An adaptive energy reduction approach for semilinear diffusion-reaction models

Thomas Wihler[1]

Abstract

We present a novel energy-based numerical analysis of semilinear elliptic PDE. Our procedure aims to generate a sequence of numerical approximations, which results from the iterative solution of related (stabilised) linearised discrete problems, and tends to a local minimum of the underlying energy functional. Simultaneously, the finite-dimensional approximation spaces are adaptively refined; this is implemented in terms of a new mesh refinement strategy in the context of finite element discretisations, which again relies on the energy structure of the problem under consideration. In combination, the resulting adaptive algorithm consists of an iterative linearisation procedure on a sequence of hierarchically refined discrete spaces. Numerical experiments demonstrate the robustness and reliability of our approach for a series of examples.

[1]Universität Bern