

МОЩНОСТИ

$$\begin{aligned}
 P &= \frac{1}{T} \int_0^T p dt = \frac{1}{T} \int_0^T u i dt = \\
 &= \frac{1}{T} \int_0^T (U_0 + u_1 + u_2 + \dots) (I_0 + i_1 + i_2 + \dots) dt = \\
 &= \underbrace{\sum_{k=0}^{\infty} \frac{1}{T} \int_0^T u_k i_k dt}_{\text{}} + \underbrace{\sum_{\substack{m=0 \\ n=0}}^{\infty} \frac{1}{T} \int_0^T u_m i_n dt}_{\text{}} = 0, \quad (m \neq n).
 \end{aligned}$$

$$P = P_0 + \sum_{k=1}^{\infty} P_k = U_0 I_0 + \sum_{k=1}^{\infty} U_k I_k \cos \varphi_k,$$

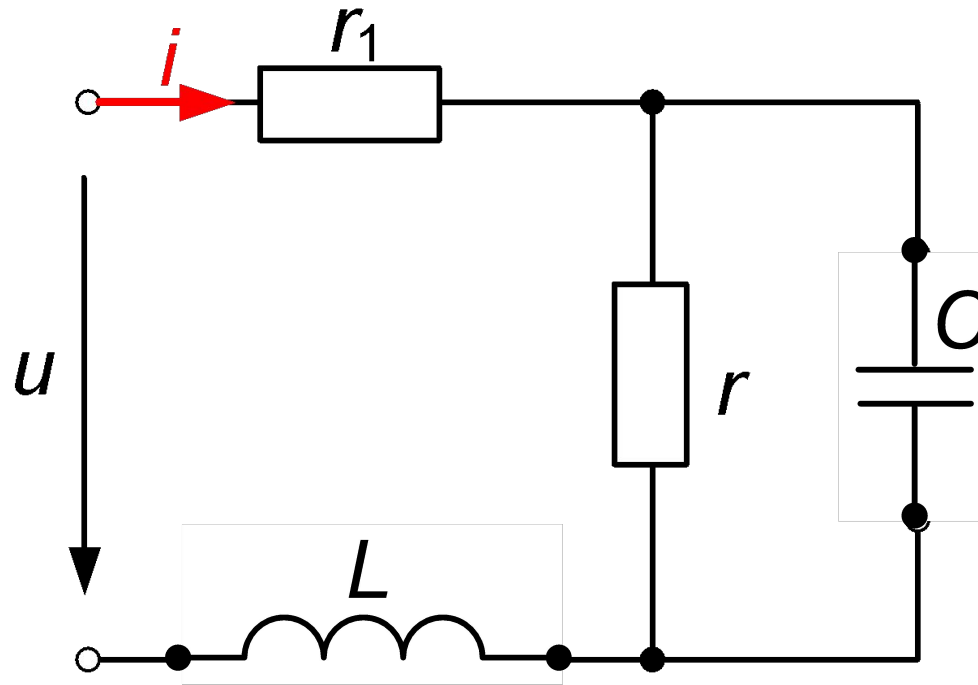
$$Q = \sum_{k=1}^{\infty} U_k I_k \sin \varphi_k$$

$$S = UI$$

$$\lambda = \frac{P}{S}$$

$$K_{\text{НС } u} = \frac{\sqrt{\sum_{i=2}^{\infty} U_i^2}}{U_1} \quad K_{\text{НС } i} = \frac{\sqrt{\sum_{i=2}^{\infty} I_i^2}}{I_1}$$

