ERROR CONTROL AND ADAPTIVE MESHS FOR FINITE VOLUME APPROXIMATIONS OF CONVECTION-DIFFUSION-REACTION PROBLEMS

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In this presentation, we shall discuss construction, theoretical justification, and testing of computational methods for a reliable error control of finite volume element discretizations (FV) of elliptic problems in 2 and 3 dimensions on unstructured grids. We achieve balance between obtaining reliable control of the error and efficient use of the available computational resources by an adaptive process based on a posteriori error analysis and efficient iterative solution of the algebraic system. Our a posteriori error analysis exploits the ideas known from the finite element method. We have constructed estimators based on local residuals and least-squares projections of the gradient for FV approximations and have theoretically justified them. Namely, under appropriate assumptions, we have proved that these estimates provide both lower and upper bounds for the error. The error analysis is performed in global H_1 and L_2 norms. We also will present numerical tests that provide an experimental support of our theoretical results. Our test are aimed to study experimentally the behavior of the error estimators for various convection-diffusion problems.

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