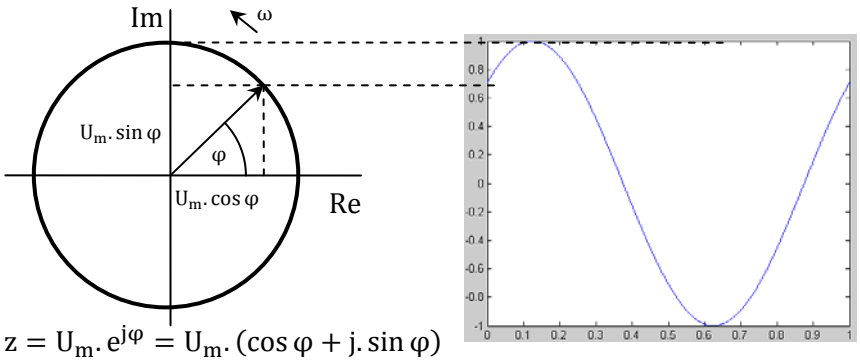
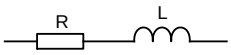


$$z = U_m.e^{j\varphi} = U_m.(\cos\varphi + j.\sin\varphi)$$

$$z = a + j.b$$

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

$$\left|e^{j\varphi}\right| = \sqrt{\cos^2\varphi + \sin^2\varphi} = 1$$



$$\hat{Z}_R + \hat{Z}_L = \underbrace{R}_{a} + j\,\underbrace{\omega L}_{b}$$

$$tg\,\varphi = \frac{b}{a} \Rightarrow \varphi = arctg\frac{b}{a}$$

$$\hat{I} = \frac{\hat{U}}{\hat{Z}} = \hat{U}.\hat{Y}$$

$$\Psi = -\varphi$$

$$\hat{Z}_R = R$$

$$\hat{Z}_L = j\omega L$$

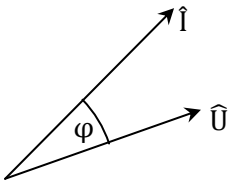
$$\hat{Z}_C = \frac{1}{j\omega C}$$

$\hat{Z}$

$$\hat{U} = \hat{Z}.\hat{I}$$

$$\hat{I} = |I_m|.e^{j0}$$

$$\hat{Z} = \left|\hat{Z}\right|.e^{j\varphi}$$

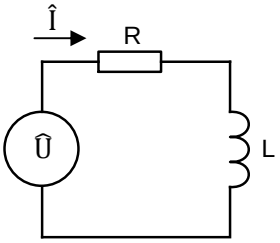


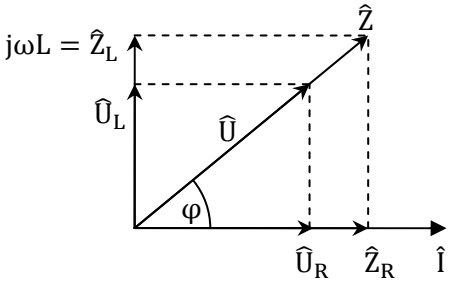
$$\hat{U} = U_m.e^{j\alpha} = \left|\hat{Z}\right|.e^{j\varphi}.|I_m|.e^{j0}$$

$$\hat{U} = U_m.e^{j\alpha} = \left|\hat{Z}\right||I_m|.e^{j\varphi}$$

$$\alpha = \varphi$$

RL obvod





$$\left|\hat{U}\right| = \sqrt{\left|\hat{U}_R\right|^2 + \left|\hat{U}_L\right|^2} = \underbrace{\sqrt{(\omega L)^2 + R^2}}_{|\hat{Z}|}.\left|\hat{I}\right|$$

$$\hat{U}_R = R.\hat{I}$$

$$\hat{U}_L = j\omega L.\hat{I}$$

$$|U_L| = |j\omega L|.\left|\hat{I}\right| = \omega L.\left|\hat{I}\right|$$

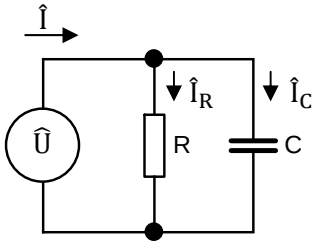
$$|U_R| = R.\left|\hat{I}\right|$$

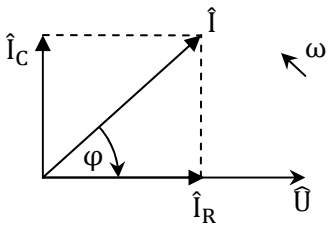
$$\hat{U} = \hat{U}_R + \hat{U}_L = R.\hat{I} + j\omega L.\hat{I} = (R + j\omega L).\hat{I}$$

$$\left|\hat{U}\right| = \left|\hat{I}\right|.|R + j\omega L| = \left|\hat{I}\right|.\sqrt{R^2 + (\omega L)^2}$$

$$tg\,\varphi = \frac{\omega L}{R}$$

RC obvod





$$Y_R = \frac{1}{R}$$
$$Y_C = j\omega C$$
$$Y_L = \frac{1}{j\omega L}$$

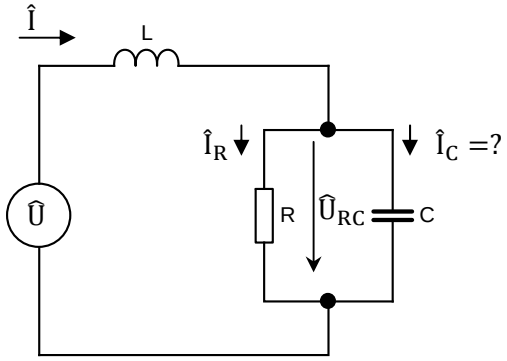
$\hat{I} = \hat{I}_R + \hat{I}_C \qquad \hat{I} = \hat{Y}.\hat{U}$

