HIERARCHICAL ERROR ESTIMATION FOR ELLIPTIC AND PARABOLIC EQUATIONS IN TWO AND THREE SPACE DIMENSIONS

Peter K. Moore

Department of Mathematics
Southern Methodist University
Dallas, TX 75275
pmoore@mail.smu.edu

Several authors have proposed an error estimation strategy for the finite element method applied to linear reaction-diffusion equations in two space dimensions based on an odd/even-order dichotomy principle. For odd-order approximations the estimates are computed directly. For even-order approximations a second solution is computed. Although both estimators are asymptotically exact the latter are more robust. I will describe how the even-order method can be extended to all orders greater than one and to three space dimensions.

These estimators work for several sets of basis functions. The optimal basis, from the perspective of asymptotic exactness, is the tensor-product basis. However, the total number of degrees of freedom is quite large. Adjerid *et al* [1] proposed a smaller basis in two dimensions which can be extended to three dimensions. This basis lacks robustness (error estimates are poor on coarse grids) for high order. I will examine a family of basis sets between these two extremes showing their robustness as a function of the degrees of freedom.

References

[1] S. Adjerid, B. Belguendouz and J.E. Flaherty, A *posteriori* error estimation for diffusion systems, *SIAM J. Sci. Comput.,* v. 21, p. 728-746, 1999.