

TASK 1 – FIRST FIELD OF WORK

An independent voltage generator of electromotive force acts in the electric circuit shown at Fig. 1, $e(t) = 4h(t)$ [V],

$$\text{or } e(t) = \begin{cases} 4 & \text{for } t \geq 0_+ \\ 0 & \text{for } t \leq 0_- \end{cases} \text{ [V].}$$

The following values are known: $R = 2\Omega$, $C_1 = 2$, $C_2 = 1$, $a = 3$. Condenser capacities are given as normed values per time.

Determine the time function of the voltage change on the condenser C_1 , $u_{C1}(t)$, accordingly $u_{C1}(t)$ for $t \geq 0$.

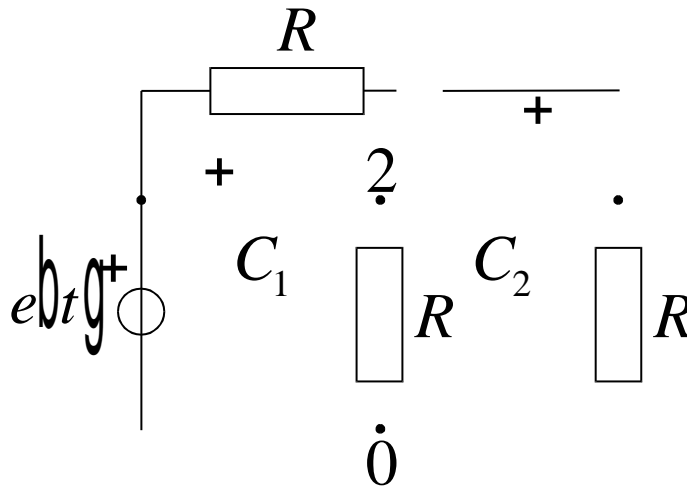


Fig. 1

$h(t)$ – Heaviside function

TASK 2 – SECOND FIELD OF WORK

An independent complex-periodical voltage generator acts on the entrance of the circuit shown on Fig. 2.

$$u(t) = 192\sqrt{2} \sin\left(\omega t + \frac{\pi}{3}\right) + 96\sqrt{2} \sin 3\omega t \text{ V.}$$

The resistivity of the resistor R is $R = 20\Omega$, and the absolute values of inductivity reactance L_1 and L_2 for fundamental circular frequency ω : $X_{L1} = \omega L_1 = 30\Omega$, $X_{L2} = \omega L_2 = 15\Omega$.

- Determine the absolute reactance values of the marked condensers C_0, C_1, C_2 and the inductivity L for the fundamental circular frequency ω , if the time function of the current through the generator is in the form $i(t) = I^{(1)}\sqrt{2} \sin \omega t$ [A] and it does not depend on the resistivity of the resistor R_0 .
- Calculate the reactive forces at marked condensers C_0, C_1, C_2 .

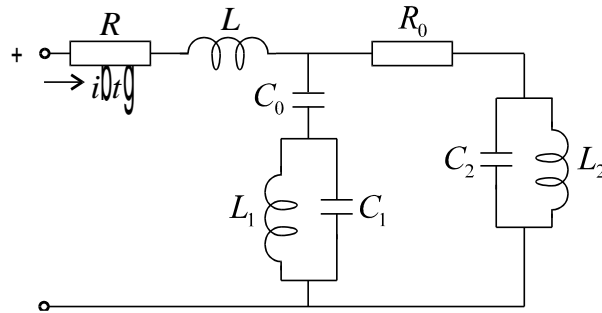


Fig 2

TASK 3 – THRID FIELD OF WORK

A simple-periodic voltage generator with a known circular frequency ω , $e_g(t) = \sqrt{2} \cdot E_g \sin \omega t = \sqrt{2} \cdot 220 \sin \omega t$ V, is used for supplying power to two consumers with known impedances for the given circular frequency ω :

$$Z_{p3} = R_3 + jX_3 = 600 + j1200 \Omega \text{ and } Z_{p5} = R_5 - jX_5 = 300 - j400 \Omega.$$

The power supply is performed over the homogenous power line without any loss of characteristics (Z_{c1}, λ_1) , $Z_{c1} = 264 \Omega$, of length d_1 . The inner impedance of the generator is set to the value $Z_g = Z_{c1} = 264 \Omega$.

As it is shown on Fig. 3, the two condensers are used for adjusting the mode of work, with absolute reactance values $X_{C1} = \frac{1}{\omega C_1}$ and $X_{C2} = \frac{1}{\omega C_2}$, and the power line without a loss of characteristics (Z_{c2}, λ_2) , $Z_{c2} = 500 \Omega$, of length $d_2 = \frac{\lambda_2}{4}$.

Note: the adjusted mode of work means that on the power line $(1,1')-(2,2')$ there are no reflected waves.

Calculate the active and reactive power of the consumers Z_{p3} and Z_{p5} .

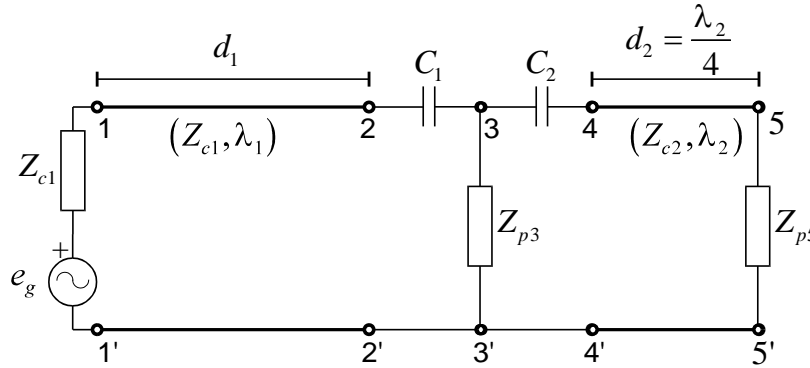


Fig. 3