

Diffuse Interfaces and Topology: A Phase-Field Model for Willmore's Energy

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Abstract

We consider the problem of minimising Willmore's energy in the class of connected surfaces with prescribed area embedded into a bounded domain which is a component of models for lipid bilayers. From a computational point of view, it may be favourable to approximate the curvature energy by a phase field functional. Diffuse Interfaces, can easily separate into multiple components along a gradient flow evolution. This is overcome using a topological penalty term in the functional involving a geodesic distance function. We present here a proof of Gamma-convergence to the sharp interface limit in two and three dimensions and numerical evidence of the effectiveness of our method in two dimensions.

Keywords: Willmore's energy, connected surface, curvature energy, geodesic distance.