1071-65-158 **Jeffrey Ovall***, jovall@ms.uky.edu, and **Michael Holst** and **Ryan Szypowski**. *Constructing and Analyzing Non-Standard Error Estimators of Hierarchical Type.*

Given the finite element solution in an approximation space V, a posteriori error estimators of hierarchical type are based on the computation of an approximate error function in an auxiliary space W. We present an approach for constructing and analyzing non-standard error estimators of this type. A practical realization of our approach is given for second-order elliptic problems in $\mathbb{R}^3$, which may be linear or quasi-linear. The approximation space V is taken to be the usual continuous piecewise-linear functions, and the error space W consists of continuous piecewise-cubic functions which vanish on all edges in the mesh. We provide an effectivity analysis under realistic assumptions, which clearly shows the dependence/independence of constants on the data—in particular, all constants are independent of the forcing term and boundary data. We also argue that the stiffness matrix associated with computations in W is spectrally-equivalent to its diagonal, and therefore simple to solve inexpensively. A series of numerical experiments demonstrate the effectivity of the error estimator, and its utility as a guide for adaptive refinement. In many cases, comparisons will be made with common error estimators of both residual and gradient-recovery types. (Received March 03, 2011)