AN ALGORITHM FOR THE NUMERICAL INVESTIGATION OF LARGE DISPLACEMENT DOMAIN WALL MOTION

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This work describes a simulation technique that is used to investigate domain wall motion in the vicinity of an arbitrary domain structure where large wall displacements can occur. This technique can address experimentally accessible domain configurations and provide a means of relating the calculated wall microstructure to experimentally observable quantities. This approach is based on the combination of a simplistic domain decomposition technique with a co-moving formulation of the basic equation of motion.

The magnetization structure is represented only in the vicinity of a domain wall. The domain structure of the material away from the domain wall must be specified, and the magnetic field produced by this domain pattern must be known or evaluated numerically. The magnetization is evolved according to the Landu-Lifshitz-Gilbert equation with a 2nd order Runge-Kutta algorithm in the represented region. A co-moving formulation of the Landau-Lifshitz-Gilbert equation is used to keep the domain wall in the represented region. The wall velocity is updated at an interval of 20 to 100 times the basic integration step of approximately 1 ps with a predictor corrector algorithm. The relative wall position can be maintained to within 1 % of the domain wall width by a suitable choice of the update interval.

This technique can be used 10 investigate domain wall motion in a physically accessible configurations because of the flexibility in the choice of the adjacent domain structure. It has been used to investigate the dynamics of stripe compression in thin garnet films with a large uniaxial anisotropy perpendicular to the plane of the material. These mulls have been successfully compared with experimental results, and provide a valuable means of interpreting the experimentally observed wall motion.

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