

ON THE MULTISCALE LANDAU-LIFSHITZ-GILBERT EQUATION: TWO-SCALE CONVERGENCE AND STABILITY ANALYSIS

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ABSTRACT

Permalloy is a nickel-iron magnetic alloy, which typically has a face-centered cubic phase but may form an irregular polycrystalline structure. Its magnetization dynamics is modeled by the multiscale Landau-Lifshitz-Gilbert (LLG) equation with locally periodic material coefficients. We consider homogenization of the multiscale LLG equation in this work, and the novelty lies in three aspects. First, we derive the homogenized LLG equation using the formal asymptotic expansion and prove the rigorous convergence using the notion of two-scale convergence. Second, we establish a stability result of the homogenized LLG equation under small disturbances of material coefficients. Third, a modified Gauss-Seidel projection method is implemented to verify the convergence between the multiscale and homogenized LLG equations and the stability result.

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