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Low-frequency dynamics of magnetostatically coupled vortices[1]
K. YU. GUSLIENKO, K. BUCHANAN, S.D. BADER, V. NOVOSAD, Materials Science Division, Argonne National Laboratory — The low-frequency dynamics of magnetostatically coupled vortices trapped in submicron magnetic dots have been investigated analytically and numerically. The system of interest consists of two identical disk-shaped ferromagnetic (F) elements with a single vortex ground state separated by a non-magnetic spacer (N). This allows for a detailed investigating of the effects of interlayer magnetostatic interactions on the low frequency spin excitation mode predicated for translational motion of the vortex core [K.Yu. Guslienko et al., J. Appl. Phys. 91, 8037 (2002).]. The proposed model is based on the equations of motion for the vortex center positions. The vortex restoring force was calculated analytically, taking into account the magnetostatic interactions assuming a realistic "surface charges free" spin distribution. For the tri-layer F/N/F dot (opposing chiralities, same polarization) we predict the existence of two excitation modes with size-dependent eigenfrequencies, one of which has a low frequency in the MHz range. The calculated vortex core trajectories depend on the vortex topological charges (vorticity, polarization and chirality). Analytical results for all combinations of core polarizations and magnetization chiralities will be compared with numerical simulations.

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