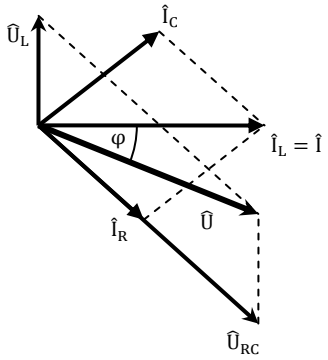
$\hat{U} = \hat{Z}.\hat{I}$

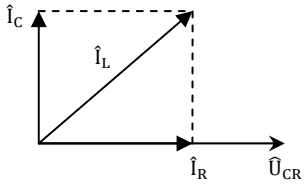
$$\hat{Z} = \frac{Z_R.Z_C}{Z_R + Z_C} = \frac{R.\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}}.\frac{j\omega C}{j\omega C} = \frac{R}{Rj\omega C + 1}.\frac{1 - j\omega RC}{1 - j\omega RC} = \frac{R}{1 + \omega^2R^2C^2} + j.\frac{R}{1 + \omega^2R^2C^2}$$

$\hat{Z} = \underbrace{R}_{\text{rezistance}} + j.\underbrace{X}_{\text{reaktance}}$

$\hat{Y} = \underbrace{G}_{\text{konduktance}} + j.\underbrace{B}_{\text{susceptance}}$







$$\hat{I}_C = \frac{\hat{U}_{RC}}{\hat{Z}_C} = \frac{\hat{U}_{RC}}{\frac{1}{j\omega C}} \qquad \hat{Z}_{RC} = \frac{R.\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}}$$

$$\hat{U}_{RC} = \hat{U}.\frac{\hat{Z}_{RC}}{\hat{Z}_L + \hat{Z}_{RC}} = \hat{U}.\frac{\frac{R}{j\omega C}}{\frac{R}{R + \frac{1}{j\omega C}}} = \cdots = a + j.b = \underbrace{\sqrt{a^2 + b^2}}_{|\hat{I}_C|}.e^{j.\text{artg}\frac{b}{a}}$$
$$j\omega L + \frac{R + \frac{1}{j\omega C}}{R + \frac{1}{j\omega C}}$$

Výkon střídavého proudu

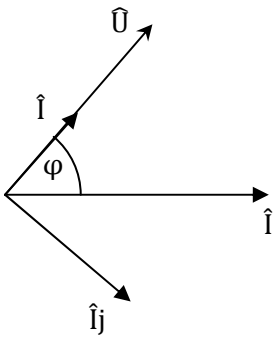
P = U. I – stejnosměrné proudy

$u = U_m . \sin(\omega t + \varphi)$

$i = I_m . \sin(\omega t)$

$$\begin{pmatrix} \sin(x+y) = \sin x . \cos y + \cos x . \sin y \\ \sin 2x = 2 . \sin x . \cos x \\ \cos 2x = \cos^2 x - \sin^2 x \end{pmatrix}$$

$$p = u(t) . i(t) = U_m . I_m . \sin(\omega t + \varphi) . \sin(\omega t) = U_m . I_m . (\sin(\omega t) . \cos\varphi + \cos(\omega t) . \sin\varphi) . \sin\omega t =$$
$$= \frac{U_m . I_m}{2} . (\cos\varphi . (1 - \cos(2.\omega t)) + \sin\varphi . \sin(2.\omega t))$$



$$P = \frac{1}{T} . \int_0^T p(t) . dt = \cdots = \frac{U_m . I_m}{2} . \cos\varphi = \frac{\underbrace{\frac{U_m}{\sqrt{2}}}_{U_{ef}}}{U} . \frac{\underbrace{\frac{I_m}{\sqrt{2}}}_{I_{ef}}}{I} . \cos\varphi = U . I . \cos\varphi$$

$$\underbrace{\hat{U}}_{\varphi_1} . \underbrace{\hat{I}}_{\varphi_2} = U_m . I_m . e^{j.\varphi_1} . e^{j.\varphi_2} = U_m . I_m . e^{j.(\varphi_1 + \varphi_2)}$$

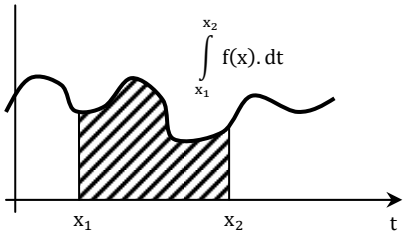
$$\hat{U} . \hat{I}^* = U . I . e^{j.\varphi_1} . e^{-j.\varphi_2} = U . I . e^{\overbrace{j.(\varphi_1 - \varphi_2)}^{\varphi}} = U . I . (\cos\varphi + j . \sin\varphi)$$

