# Determination of High Power Turbogenerator Subtransient Reactances Based on the Analysis of Two-Phase Short-Circuit Non-Symmetrical Waveforms

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## Abstract

In the paper, there is presented a method for determining selected parameters of the synchronous generator circuit model on the basis of the analysis of a high power turbogenerator electromagnetic field at non-symmetrical two-phase short-circuit. Waveforms of currents and voltages of the stator winding in the steady and transient state were determined by the finite element method based on the generator 2D field-circuit model including higher spatial and time harmonics of the magnetic field and the effect of eddy currents in the rotor damping circuits [1]. The used FEM model was experimentally verified. The steady state waveforms at two-phase short-circuit calculated by the FEM method were compared with the waveforms calculated based on analytical dependencies. The analytical dependencies determining the waveforms of currents and voltages for the generator field-circuit model were derived from the machine equations in the coordinate system ($\alpha$, $\beta$, 0) attached to the stator when using the orthogonal coordinate system transformation and the Heaviside operational calculus [2, 3]. There were assumed the constant rotational speed of the rotor and the linear magnetic circuit of the generator. There were neglected the influence of the stator resistance on the waveforms of currents and voltages and the effect of higher spatial harmonics of the magnetic field. The higher time harmonics of the waveforms of the generator stator currents and voltages at two-phase short-circuit (determined based on the FFT analysis) were used to calculate the subtransient reactances in the d and q axis of a 200 MW turbogenerator [4]. The values of the calculated reactances were compared with those determined by other methods.

## References

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