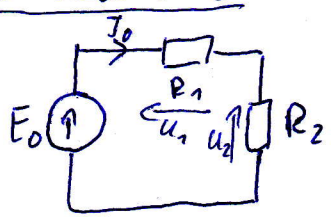
Kolokwium 2, zadanie 2, grupa C

Rozwiązanie:

Analiza dla $\omega = 0$

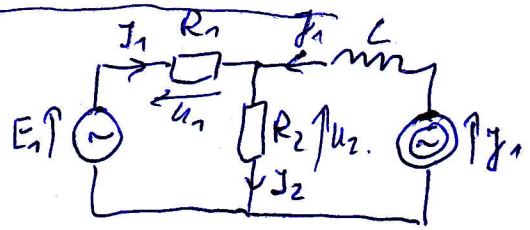


$R = R_1 = R_2$

$u_1 = u_2 = \frac{E_0}{2}$

$P_1^{(0)} = P_2^{(0)} = u_1 \cdot J_0 = u_2 \cdot J_0 = \frac{u_1^2}{R} = \frac{E_0^2}{4R} = \frac{64}{4 \cdot 2 \cdot 10^3} = 8\,mW$

Analiza dla $\omega = \omega_0$



$J_2 = J_1 + j_1$

$E_1 = J_1 R_1 + J_2 R_2$

$E_1 = J_1 R_1 + J_1 R_2 + j_1 R_2 \Rightarrow J_1 = \frac{E_1 - j_1 R_2}{R_1 + R_2} = \frac{4 - 2 \cdot 10^3 \cdot 4 \cdot 10^{-3}}{4 \cdot 10^3} = \frac{-4}{4} \cdot 10^{-3} = -1\,mA$

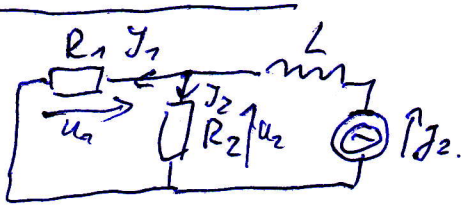
$J_2 = -1\,mA + 4\,mA = 3\,mA$

$|J_1| = 1\,mA \qquad |J_2| = 3\,mA$

$P_1^{(1)} = \frac{1}{2} Re\{J_1 \cdot U_1^*\} = \frac{1}{2} |J_1|^2 \cdot R_1 = \frac{1}{2} \cdot 10^{-6} \cdot 2 \cdot 10^3 = 1\,mW$

$P_2^{(1)} = \frac{1}{2} Re\{U_2 \cdot J_2^*\} = \frac{1}{2} |J_2|^2 \cdot R_2 = \frac{1}{2} \cdot 9 \cdot 10^{-6} \cdot 2 \cdot 10^3 = 9\,mW$

Analiza dla $\omega = 2\omega_0$



$u_1 = u_2 \qquad J_1 = J_2 = \frac{j_2}{2}$

$P_1^{(2)} = P_2^{(2)}$ – gdyż $R_1 = R_2$ i $J_1 = J_2$.

$P_1^{(2)} = P_2^{(2)} = \frac{1}{2} |J_1|^2 \cdot R = \frac{1}{2} \cdot \frac{j_2^2}{4} \cdot R = \frac{1}{8} \cdot 4 \cdot 10^{-6} \cdot 2 \cdot 10^3 = 1\,mW$

$P_1 = P_1^{(0)} + P_1^{(1)} + P_2^{(1)} = 8\,mW + 1\,mW + 1\,mW = 10\,mW$

$P_2 = P_2^{(0)} + P_2^{(2)} + P_2^{(2)} = 8\,mW + 9\,mW + 1\,mW = 18\,mW$