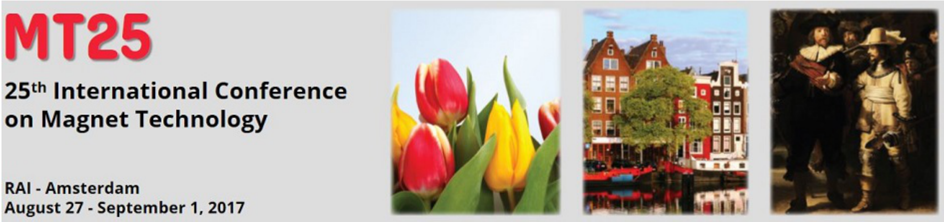

Contribution ID: **388**

Type: **Poster Presentation of 1h45m**

Application of hierarchical matrices to large-scale electromagnetic field analyses of coils wound with coated conductors

Tuesday 29 August 2017 13:15 (1h 45m)

Electromagnetic field analyses of three-dimensional-shape coils wound with coated conductors are necessary for understanding their electromagnetic phenomena, calculating their ac losses, and evaluating their field uniformity and stability. We have been developing a series of models for the numerical electromagnetic field analyses using current vector potentials. In these models, because the coefficient matrix of the linear system derived from the integral equation is dense, the analysis of a large-scale coil requires large amount of memory and long computation time. In this research, we introduce hierarchical matrices (H-matrices) by using the HACApK library in order to reduce both the memory consumption and the computation time: the dense coefficient matrix is decomposed into submatrices, to which low-rank approximation is applied. Memory consumption of the “H-matrix”, which is composed of these approximated submatrices, can be smaller than that of the original matrix. In a pancake coil, for example, a thin coated conductor wound with a small separation should be modelled with layered meshes, and each mesh is often elongated along the conductor. Its elongated edges are much longer than the separation between the layered meshes. In this case, it was found that the conventional low-rank approximation does not work well for the submatrices near the diagonal component of the original matrix. We modify the H-matrix-generation algorithm of the HACApK to improve the applicability to the coils wound with coated conductors. The effect of the method with respect to the memory consumption is examined in numerical tests using various shapes of coated conductors such as straight ones, pancake coils, solenoid coils, and racetrack coils. Furthermore, the effect of parallel computations is discussed to accelerate the analyses.
This work is supported by JSPS KAKENHI Grant Number JP16H02326.

Submitters Country

Japan

Author: TOMINAGA, Naoki (Kyoto University)

Co-authors: MIFUNE, Takeshi (Kyoto University); IDA, Akihiro (The University of Tokyo); SOGABE, Yusuke (Kyoto University); IWASHITA, Takeshi (Hokkaido University); AMEMIYA, Naoyuki (Kyoto University)

Presenter: TOMINAGA, Naoki (Kyoto University)

Session Classification: Tue-Af-Po2.10

Track Classification: G7 - Multi-Physics Design and Analysis