SUPPORTING PARALLEL ADAPTIVE *hp* SCHEMES

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We will report here on the development of techniques for supporting parallel adaptive *hp* schemes for the modeling of two problems. First we will report on the problems of classical linear elastostatics. Secondly we will describe work on hyperbolic systems arising from a class of geophysical mass flows arising from landslides, avalanches and the like. Accurate numerical modeling of such flows is of great importance in conducting the realistic simulations necessary for a variety of purposes ranging from public safety planning to validation of the models. In both cases a single integrated set of components for parallel data structures, partitioners, refinement and unrefinement worked quite efficiently.
Developing parallel adaptive *hp* finite element simulations requires development of suitable data structures (see for e.g.Laszloffy, Long and Patra [1], load balancing schemes and solvers. For the elliptic systems, we will describe some of our recent work on developing reliable and portable equation solvers using a variety of preconditioners. The goal of the solution strategies is performance portability [2] – that is obtainable only through a combination of flexible algorithms that may be tuned for the combination of processor and communication resources available.
For the hyperbolic systems using explicit solution strategies we will discuss strategies for the creation of parallel adaptive approximations using ghost cell type ideas and suitable techniques for constructing the numerical fluxes .

References

[1] A. Laszloffy, J. Long and A. Patra, "Simple Data management Schemes and Scheduling Schemes For Managing the Irregularities in Parallel Adaptive *hp* Finite Element Simulations" *Parallel Computing* vol 26, 2000, pp.1765-1788.

[2] A. C. Bauer, S. Sanjanwala and A. Patra, "Portable Efficient Solvers for Adaptive Finite Element Simulations of Elastostatics in Two and Three Dimensions", in **Recent Developments in Domain Decomposition Methods** L. F. Pavarino and A. Toselli ed., Springer, 2002.