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Transition States and the Energy Barrier to Magnetization Reversal of Thin Film Nanomagnets with Perpendicular Anisotropy
GABRIEL CHAVES-O'FLYNN, DANIEL BEDAU, ERIC VANDEN-EIJNDEN, DANIEL STEIN, ANDREW KENT, New York University — We use the String Method [1] in conjunction with the micromagnetics OOMMF package to calculate the energy barrier for magnetization reversal of square thin film nanomagnets with perpendicular anisotropy. The lowest energy state consists of out of plane magnetization configurations. A field applied perpendicular to the plane lifts the degeneracy between the states. The effect of the element size and the consequences of breaking the square symmetry are investigated. We find that the transition state is not uniform: it starts with a localized nucleation, which expands to complete the reversal. The field dependence of the energy barrier is compared to that of macrospin model, and nonuniform reversal is shown to be the preferred transition configuration, providing a lower energy barrier to reversal. This result indicates the limits of the macrospin model. We present the dependence on the energy barrier on the exchange constant and simulation cell size. [1] W. E, W. Ren, E. Vanden-Eijnden, J. Chem. Phys. 126, 164103 (2007)

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