EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research,
Development and Education

MINISTRY OF EDUCATION,
YOUTH AND SPORTS

ESF II project of the University of West Bohemia in Pilsen

reg. č. CZ.02.2.69/0.0/0.0/18_056/0013239

Symmetrization device

Assignment:

Design a symmetrizing device to connect a single-phase resistive load to a three-phase symmetrical network for a specified value of active resistance. The design should be made for
a) star connection
b) into a triangle.

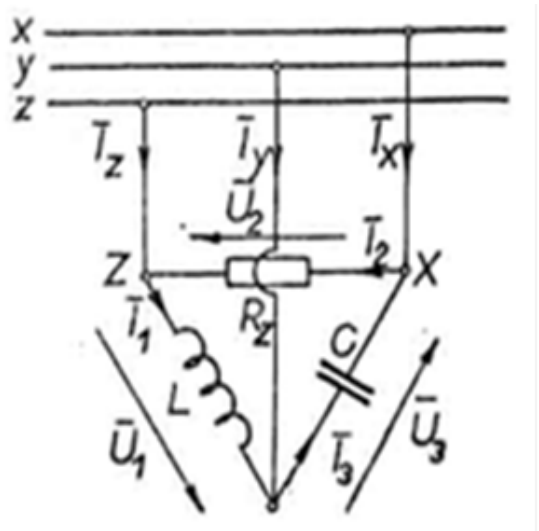
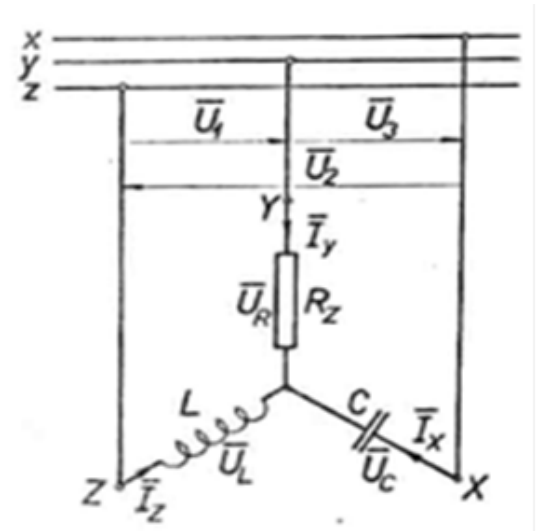
Theoretical analysis:

In practice, loads of different types are connected to the network. One appliance that is connected to the grid is an induction melting furnace. We assume that the furnace is tuned and loads the grid only as an ohmic resistor. Since this is a single-phase load with a significant input power, it is necessary to connect another device to the furnace to ensure a symmetrical load on the three-phase supply network.

These are the symmetrizing inductance Ls and capacitance Cs, which are connected together with the furnace to a three-phase network either in a triangle or in a star.

When the network is uniformly loaded, it is required that the currents in the individual phases are equal and parallel to the respective phase voltages. The correct phase sequence must be used for both connections, since the magnitude of the currents or voltages depends on this sequence.

Wiring diagram:

into a triangle	to the star
	
$= \frac{\sqrt{3}R_Z}{2\pi f}, L_S = \frac{1}{2\pi f\sqrt{3}R_Z}$	$= \frac{R_Z}{2\pi f\sqrt{3}}, L'_S = \frac{\sqrt{3}}{2\pi f R_Z}$

Procedure:

Connect the circuit according to the diagram into a star or triangle (according to the specification, Rz will also be specified). Calculate the inductance and capacitance values for the specified circuit. Connect one ammeter to each branch. Measure the voltages at each element and at the source using a voltmeter. Measure all voltages and currents with the correct phase sequence (symmetrical condition) and then with the incorrect phase sequence (unsymmetrical condition).

Give the measured values and calculate all phasors to construct a phase diagram: phase

diagram for symmetrical and unsymmetrical state

Conclusion: