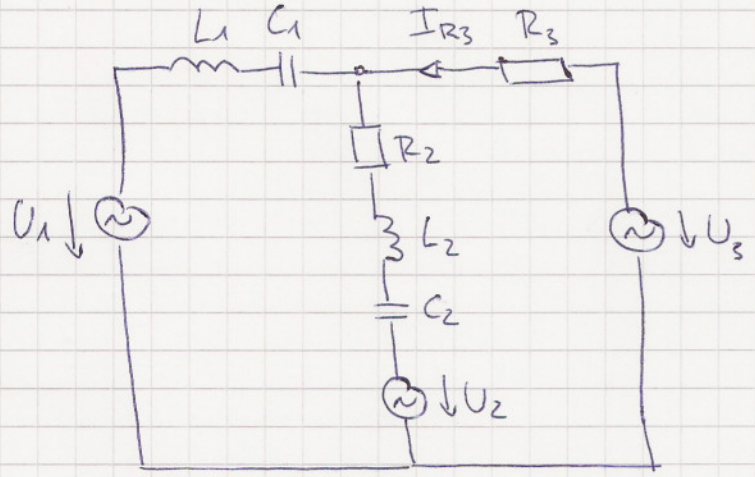
G.

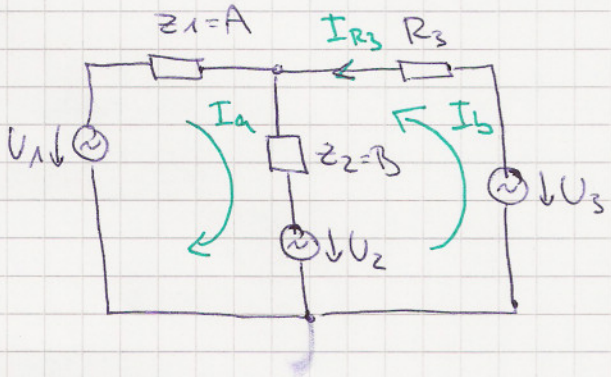


Platí: $u_1 = U_1 \sin(\omega t)$
$u_2 = U_2 \cdot \sin(\omega t)$
$u_3 = U_3 \cdot \sin(\omega t)$

$U_1 = 10\,V,\ U_2 = 1\,V,\ U_3 = 5\,V$
$\omega = 50\ rad/s,\ R_2 = 0{,}5\,\Omega$
$R_3 = 0{,}5\,\Omega,\ C_1 = C_2 = 0{,}002\,F$
$L_1 = L_2 = 0{,}02\,H$

Určete I_{R3} ve tvaru $I_{R3} = A + jB$

Obvod zjednodušíme tak, že spočítáme impedanci z_1 a z_2:



$$z_1 = j\omega L_1 + \frac{1}{j\omega C_1} = j \cdot 50 \cdot 0{,}02 + \frac{1}{j \cdot 50 \cdot 0{,}002} = j + \frac{1}{0{,}1j} = j - 10j = -9j = A$$

$$z_2 = j\omega L_2 + \frac{1}{j\omega C_2} + R_2 = j \cdot 50 \cdot 0{,}02 + \frac{1}{j \cdot 50 \cdot 0{,}002} + \frac{1}{2} = -9j + \frac{1}{2} = B = A + \frac{1}{2}$$

V obvodu vyznačíme smyčkové proudy I_a, I_b. Platí $I_{R3} = I_b$
Pomocí II. K.Z. vyjádříme každou smyčku v rovnici:

$$A \cdot I_a + (I_a + I_b) B + U_2 - U_1 = 0$$
$$R_3 \cdot I_b + (I_b + I_a) B + U_2 - U_3 = 0$$

$$I_a \cdot (A+B) + I_b \cdot B = U_1 - U_2 = 10 - 1 = 9$$
$$I_a \cdot B + I_b \cdot (B + R_3) = U_3 - U_2 = 5 - 1 = 4$$

Spočítáme determinant: $D = \begin{vmatrix} A+B & B \\ B & (B+R_3) \end{vmatrix} = (A+B)(B+R_3) - B^2$

Pomocí Cramerova pravidla spočítáme proud I_b:

$$I_b = \frac{\begin{vmatrix} A+B & 9 \\ B & 4 \end{vmatrix}}{D} = \frac{(A+B) \cdot 4 - 9B}{(A+B)(B+R_3) - B^2} = \frac{4A + 4B - 9B}{AB + AB + \frac{1}{2}A + B^2 + \frac{1}{2}B - B^2} = \frac{4A - 5B}{AB + \frac{1}{2}(A+B)}$$

Dosadíme za $B = A + \frac{1}{2}$

$$I_b = \frac{4A - 5 \cdot (A + \frac{1}{2})}{A \cdot (A + \frac{1}{2}) + \frac{1}{2}(A + A + \frac{1}{2})} = \frac{-A - \frac{5}{2}}{A^2 + \frac{1}{2}A + \frac{1}{2} \cdot 2A + \frac{1}{4}} = \frac{-A - \frac{5}{2}}{A^2 + \frac{3}{2}A + \frac{1}{4}}$$

Dosadíme $A = -9j$

$$I_b = \frac{-(-9j) - \frac{5}{2}}{(-9j)^2 + \frac{3}{2}(-9j) + \frac{1}{4}} = \frac{9j - \frac{5}{2}}{-81 - \frac{27}{2}j + \frac{1}{4}} = \boxed{\frac{-36j + 10}{54j + 323}} \cdot \frac{(54j - 323)}{(54j - 323)} =$$

$$= \frac{1944 + 12168j - 3230}{54^2 + 323^2} \doteq \underline{-0{,}011991235 + 0{,}113459835\,j}$$