Dynamics of domain walls in nanostrips via collective coordinates

D. CLARKE, Johns Hopkins University, O. TRETIAKOV, New York University, G.-W. CHERN, JHU, YA. B. BAZALIY, University of South Carolina, O. TCHERNYSHYOV, JHU — The rich internal structure of domain walls in nanostrips [1-2] greatly affects the motion when an external magnetic field or electric current is applied, leading to reduced mobility when the driving force is strong. We generalize Thiele’s equations [3] to describe arbitrary wall motion with any number of collective coordinates [4]. The formalism is sufficiently general as to allow the inclusion of spin current, and can be applied to films with in- or out-of-plane magnetic anisotropy. We examine a model wall [5] with two soft modes corresponding to the coordinates of a vortex core. As in a one-dimensional domain wall [6], the system has a steady-state regime below a critical field and an oscillatory regime above it. We calculate the drift velocity in both regions. The results are compared to numerical simulations and to available experimental data [7]. This work was supported in part by the NSF Grant DMR-0520491.


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