POLYTECH
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SCIENTIFIC AND TECHNICAL CENTER
OF UNIFIED POWER SYSTEM

Mathematical Modeling and Analysis of Antiresonant Properties of a 35 kV Voltage Measuring Transformer

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The goal of the work and tasks

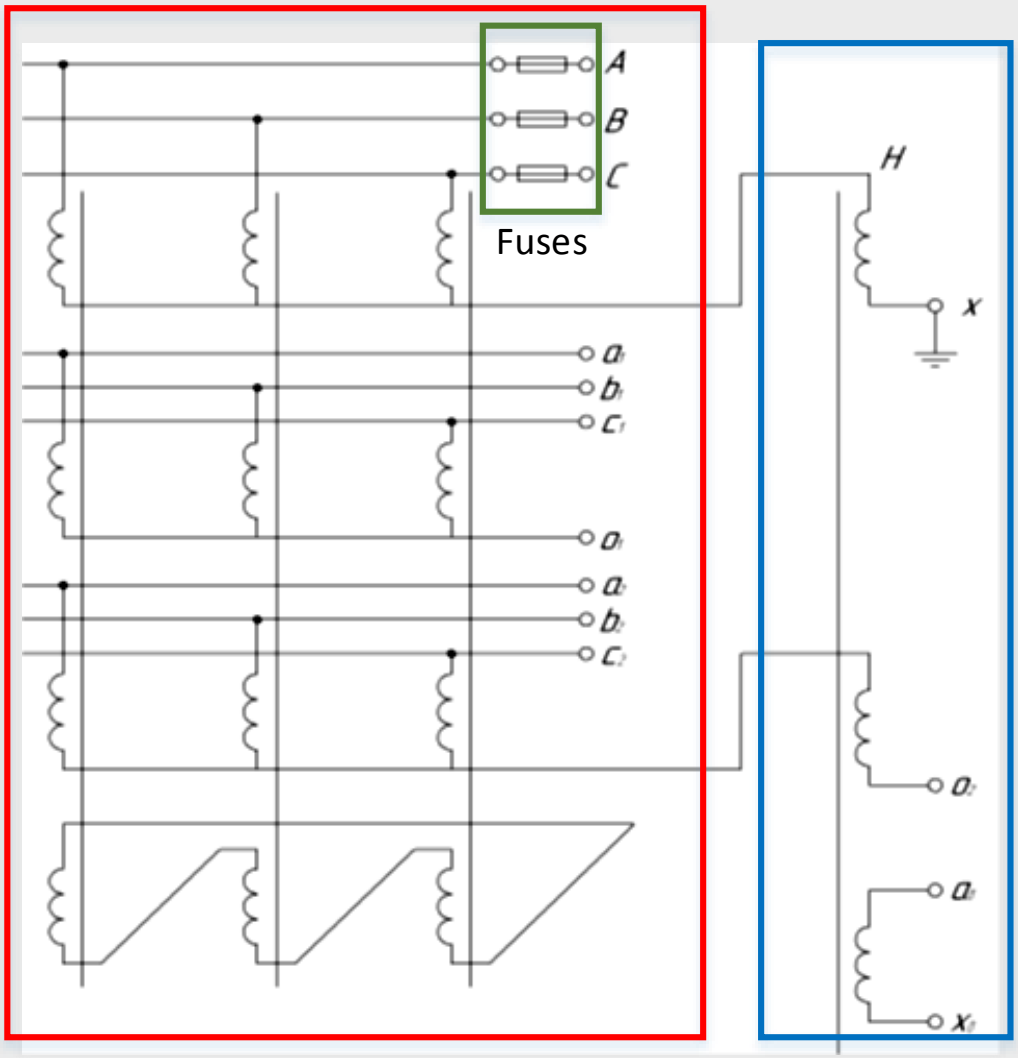
Goal

Determination of possible reasons for the operation of protective fuses of an antiresonant voltage transformer 35 kV.

Tasks

- Creation of a computer model of an antiresonant voltage measuring transformer 35 kV;
- Verification of the computer model;
- Analysis of transient processes for various operating modes of the 35 kV electrical network.

