

Numerical Analysis of the Contribution of Magnetic Forces and Magnetostriction to the Vibrations in Induction Machines

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Abstract

Magnetic forces and the magnetostriction effect both contribute to the vibrations and noise of electromechanical devices. In this paper, the contribution of these causes to the vibrations is analysed numerically by using the finite element method for both the magnetic and the mechanical calculations. The magnetic forces are calculated on the basis of an analytical expression and the magnetostriction is calculated by making use of magnetostriction measurements, conducted in a test setup. Calculations have been carried out on a two-pole and a four-pole induction machine (IM). When considering only the main components of the vibrations, analysis of the results reveals that in the case of the two-pole IM, the contributions of the magnetic forces and the magnetostriction add up, while in the case of the four-pole IM the respective contributions subtract. We can conclude that the contributions of the magnetic forces and the magnetostriction to the vibrations of an electromechanical device, can either add up or subtract, depending on the geometry of the device and the vibration mode.