**Modeling of the magnetic field and the current density distributions in superconducting magnetic energy storage systems.**

*Bagan S., Govor V. M., Kalimov A. G.*

The application of superconducting magnetic energy storage (SMES) wounded with high-temperature superconducting tapes of the second-generation (2G HTS) is a promising way to improve the quality of electricity in microgrids due to a number of advantages over traditional energy storage systems. However, to ensure the high efficiency of such energy storage devices, it is necessary to define the limits of their possible operation, which are mainly determined by the parameters of HTS tapes and the design of the SMES. Calculation of these limits of pancake coils operation is a challenging problem. The example of the HTS coil magnetic field modeling is described in this paper. The approach includes the application of the T-A formulation of the electromagnetic problem in combination with the homogenization of the superconducting coil and Kim critical state model. This formulation of the problem makes it possible to obtain the flux density distribution and the current density distribution over coil cross section. Further its analysis allows investigating coil behavior during an exploitation under different conditions.

*Key words: Renewable energy, SMES, HTS tapes, T-A formulation, numerical modeling, hysteresis losses.*