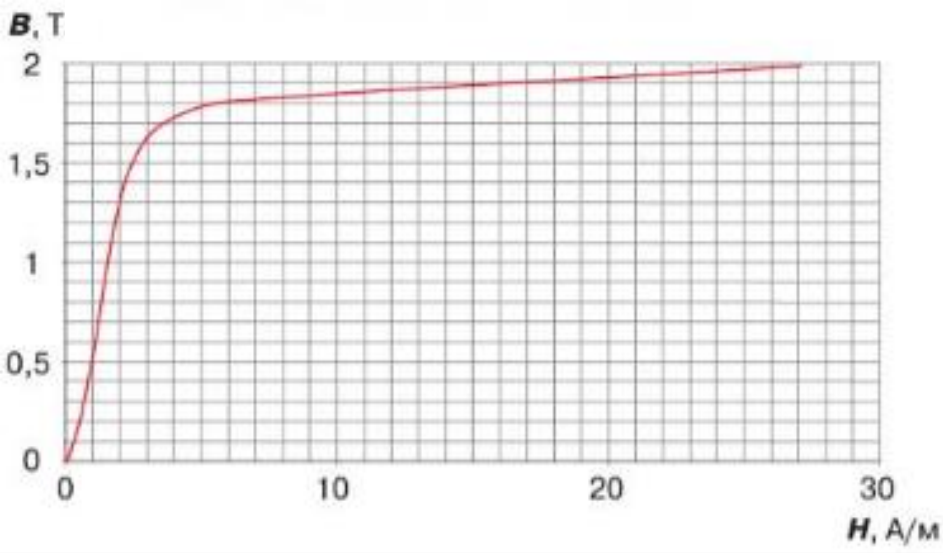
Transformer scheme



Schematic diagram of the transformer (DST - red and ZST - blue)

Creation of a computer model

Magnetic resistance of a section of a magnetic circuit :



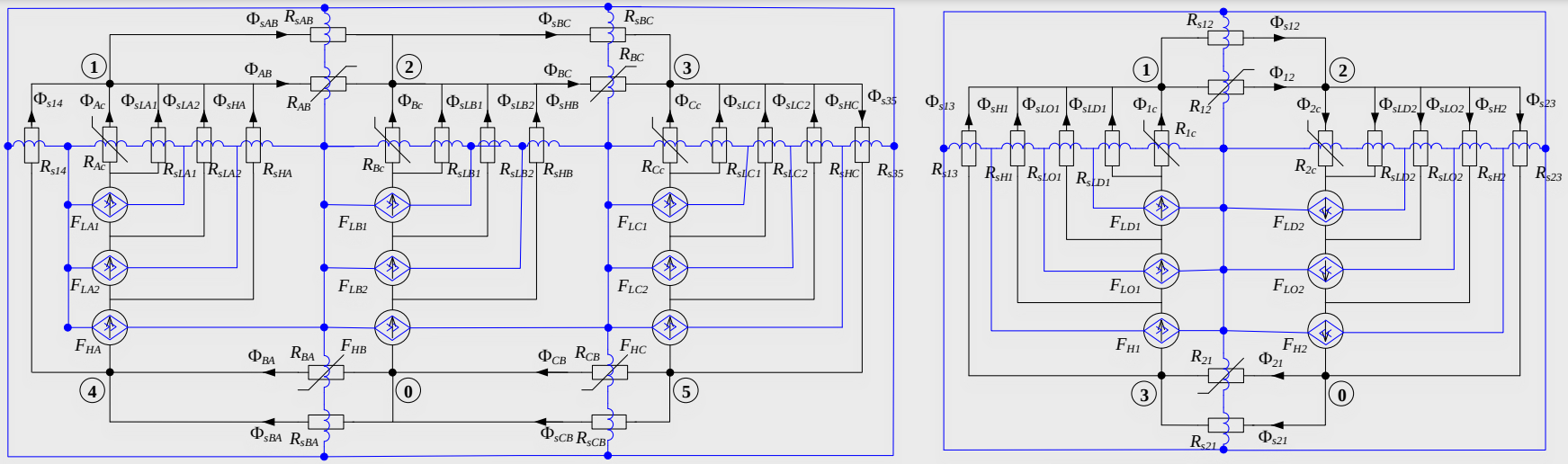
Magnetization Curve of Electrical Steel 3408, 0.3mm Thick