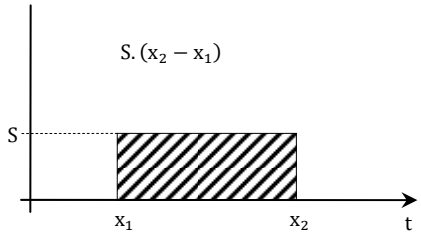
↘ komplexně sdružené

$\mathrm{Re}\{\hat{U} . \hat{I}^*\}$ – činný výkon

$\mathrm{Im}\{\hat{U} . \hat{I}^*\}$ – jalový výkon

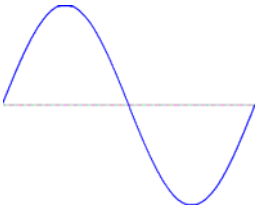
Střední hodnota proudu





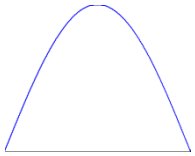
$$\int_{t_1}^{t_2} f(x) . dt = S . (x_2 - x_1)$$

$$\frac{1}{x_2 - x_1} . \int_{x_1}^{x_2} f(x) . dt = S$$

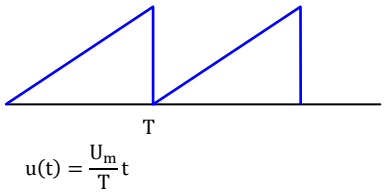


$$U_{STŘ} = \frac{1}{T}.\int_0^T Um.\sin\omega t\,.dt = \frac{U_m}{T}.\int_0^T \sin\frac{2\pi}{T}t\,.dt = \frac{U_m}{T}.\left[-\cos\frac{2\pi}{T}\right]_0^{2\pi}.\frac{T}{2\pi} =$$

$$= \frac{U_m}{2\pi}.(-1+1) = 0$$



$$U_{STŘ} = \frac{1}{\frac{T}{2}}.\int_0^{\frac{T}{2}} U_m.\sin\omega t\,.dt = \frac{2}{T}.U_m.\left[-\cos\frac{2\pi}{T}t\right]_0^{2\pi}.\frac{T}{2\pi} = \frac{U_m}{\pi}(1+1) = \frac{2}{\pi}.U_m$$



$$U_{STŘ} = \frac{1}{T}.\int_0^T f(t).dt = \frac{1}{T}.\int_0^T \frac{U_m}{T}t.\,dt = \frac{U_m}{T^2}.\int_0^T t.\,dt = \frac{U_m}{T^2}.\left[\frac{t^2}{2}\right]_0^T =$$

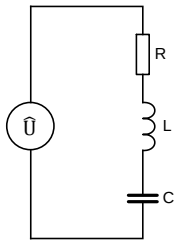
$$= \frac{U_m}{2}$$

Efektivní hodnota

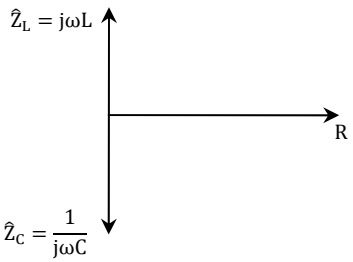
$$U_{ef}.I_{ef}.T = \int_0^T u(t).i(t).dt$$

Rezonance

Napěťová



$$\hat{Z} = R + j\omega L + \frac{1}{j\omega C} = R + j.\underbrace{\left(\omega L - \frac{1}{\omega C}\right)}_{=0}$$



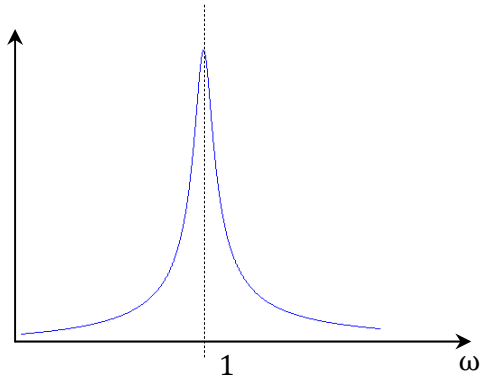
$$\omega L - \frac{1}{\omega C} = 0$$

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

$$\omega^2 LC = 1$$

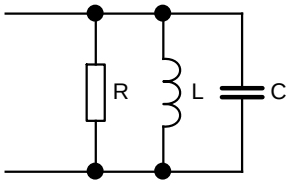
$$\omega = \frac{1}{\sqrt{LC}} \Rightarrow f = \frac{1}{2\pi\sqrt{LC}}$$

$$\hat{I} = \frac{\hat{U}}{R + j.\left(\omega L - \frac{1}{\omega C}\right)}$$



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

Proudová



$$Y = G + j\omega C - j.\frac{1}{\omega L} = G + j.\left(\omega C - \frac{1}{\omega L}\right)$$

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