
Soft Ferromagnetic Thin Films

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Micromagnetics is a nonlocal, nonconvex variational problem. Its local minimizers represent the stable magnetization patterns of a ferromagnetic body under a specified applied field. The analysis of soft thin films is particularly rewarding because their patterns are readily observable. This problem is rich, experimentally and mathematically, because there are three interacting length scales: the thickness and diameter of the film, and the exchange length of the magnetic material. I will discuss recent work with DeSimone, Otto, and Mueller, which identifies a physically relevant thin film limit and derives, in this limit, a reduced variational problem. The reduced problem is degenerate but convex; as a result it determines some but not all features of the ground state magnetization pattern.