
Ty Thompson
**Efficient Uncertainty Quantification for a Stochastic
Ginzburg-Landau Model**

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We focus on the efficient simulation of nondeterministic critical phenomena in the Ginzburg-Landau (GL) model for superconductivity. Deterministic GL is widely used to study the formation of vortex configurations in thin superconductors. When such phenomena are essentially nondeterministic, the Langevin version of the time dependent GL problem applies, and simulation presents a significant computational challenge.

To investigate nondeterministic dynamics, we work on 2-manifolds having rotational symmetry about the axis of a constant magnetic field, and consider an ideal (superconductor or normal) initial state. Using highly efficient deterministic schemes, we first motivate the stochastic extension, and demonstrate an ad hoc approach for simulating the evolution of dense, locally stable vortex configurations. For stochastic simulations, we identified an opportunity to use a spectral Galerkin approach. Building upon a linearized Crank-Nicolson scheme, we used generalized spectral decompositions to reliably achieve a reduction in dimensionality. The efficiency of the method is examined through comparisons with monte carlo estimators, and our efforts at qualifying the perturbation approach are discussed.