MODELING OF TRANSIENTS IN ELECTRICAL NETWORKS IN PHASE COORDINATES

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Electric networks with a voltage 6-35 kV has a large branching and length. To improve the efficiency of modeling these networks, it is necessary to develop formalized procedures that provide automation of the formation and solution of systems of equations of transient processes. In order to facilitate the development of models are used to move from the real three-phase network to other systems of coordinates. Published works, where modeling for transients studying in distribution networks were used are characterized by the following: during the study of ongoing transient processes, the simplified substitution schemes of networks with the limiting generalization of their parameters are adopted; often involves the automation of the process of solving systems of differential equations only; in the absence of complete models the use of simplified models leads to contradictory results, makes it difficult to assess the effectiveness of various methods and means of limiting currents and overvoltage objectively. The model represents of elements equations in phase coordinates network, instead of the single-phase equivalents. These equations contain the network elements' parameters and parameters of grid's regime that correspond to real physical parameters of power systems.

The following provisions are adopted as the basis methodology for electrical networks under transient conditions mathematical models constructing:

– the decomposition level: three-phase multipoles;

– the electrical network are represented by differential equations in phase coordinates, the numerical integration method: the second-order formula of implicit Gear method;

– the formation of equations system in numerical integration step is performed with the branch current method applied to circuits with multipole elements.

To obtain the equations in phase coordinates the three-phase circuit of an electric network is composed, the elements of which are three-phase longitudinal and transverse branches. Three-phase electric network corresponds to the discrete scheme in step numerical integration of differential equations of the network. The task of simulating transients in the network scheme is reduced to a multiple procedure for finding the current parameters of its mode for each interval of time at which the algebraization of differential equations occurs.

A software implementation of the transient processes mathematical model in electrical networks is performed on the basis of equations in phase coordinates.

The developed mathematical model reflects the inductive and capacitive parameters of the network elements, reproduces the magnitudes of currents and overvoltages. It enables to make a wide range of computational experiments for electromagnetic transients studying at ground faults in electrical networks 6 kV of arbitrary configuration with different modes of neutral and means for surge limitation.