A POSTERIORI ERROR ESTIMATES FOR THE STOKES PROBLEM

F. Nobile

Institute for Computational Engineering and Sciences
The University of Texas at Austin
1 University Station, C0200, Austin, TX 78712
nobile@ices.utexas.edu

In this talk we propose a new technique to obtain upper and lower bounds on the energy norm of the error in the velocity field, for the Stokes problem. It relies on a splitting of the velocity error in two contributions: a projection error, i.e. the distance of the computed solution to the space of divergence free functions, and an error in satisfying the momentum equation. We will show that both terms can be sharply estimated, form above and from below, by implicit a posteriori error estimators. In particular, the proposed estimator is based on the solution of local problems on patches of elements. We introduce both local problems in weighted spaces, with "Neumann-type" boundary conditions, extending the ideas presented in [1,2] for the Laplace equation, and local problems in unweighted spaces, with homogeneous Dirichlet boundary conditions. The numerical results show very good effectivity indices. The underlining idea is quite general and can be applied to other saddle point problems as the ones arising in mixed formulations of second order PDEs.

References

[1] P. Morin, R.H. Nochetto, and K.G. Siebert, "Local problems on stars: a posteriori error estimation, convergence, and performance," *Mathematics of Computation* (to appear).

[2] S. Prudhomme, F. Nobile, L. Chamoin, and J.T. Oden, "Analysis of a subdomain-based error estimator for finite element approximations of elliptic problems," *TICAM Report 02-34* to appear on *Numer. Methods Partial Differ. Eqs.*

[3] F. Nobile, "A posteriori error estimates for the finite element approximation of the Stokes problem," *TICAM Report 03-13*, April 2003.