Пример расчёта



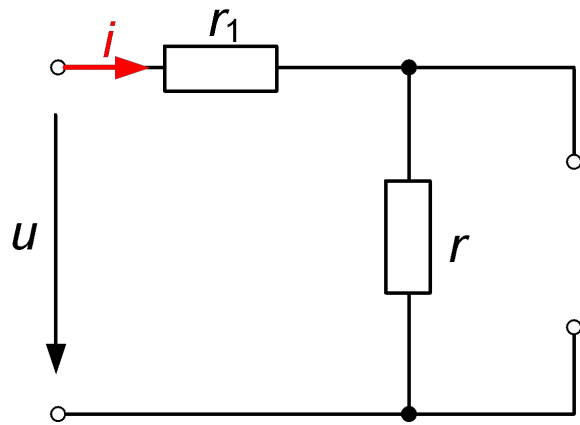
$$u(\text{В}) = 30 + 20\sqrt{2} \sin \omega t + 5\sqrt{2} \sin (3\omega t + 45^\circ),$$

$$r_1 = 5 \text{ М};$$

$$x_L = 10 \text{ М};$$

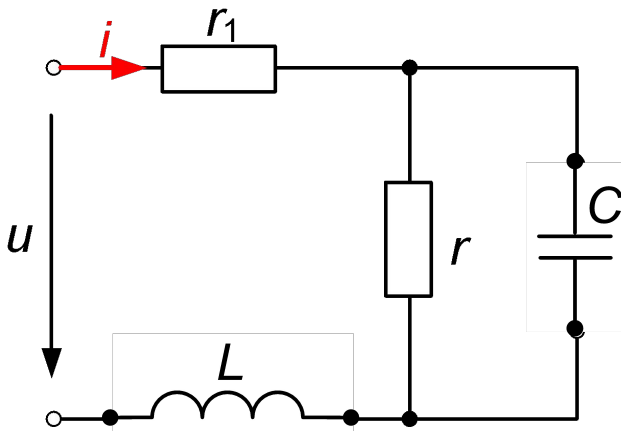
$$r = 10 \text{ М};$$

$$x_C = 10 \text{ М}.$$



$$Z_0 = r_0 = r_1 + r = 0,5 \text{ M};$$

$$I_0 = \frac{U_0}{r_0} = \frac{30}{15} = 2 \text{ A};$$



$$Z_1 = r_1 + \frac{r(-jx_C)}{r - jx_C} + jx_L;$$

$$Z_3 = r_1 + \frac{r\left(-\frac{jx_C}{3}\right)}{r - \frac{jx_C}{3}} + 3jx_L;$$

$$\begin{aligned}
 Z_1 &= 5 + \frac{10(-j10)}{10 - j10} + j10 = \\
 &= 5 + \frac{100e^{-j90^\circ}}{14,14e^{-j45^\circ}} + j10 = \\
 &= 5 + 7,07e^{-j45^\circ} + j10 = 5 + 5 - j5 + j10 = \\
 &= 10 + j5 = 11,18e^{j26,6^\circ};
 \end{aligned}$$

$$I_1 = \frac{\dot{U}_1}{Z_1} = \frac{20e^{j0^\circ}}{11,18e^{j26,6^\circ}} = 1,79e^{-j26,6^\circ}.$$

$$\begin{aligned}
 Z_3 &= 5 + \frac{10(-j10/3)}{10 - j10/3} + j10 \cdot 3 = \\
 &= 5 + \frac{33,33e^{-j90^\circ}}{10,54e^{-j18,43^\circ}} + j30 = \\
 &= 5 + 3,16e^{-j71,6^\circ} + j30 = 5 + 1 - j3 + j30 = \\
 &= 6 + j27 = 27,66e^{j77,5^\circ};
 \end{aligned}$$

$$I_3 = \frac{\dot{U}_3}{Z_3} = \frac{5e^{j45^\circ}}{27,66e^{j77,5^\circ}} = 0,18e^{-j32,5^\circ}.$$

$$i = i_0 + i_1 + i_3;$$

$$i_0 = I_0 = 2 \text{ A};$$

$$I_1 = 1,79 e^{-j26,6^\circ}; \rightarrow i_1 = 1,79\sqrt{2} \sin(\omega t - 26,6^\circ),$$

$$I_3 = 0,18 e^{-j32,5^\circ}; \rightarrow i_3 = 0,18\sqrt{2} \sin(3\omega t - 32,5^\circ),$$

$$i = 2 + 1,79\sqrt{2} \sin(\omega t - 26,6^\circ) + 0,18\sqrt{2} \sin(3\omega t - 32,5^\circ),$$