A Flexible Data Structure For the Adaptive Refinement of Unstructured Grids in Parallel

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We are currently developing a package designed to be used on parallel processors which adaptively refines unstructured grids. By its very nature, such a package needs to be very flexible and is not a trivial piece of code. It must address the usual problems associated with a finite element package, such as construction of the stiffness matrix, calculation of the error indicator, splitting of the elements in the grid and the solution of the system of equations (with the added complication of being done in parallel) along with the problems specific to the parallel implementation like load balancing and unstructured communication.

Our approach to managing these issues is to use a very flexible data structure combined with an object orientated language, namely C^{++}. The advantages of using an object orientated language is that the code can be written in a manner which more closely mimics the conceptual view of the problem. Furthermore it allows you to write an interface which, we believe, is easy for the user to understand and learn.

In this talk we plan to describe the data structure in some detail and try to verify its flexibility by giving some examples from the solution of linear and non-linear equations.

To solve the system of equation we currently use the multigrid method, but we plan to incorporate a domain decomposition package called Doug to solve 2D and 3D problems.

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