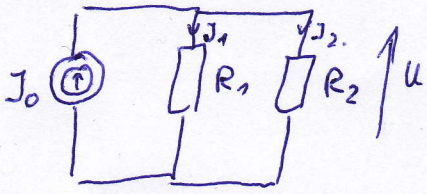


Kolokwium 2, zadanie 2, grupa A

Rozwiązanie:

Analiza dla $\omega = 0$ 1p



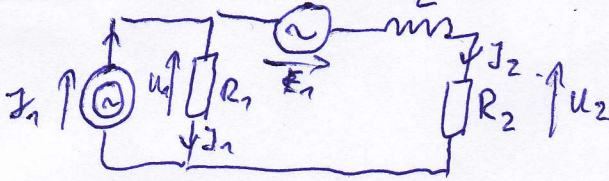
$$J_1 = \frac{J_0}{2}, J_2 = \frac{J_0}{2}$$

$$u = J_1 \cdot R_1 = J_2 \cdot R_2$$

$$P_1^{(0)} = u \cdot J_1 = J_1^2 \cdot R_1 = \frac{J_0^2}{4} \cdot R_1 = \frac{4}{4} \cdot 0,5 = 0,5 \text{ mW}$$

$$P_2^{(0)} = u \cdot J_2 = J_2^2 \cdot R_2 = \frac{J_0^2}{4} \cdot R_2 = 0,5 \text{ mW}$$

Analiza dla $\omega = \omega_0$ 3p



$$P_1^{(1)} = \frac{1}{2} \operatorname{Re}\{u_1 \cdot J_1^*\} = \frac{1}{2} |J_1|^2 \cdot R_1, \quad P_2^{(1)} = \frac{1}{2} |J_2|^2 \cdot R_2$$

$$\begin{cases} J_1 = J_2 \Rightarrow J_1 = J_2 \\ J_1 \cdot R_1 + E_1 = J_2 (R_2 + j\omega_0 L) \end{cases}$$

$$(J_1 - J_2) R_1 + E_1 = J_2 (R_2 + j\omega_0 L) \Rightarrow J_2 = \frac{J_1 R_1 + E_1}{R_1 + R_2 + j\omega_0 L}$$

$$J_2 = \frac{2 \cdot 10^{-3} \cdot 500 + 5}{1000 + j10^6 \cdot 10^{-3}} = \frac{1 + 5j}{1000 + j1000} = \frac{1 + 5j}{1 + j} \cdot 10^{-3} = \frac{(1 + 5j)(1 - j)}{2} \cdot 10^{-3} = \frac{1 - j + 5 - 5j}{2} \cdot 10^{-3} = 3 - j3 \text{ mA}$$

$$J_1 = J_2$$

$$J_1 = (2 - 3 + j3) \text{ mA} = -1 + j3 \text{ mA}$$

~~$$P_1^{(1)} = \frac{1}{2} (|1 + 5j|)^2 \cdot 500 \mu\text{W} = 250 (10)^2 \mu\text{W} \quad P_2 = \frac{1}{2} (|3 + 5j|)^2 \cdot 500 \mu\text{W} = 750 (10)^2 \mu\text{W}$$~~

$$P_1^{(1)} = \frac{1}{2} |J_1|^2 \cdot R_1 = \frac{1}{2} \cdot 10 \cdot 500 \mu\text{W} = 2,5 \text{ mW}$$

$$P_2 = \frac{1}{2} |J_2|^2 \cdot R_2 = \frac{1}{2} \cdot 18 \cdot 500 \mu\text{W} = 4,5 \text{ mW}$$

Analiza dla $\omega = 2\omega_0$ 3p



$$R_1 = R_2$$

$$P_1^{(2)} = \frac{1}{2} |J_2|^2 \cdot R_1 = P_2^{(2)} \text{ gdyż } R_1 = R_2$$

$$J_2 = \frac{E_2}{2R + j2\omega_0 L} = \frac{10}{1000 + j2000} = \frac{10 \cdot 10^{-3}}{1 + j2} = \frac{1 - j2}{\sqrt{5}} \cdot 10 \cdot 10^{-3} = (2 - j4) \text{ mA}$$

Odp:

$$|J_2| = \sqrt{4 + 16} = \sqrt{20} = 2\sqrt{5} \text{ mA}$$

$$P_1^{(2)} = P_2^{(2)} = \frac{1}{2} \cdot 4 \cdot 5 \cdot 500 \mu\text{W} = 5 \text{ mW}$$

$$P_1 = 0,5 \text{ mW} + 2,5 \text{ mW} + 5 \text{ mW} = 8 \text{ mW}$$

$$P_2 = 0,5 \text{ mW} + 4,5 \text{ mW} + 5 \text{ mW} = 10 \text{ mW}$$