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Sommario/riassunto	Long description: This thesis is concerned with the numerical solution of boundary value problems (BVPs) governed by nonlinear elliptic partial differential equations (PDEs). To iteratively solve such BVPs, it is of primal importance to develop efficient schemes that guarantee convergence of the numerically approximated PDE solutions towards the exact solution. The new adaptive wavelet theory guarantees convergence of adaptive schemes with fixed approximation rates. Furthermore, optimal, i.e., linear, complexity estimates of such adaptive solution methods have been established. These achievements are possible since wavelets allow for a completely new perspective to attack BVPs: namely, to represent PDEs in their original infinite dimensional realm. Wavelets in this context represent function bases with special analytical properties, e.g., the wavelets considered herein are piecewise polynomials, have compact support and norm equivalences between certain function spaces and the ellâ sequence spaces of expansion coefficients exist. This theoretical framework is implemented in the course of this thesis in a truly dimensionally unrestricted adaptive wavelet program code, which allows one to

harness the proven theoretical results for the first time when numerically solving the above mentioned BVPs. Numerical studies of 2D and 3D PDEs and BVPs demonstrate the feasibility and performance of the developed schemes. The BVPs are solved using an adaptive Uzawa algorithm, which requires repeated solution of nonlinear PDE sub-problems. This thesis presents for the first time a numerically competitive implementation of a new theoretical paradigm to solve nonlinear elliptic PDEs in arbitrary space dimensions with a complete convergence and complexity theory.