

# Development of High-Speed and Highly Accurate Numerical Analysis Technology of Rotating Machine by 3-D Finite Element Method

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## Abstract

The improvement of efficiency of rotating machines has been strongly desired to address environmental problems.

The aim of this project is to develop a parallel computing method using the 3-D finite element method for the magnetic field analysis of rotating machines, and to achieve the high-speed and highly accurate large-scale magnetic field simulation of rotating machines.

In this report, we developed a parallel computing method using the  $A-\phi$  method to solve the eddy current problems in a short amount of time, and applied the periodic boundary conditions to the magnetic field analysis to decrease the analysis region. The validity and the utility of the developed method are clarified through the analysis of the IPM motor. Consequently, it is confirmed that the characteristics of rotating machines can be efficiently analyzed in parallel on the Earth Simulator.

**Keywords:** rotating machine, magnetic field analysis, finite element method with edge elements, domain decomposition method,  $A-\phi$  method