A posteriori energy norm error estimation for 2nd-order partial differential equations

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Five classes of up to 13 a posteriori error estimators compete in three second-order model cases, namely the conforming and non-conforming first-order approximation of the Poisson-Problem plus some conforming obstacle problem. Since it is the natural first step, the error is estimated in the energy norm exclusively. The competition allows merely guaranteed error control and excludes the question of the best error guess. The former a posteriori error estimators apply to the obstacle problem as well and lead to surprisingly accurate guaranteed upper error bounds. This approach allows an extension to more general boundary conditions and a discussion of efficiency for the affine benchmark examples. The Luce-Wohlmuth and the least-square error estimators win the competition in several computational benchmark problems. Novel equilibration of nonconsistency residuals and novel conforming averaging error estimators win the competition for Crouzeix-Raviart nonconforming finite element methods. Our numerical results provide sufficient evidence that guaranteed error control in the energy norm is indeed possible with efficiency indices between one and two.

References

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