SPACE TREES – INCREASING THE POTENTIAL OF CARTESIAN GRIDS

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Concerning simulation applications where one encounters complicated or moving geometries, there is often bound to be a trade-off between numerical efficiency on the one hand and simplicity as well as flexibility on the other hand. For example, hierarchical and adaptive Cartesian grids are known to be easy to generate and manage, and their straightforward structure allows for simple interfaces to neighbouring tasks like geometric modelling or visualization. However, concerning geometry approximation (and, hence, computational effort), their drawbacks compared with unstructured grids, e. g., are evident in many situations.

Recently, octree-related grid structures have been studied for discretization purposes. In this context, the space tree concept aims at providing a unified representation for both geometry description and numerical computations independent of the number of underlying dimensions, and at overcoming the drawback of a reduced accuracy. The latter is obtained via a hybrid approach that – within the same data structure – logically uncouples the resolution of geometry description and the resolution of numerical computations.

The talk provides an overview of the space tree concept and presents recent results concerning the use of octree- and space-tree-based grids.

References

[1] M. Bader, H.-J. Bungartz, A. Frank, and R.-P. Mundani, "Space tree structures for PDE software", *Lecture Notes in Computer Science*, v. 2331, p. 662-671, 2002.