

A phase field approximation for Plateau's problem

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Abstract

The goal of this work is to use a phase field method to approximate the notorious Plateau problem. To this aim, we want to generalise the functional, introduced by M. Bonnivard, A. Lemenant and F. Santambrogio for the Steiner problem, to the Plateau problem with a Reifenberg formulation. The novelty of this approach is thus to deal with a topological constrain by penalizing some geodesic distance, which must be defined. We first properly define the Plateau problem we consider, then we show a Gamma-convergence type result for the new approximation functional. Here we only deals with the case of codimension 1. Finally, this analysis allows us to obtain some numerical simulations of the minimizers for the Plateau problem. This numerical work is inspired by an other article on simulations for the Steiner problem, by M. Bonnivard, E. Bretin and A. Lemenant. The main tool to get such simulations is the use of the Fast Marching Method to optimize with respect to the geodesics.