$$R_m = \frac{F}{\Phi} = \frac{l}{S \cdot \mu_0 \cdot \mu}$$

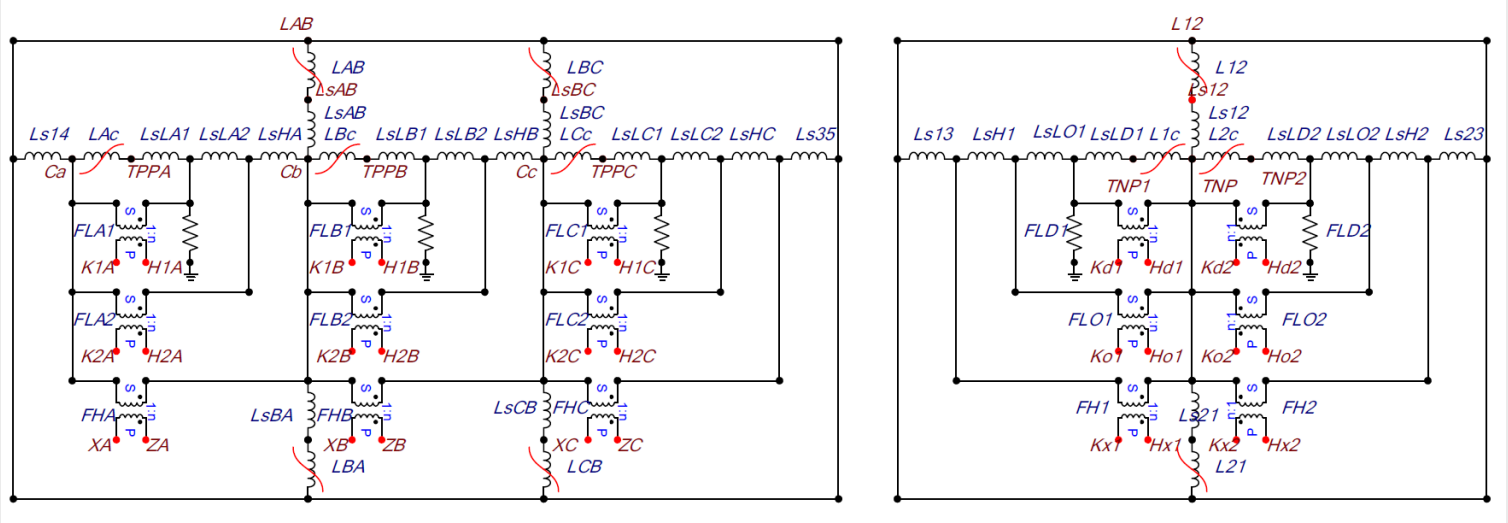
Inductance per turn :

$$L = \frac{w^2}{R_m} = \frac{1}{R_m}$$

Creation of a computer model

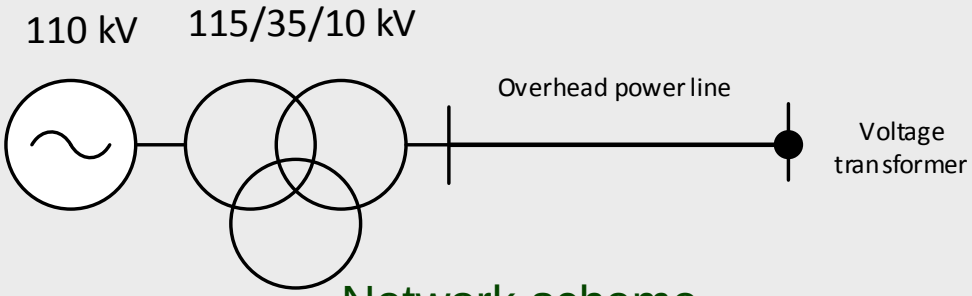


Equivalent circuits of magnetic (black) and electric (blue) circuits of DST (left) and ZST (right)



