Two-Refinement Approach to Parallel

Parallel Refinement

Consistency is maintained in parallel by globally numbering I, J, K layers. Even-odd pairing of layers and the resulting marking is guaranteed to be the same across processors.

3D Node Marking

Visualization of the initial cells identified for uniform refinement. The 3-3-3 templates are applied on quads for 2-D refinement. The 1-1-1 templates are applied on quads with marked nodes in 2-D direction. Each even-odd row pair of quads are traversed and nodes between the rows adjacent to at least one marked quad are marked.

3D Refinement Criteria

For testing purposes hexes are marked for uniform refinement whenever the average volume fraction of a cell's eight child cells exceeds a threshold difference from the parent cell. Refinement criteria was not within the scope of this work and will need additional attention to ensure geometric features are accurately captured.

Sculpt Refinement

Refinement is first performed on a Cartesian grid which is then used as the base grid in Sculpt. Sculpt is a parallel companion application to Sandia's Cubit. Cubit provides a grid refinement end to Sculpt.

All refined mesh for each platform were identical regardless of processor count. Minimum scaled Jacobian for refined grid was 0.408 before smoothing projection.

Performance

Strong scaling performed on Sandia's (a) Reddy and (b) Chama platforms up to 256 processors. (a) Refined from 32K to 735K hexes. (b) Refined from 499K to 4.75M. All refined meshes for each platform were identical regardless of processor count.