Computational Micromagnetics for Magnetostrictive Actuators

Abstract

Computational micromagnetics plays an important role in design and control of magnetostrictive actuators. A systematic approach to calculate magnetic dynamics and magnetostriction is presented. A method is developed to solve the coupled Landau-Lifshitz-Gilbert equation for dynamics of magnetization and the 1-D elastic motion equation. A hierarchical algorithm using multipole approximation speeds up the evaluation of the demagnetizing field, reducing computational cost from $O(N^2)$ to $O(NlogN)$. A hybrid 3D-1D scheme is adopted to compute the magnetostriction. Numerical results include domain wall dynamics, hysteresis, magnetostriction, and applications to control of actuators.

Keywords: Micromagnetics, Magnetostriction, Multipole Approximation, Hysteresis

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