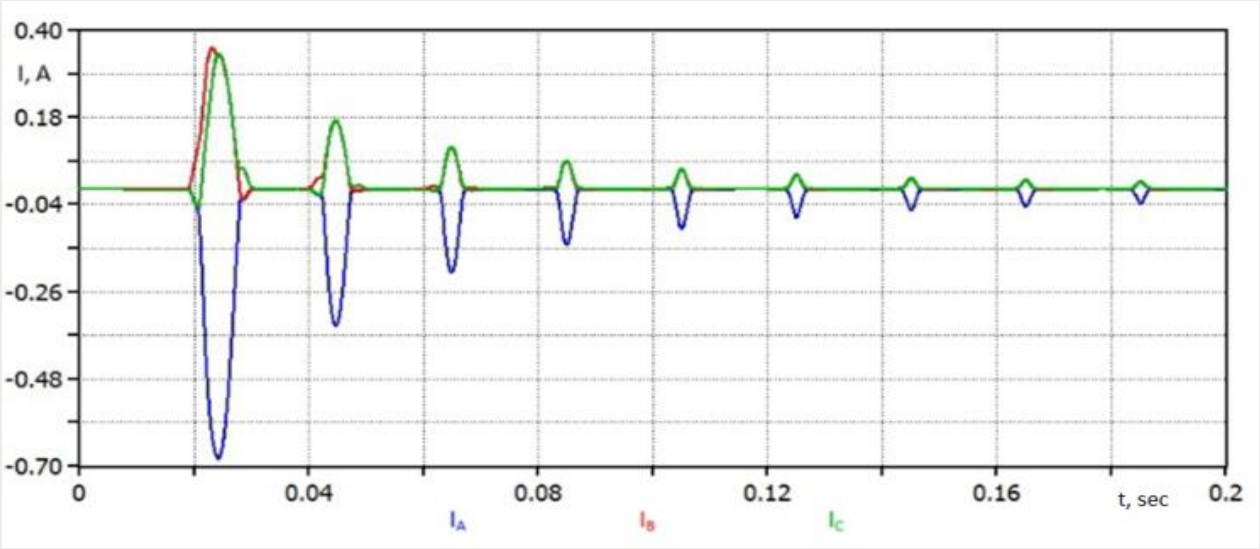
Computer model of a transformer in EMTP with ATPDraw GUI

Transient analysis



Network scheme

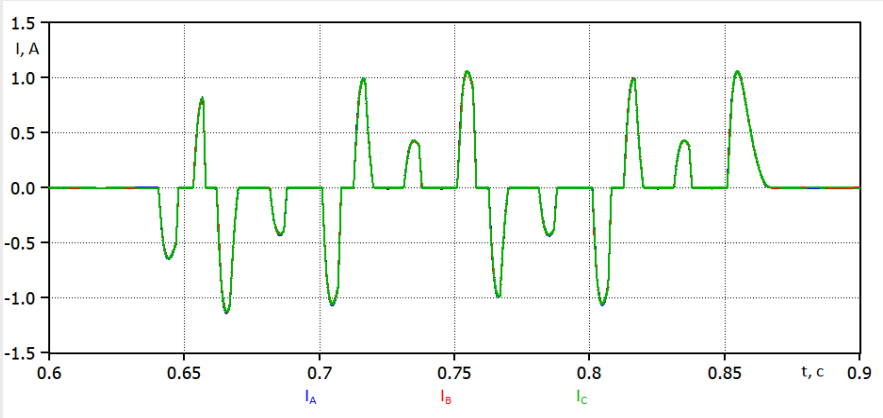
The value of the ground fault current in this network is 1.7 A



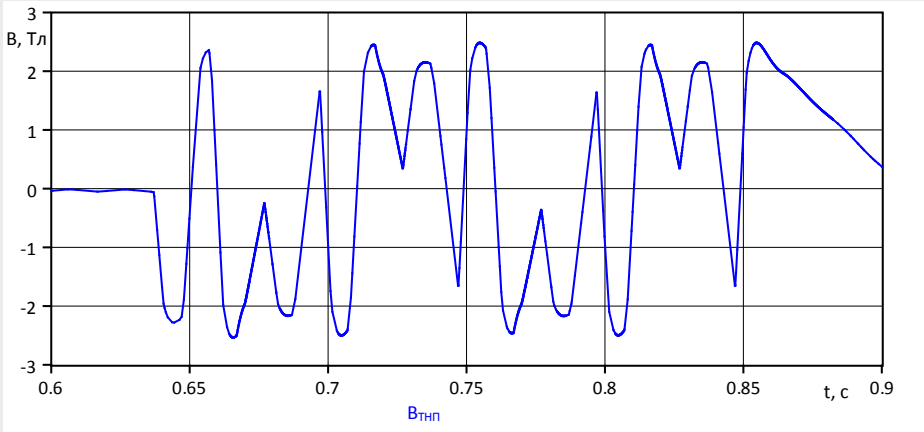
Input surge current in primary windings

The maximum current was 685 mA, which exceeds the fuse's rated current (300 mA)

