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PSpice modeling of the inrush and fault currents in a 21 MVA HTS transformer

Computer models of superconducting transformers allow for optimal selection and construction, as well as for performing numerical tests, at a time when the performance of laboratory experiments is difficult and would lead to the destruction of the transformer.
The study shows computer models of single-phase transformers with the power of 21 MVA: a conventional one with copper windings and a superconducting one with windings made of 2G HTS tape. The HTS transformer model takes into account the influence of temperature and current on the thermal and electric properties of windings consisting of two kinds of second-generation superconductor tape, differing in the copper stabilizer. Smooth transition of the YBCO superconductor layer to the resistive state is described by means of Rhyner's power law. To consider the non-linear magnetic core of the transformer in the computations a modified Jiles-Atherton model was used.
The proposed models allowed numerical determination of the waveforms and specification of the duration of impulses of the transformer's inrush current, as well as calculation of the heat and temperature increases of the windings during this process. In addition, current, resistance and winding temperature waveforms were determined and compared during operational faults of 21 MVA transformers with copper and superconducting windings.

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