

Development of the Coil Loss Reduction Technique by the Large-Scale Numerical Analysis

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Abstract

This report presents the analysis results of the stranded wire coil obtained by the 3-D finite element method (FEM) using the Earth Simulator.

Recently, the loss reduction of the coil products is demanded for saving of energy and high frequency operation of power supply circuits, etc. In order to reduce the eddy current loss of the coil, the stranded wire (e.g. Litz wire) is used. Thus, the development of the low loss coil products with the best performance of the stranded wire requires the deep knowledge of the eddy current loss mechanisms in the coil.

The FEM simulation is useful for the analysis of the eddy current loss mechanisms. However, the FEM analysis of the 3-D structure of the stranded wire coil by a personal computer is very difficult, because that needs large scale calculation. Therefore, the large-scale FEM analysis of the stranded wire coil using the Earth Simulator has been attempted.

As a result, the fact that the Earth Simulator is able to analyze the 3-D structure of the stranded wire coil in the practical time has been confirmed. Moreover, the loss reduction effect of the stranded wire has been clarified quantitatively.

Keywords: large-scale simulation, finite element method, coil, stranded wire, eddy current