Long single-phase ground fault with an interleaved arc



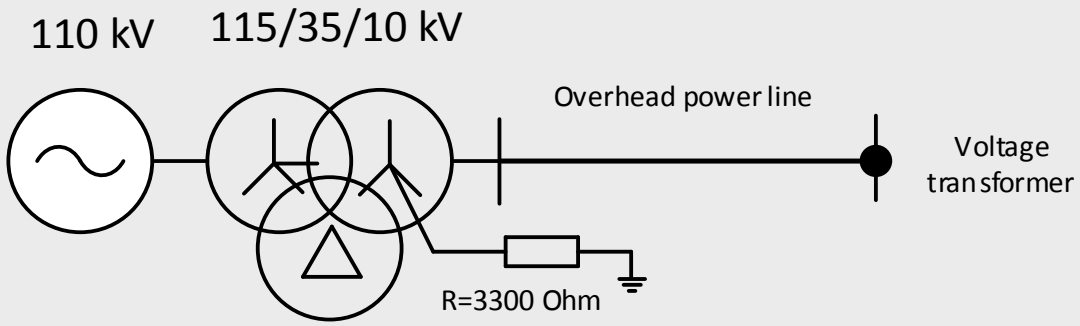
VT primary current



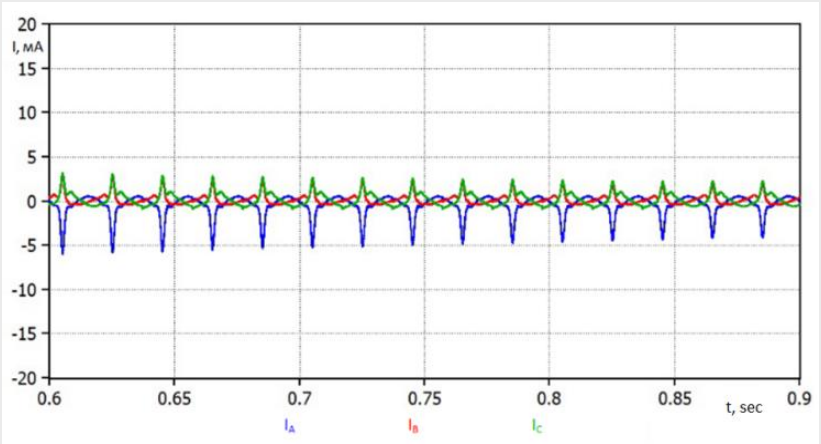
Flux density in ZST

Transient analysis

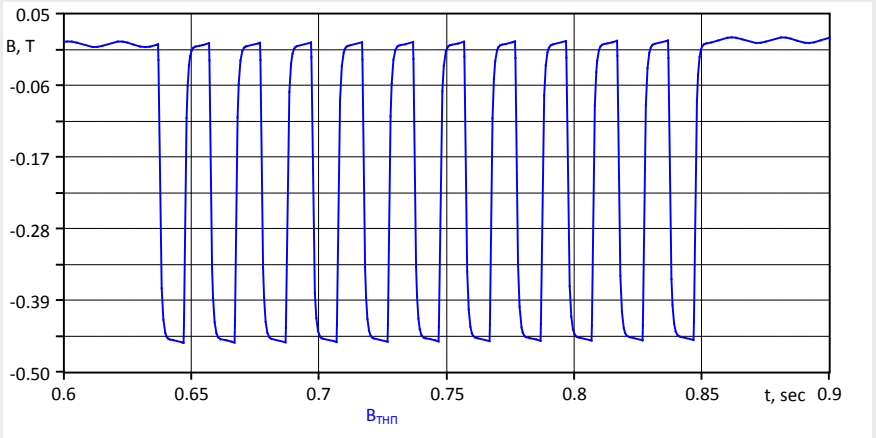
Long single-phase ground fault with an interleaved arc with high-resistance neutral grounding



