Adaptive wavelet methods for linear and nonlinear least squares problems

Rob Stevenson

The adaptive wavelet Galerkin method for solving linear, elliptic operator equations introduced in [*Math. Comp.*, 70 (2001), 27–75] by Cohen, Dahmen, and DeVore, is extended to nonlinear equations, and is shown to converge with optimal rates without coarsening. Moreover, when an appropriate scheme is available for the approximate evaluation of residuals, the method is shown to have asymptotically optimal computational complexity.

The application is studied of this method to solving least-squares formulations of operator equations $G(u) = 0$, where $G : H \to K'$. For formulations of PDEs as first order least squares systems, a valid approximate residual evaluation is developed, which is easy to implement and quantitatively efficient.