

A Toolkit Approach for Mesh Generation Algorithm Development

Mesh generation is a unique mix of mathematics, computer science, and engineering. Good meshing schemes are usually a combination of a sound algorithm backed up by theory, an efficient implementation, and sufficient foresight for corner cases which are not covered by the theory but which may have engineered solutions that work often enough to be valuable. Part of the difficulty in designing good meshing algorithms is the seemingly infinite set of cases which defy attempts at classification into a finite number of bins. Currently, most general toolkits for mesh generation are not in the public domain. In this situation it is impossible to contribute experimental or specialized algorithms which complement those toolkits.

In this presentation I will describe work to start building such a general, public-domain mesh generation toolkit. I will describe the characteristics necessary to make this toolkit succeed, in both research and production settings. Some of these characteristics are related to algorithms (e.g. automatic surface and volume meshing) while others are software-related (e.g. public domain, support for geometry import and visualization). I will describe applications of the current capability to petascale-class reactor simulations.