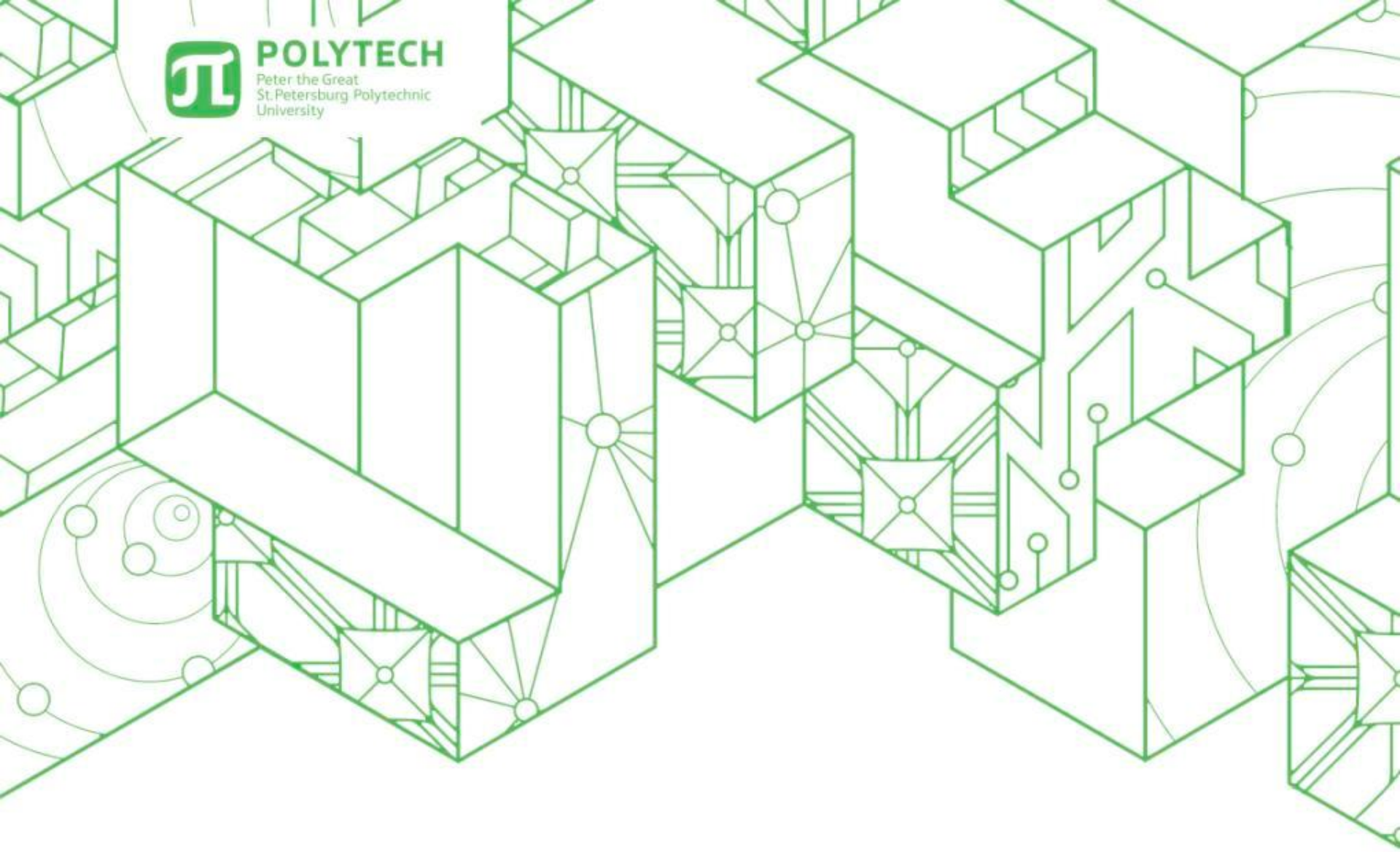
Network scheme with high-resistance neutral grounding



VT primary current



Flux density in ZST



Thank you for your attention!