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Simulation of magnetization reversal dynamics on the Connection Machine (invited) (abstract)

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Magnetization reversal processes in thin magnetic films have been simulated on the Connection Machine (CM). The massive parallelism of the CM allows large lattices of dipoles to interact while following the dynamic equation of Landau–Lifshitz and Gilbert toward equilibrium. Our two-dimensional hexagonal lattice consists of 256×256 dipoles with local uniaxial anisotropy, nearest-neighbor Heisenberg exchange, and long-range dipole-dipole (demagnetizing) interactions. The demagnetizing field has been computed with the fast Fourier transform technique[1] which is particularly suited for the CM environment. Two sets of material parameters are considered in these studies. The first set is representative of amorphous rare earth–transition metal (RE-TM) alloys, which are currently of interest for their application as the media of erasable optical data storage. The second set corresponds to polycrystalline cobalt alloys (such as CoCr and CoPt), which are high-quality materials for in-plane magnetic recording applications. The discrete models of the RE-TM films have a cell size of approximately 10 Å, accomodating the narrow wall width of these media. In contrast, the cell size for CoCr-type media is typically 500 Å, which is their average crystallite size. We present simulation results that show domain nucleation and growth processes during magnetization reversal. Hysteresis loops and torque curves have also been computed by simulation, and we show the close agreement between these results and those of experiments. Complex magnetic ripple structures are observed in CoCr-type media when random axis anisotropy competes with demagnetization. Some of the more interesting features of these simulation ripples will be described.

[a] Paper to be published in Computers in Physics, May/June 1990.

[1] M. Mansuripur and R. Giles, IEEE Trans. Magn. **24**, 2326 (1988).

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