Numerical Modeling for Phase Changing Materials

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In this work we present a numerical approach for the heat equation in heterogeneous materials with inclusions (phase changing materials), where the conductivity and the temperature are discontinuous at the inclusion boundary. We describe the design criteria of a finitite-difference scheme based on hierarchical meshes (octrees in 3D and quadtrees in 2D cases) and detail the necessary conditions for a consistent cell-centered method that can easily be solved in parallel. Thanks to this approach, the boundary of the inclusions can arbitrarely cross the mesh, allowing the discretization of complex 3D problems with many inclusions with irregular boundaries. The mesh refinement follows the hybrid material interface with the objective of an increased accuracy along the discontinuity presented by the physical problem. Parallel numerical tests concerning the consistency and stability of our method in 2D and 3D will be presented.

Références

[1] Min et al., A supra-convergent finite difference scheme for the variable coefficient Poisson equation on non-graded grids, Journal of Computational Physics 218 (2006).

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