Abstract

We present a general Galerkin discretization framework for the numerical approximation of nonlinear elliptic variational-type boundary value problems, i.e., whose solutions appear as (local or global) minimizers of an underlying energy functional. Our approach relies on two components: (1) a linearized iterative energy reduction procedure, which allows to minimize the energy on a given space, and (2) a novel adaptive methodology that exploits the local energy structure of the PDE (instead of a posteriori error indicators) in order to improve the approximate solution on a sequence of hierarchically enriched discrete spaces. In addition to the theoretical foundations, a series of numerical experiments in the context of finite element methods will illustrate our approach.