A Nonlinear Discretization Theory with Applications to Meshfree Methods: Quasilinear and Fully Nonlinear PDEs

K.Böhmer
Philipps-Universität Marburg
Fachbereich Mathematik und Informatik

Abstract

We extend for the first time the linear discretization theory of Schaback, developed for meshfree methods, to nonlinear operator equations, relying heavily on methods of Böhmer, Vol I. There is no restriction to elliptic problems or to symmetric numerical methods like Galerkin techniques. Trial spaces can be arbitrary, but have to approximate the solution well, and testing can be weak or strong. We present Galerkin techniques as an example. On the downside, stability is not easy to prove for special applications, and numerical methods have to be formulated as optimization problems. Results of this discretization theory cover error bounds and convergence rates. These results remain valid for the general case of quasilinear and fully nonlinear elliptic differential equations of second order.

K. Böhmer, Numerical Methods for Nonlinear Elliptic Dfferential Equations, Oxford University Press, 2010, 770pp.

R. Schaback, Unsymmetric meshless methods for operator equations, Numer. Math., 114 (2010), pp. 629 - 651.