

Parallel tree algorithms for adaptive mesh refinement

One task in the numerical solution of partial differential equations is to define the computational mesh and its partition among the processors, for any given domain geometry. For many applications, it is desirable to perform all algorithms for adaptive mesh refinement (AMR) in parallel, in core, and whenever the simulation requires it. This imposes the conditions that AMR shall scale at least as well as the numerical solvers and that absolute runtimes of AMR algorithms shall be small.

Forest-of-octrees AMR is an approach that offers both geometric flexibility and parallel scalability. We will present central data structures and algorithmic concepts from our research into the p4est and t8code libraries. p4est is an implementation of adaptive hexahedra that is being used in several modern finite element codes. t8code is a new effort that aims to unify hexahedral and tetrahedral tree-based AMR. We close with recent numerical results.