

MATHEMATICAL MODEL OF A NOM-10 VOLTAGE TRANSFORMER FOR FREQUENCIES OF THE FREE COMPONENT OF INTERNAL POWER SYSTEM OVERVOLTAGE

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The phenomenon of internal resonance causes the necessity of changes in approaches to choosing of insulation of electrical equipment with high-voltage windings and methods of justification of rated overvoltage on its elements. Major overvoltages are not those that affect the electrical equipment from power system, but those that appear on elements of equipments insulation because of internal resonance. It follows the need to create mathematical models of electrical equipment which could adequately reproduce processes in equipment under influence of free component of internal overvoltages with frequencies 50 - 100000 Hz.

The considered object is a NOM-10 voltage transformer, which has an additional (handmade) lead from the middle of the high-voltage winding, what allows to study the processes inside the transformer winding, between the winding and the ground (ground insulation) and between two winding leads B1 and B2 (longitudinal insulation).

The mathematical model of a NOM-10 voltage transformer consists of two-terminals, which represent the interconnection between the main transformer parts (winding leads, tank), and the magnetic system model. The structure and the parameters of the two-terminals are defined using experimental frequency characteristics of the relative elements.

Criterion of the mathematical model adequacy is the correspondence of the frequency characteristics of the model elements and the frequency characteristics of the real object elements.

For frequency characteristics estimation, some special test schemes have been designed, each of them contains a minimum amount of two-terminals in action. Low-frequency generator with rated voltage 100 V was used in the tests as the power source with frequencies 50-100000 Hz. Depending the nature of frequency characteristics different types of software were used to synthesize the electrical equivalents for corresponding element.

Two-terminals representing the parts of high-voltage and low-voltage windings have the resonance character and are modelled using series sections of parallel-connected R, C, and L elements. The rest of the two-terminals have capacitive character and is modelled using only capacitance C.

There is a magnetic interconnection through the magnetic core, between the two-terminals of the parts of the high- and low-voltage transformer windings, its voltage-current characteristic is defined experimentally for the voltages from 0 to the rated value (10 kV).