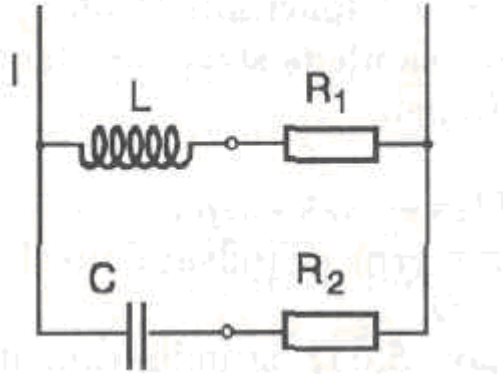
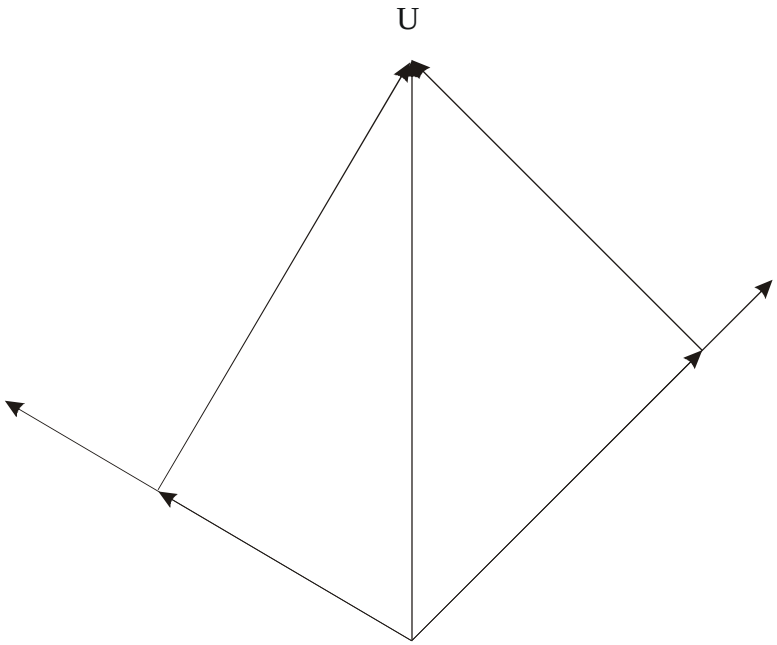
6.102

I den viste parallelforbindelse er $R_1 := 1800\,\Omega$ og $R_2 := 1500\,\Omega$,

L er en ideel induktiv reaktans på $L := 0.2\cdot H$ og C er en tabsfri kondensator.

Klemmerne a og b er sluttet til en vekselspænding $U := 5\cdot V$ med frekvens $f := 1000\,Hz$





Beregn de værdier af kondensatorens kapacitans C, som vil medføre, at den samlede strøm I er i fase med spændingen U.

$$I_{wl2} = I_{wl1}$$

$$\frac{U}{Z_2}\cdot\sin\left(\phi_2\right) = \frac{U}{Z_1}\cdot\sin\left(\phi_1\right)$$

$$\frac{U}{\left(\sqrt{R_2^{\,2} + X_c^{\,2}}\right)}\cdot\frac{X_c}{\left(\sqrt{R_2^{\,2} + X_c^{\,2}}\right)} = \frac{U}{Z_1}\cdot\sin\left(\phi_1\right)$$

$$\frac{U}{\left(\sqrt{R_2^{\,2} + X_c^{\,2}}\right)}\cdot\frac{X_c}{\left(\sqrt{R_2^{\,2} + X_c^{\,2}}\right)} = \frac{U}{Z_1}\cdot\sin\left(\phi_1\right)$$

$$\frac{1}{\left[\sqrt{R_1^{\,2} + \left(2\cdot\pi\cdot f\cdot L\right)^2}\right]}\cdot\sin\left(\phi_1\right)\cdot\left(R_2^{\,2} + X_c^{\,2}\right) - X_c = 0$$

$$\left[\frac{1}{\left[\sqrt{R_1^{\,2} + \left(2\cdot\pi\cdot f\cdot L\right)^2}\right]}\cdot\sin\left(\phi_1\right)\right]\cdot X_c^{\,2} - X_c + \left[\frac{1}{\left[\sqrt{R_1^{\,2} + \left(2\cdot\pi\cdot f\cdot L\right)^2}\right]}\cdot\sin\left(\phi_1\right)\right]\cdot R_2^{\,2} = 0$$

$$\left[\frac{1}{\left[\sqrt{R_1^{\,2} + \left(2\cdot\pi\cdot f\cdot L\right)^2}\right]}\cdot\frac{X_L}{\sqrt{X_L^{\,2} + R_1^{\,2}}}\right]\cdot X_c^{\,2} - X_c + \left[\frac{1}{\left[\sqrt{R_1^{\,2} + \left(2\cdot\pi\cdot f\cdot L\right)^2}\right]}\cdot\frac{X_L}{\sqrt{X_L^{\,2} + R_1^{\,2}}}\right]\cdot R_2^{\,2} = 0$$

$$\left[\frac{1}{\left[\sqrt{R_1{}^2+(2\cdot\pi\cdot f\cdot L)^2}\right]}\cdot\frac{2\cdot\pi\cdot f\cdot L}{\sqrt{(2\cdot\pi\cdot f\cdot L)^2+R_1{}^2}}\right]\cdot X_c{}^2 - X_c + \left[\frac{1}{\left[\sqrt{R_1{}^2+(2\cdot\pi\cdot f\cdot L)^2}\right]}\cdot\frac{2\cdot\pi\cdot f\cdot L}{\sqrt{(2\cdot\pi\cdot f\cdot L)^2+R_1{}^2}}\right]\cdot R_2{}^2 = 0$$

$$a := \frac{1}{\left[\sqrt{R_1{}^2+(2\cdot\pi\cdot f\cdot L)^2}\right]}\cdot\frac{2\cdot\pi\cdot f\cdot L}{\sqrt{(2\cdot\pi\cdot f\cdot L)^2+R_1{}^2}}$$

$$b := -1$$

$$c := \left[\frac{1}{\left[\sqrt{R_1{}^2+(2\cdot\pi\cdot f\cdot L)^2}\right]}\cdot\frac{2\cdot\pi\cdot f\cdot L}{\sqrt{(2\cdot\pi\cdot f\cdot L)^2+R_1{}^2}}\right]\cdot R_2{}^2$$

$a = 2.608\times 10^{-4}\,S$

$c = 586.71\,\Omega$

$$X_{c1} := \frac{\left(-b-\sqrt{b^2-4\cdot a\cdot c}\right)}{2\cdot a}$$

$X_{c1} = 723.026\,\Omega$

$$X_{c2} := \frac{\left(-b + \sqrt{b^2 - 4 \cdot a \cdot c}\right)}{2 \cdot a}$$

$$X_{c2} = 3.112 \times 10^{3}\,\Omega$$

$$C_1 := \frac{1}{2 \cdot \pi \cdot f \cdot X_{c1}}$$

$$C_1 = 220.123 \times 10^{-9}\,F$$

$$C_2 := \frac{1}{\left(2 \cdot \pi \cdot f \cdot X_{c2}\right)}$$

$$C_2 = 51.144 \times 10^{-9}\,F$$