

Term Project/Semesterarbeit

(Computational Science & Engineering)

Supervisor: Prof. Dr. R. Hiptmair (SAM, D-MATH)

Hash Based Data Structures for Tetrahedral Meshes

Field. Tetrahedral meshes, mesh refinement, data structures, hash tables, *software development*

Problem. Finite element schemes for boundary value problems on three-dimensional computational domains may place degrees of freedom (d.o.f.) on vertices, edges, faces, and/or cells of a tetrahedral mesh. However, it would be wasteful to store edges and faces of a mesh, if these are not needed. Thus, it becomes desirable to have a data structure that allows the easy allocation of edges and faces whenever required.

Hash based data structure. The idea is to store only the vertices of the mesh along with the incidence information of vertices and cells. Edges and faces are indexed by the ordered tuple of their vertices, which is also used as hash key. In the beginning the two hash tables representing edges and vertices are empty. If d.o.f. on edges and vertices are introduced, these hash tables are filled.

Implementation. The implementation should be done in C++ extensively using the Standard Template Library and its extensions providing hash tables.

Issues. During the term project different hash strategies (hash functions) should be implemented and their performances should be compared. A detailed profiling of the code should be carried out. The meshes should be imported from a mesh generator (NetGen developed by J.Schöberl at Uni Linz)

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