The Application of a Black-Box Solver with Error Estimate to Different Systems of PDEs

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Abstract. At first, a brief overview of the Finite Difference Element Method (FDEM) is given, above all how an explicit estimate of the error is obtained. Then for some academic examples the estimated and exact error are compared showing the quality of the estimate. The PDEs for fuel cells of PEMFC and SOFC type with extremely nonlinear coefficients are solved and the error estimate shows the quality of the solution. Finally, for a complicated fluid-structure interaction problem of a high pressure Diesel injection pump, where the domain of solution has three subdomains with different PDEs and where a nested iteration procedure is needed, the PDEs are solved and the global error estimate shows the quality of the solution. For all these examples it would be very difficult to obtain a quality control of the solution by conventional grid refinement tests.