

# 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 coils with magnetic material obtained by the 3-D finite element method (FEM) using the Earth Simulator.

The loss reduction of coil products is an important issue for energy saving and high frequency operation of electric equipments. The reduction of high frequency loss of coil products is attempted by the use of stranded wire and the improvement of magnetic material. The optimization design of coil products requires the deep knowledge of the loss mechanism in the coil because the loss mechanism is very complex.

The FEM simulation is very useful for the analysis of the loss mechanism. However, the FEM analysis of the detailed 3-D structure of coil products is very difficult, because that requires large scale calculation. Therefore, the large-scale FEM analysis of the coils with magnetic material using the Earth Simulator has been attempted.

As a result, the effects of the magnetic substrate on the stranded wire coil have been clarified quantitatively. Moreover, the eddy current flowing in the metal magnetic material has been visualized by the analysis of the toroidal coil with metal magnetic material core.

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