

# Diploma Project/Diplomarbeit

## (Mathematics/Computational Science & Engineering)

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## Auxiliary Space Methods for Edge Elements

**Field.** Finite elements, multigrid, edge elements, preconditioning

**Problem.** Given a fine unstructured mesh it is very difficult to construct the hierarchy of nested coarser meshes required for the application of multigrid preconditioners. These are needed for the efficient solution of the linear systems of equations arising from discretized elliptic PDEs. Here, we consider boundary value problems for the operator  $\mathbf{curl\,curl} + \tau$ ,  $\tau > 0$ , and their Galerkin discretization by means of so-called edge elements on tetrahedral meshes.

**Idea.** The idea is to use a structured grid that covers the computational domain though it does not resolve the geometric details. For a structured grid it is relatively easy to find coarser grids. Thus, if one succeeds in transferring the residual from the unstructured mesh to the structured grid, a multigrid solver becomes readily available.

**Task.** Different possibilities for the residual transfer to structured grids are to be investigated theoretically and numerically. Unstructured tetrahedral meshes can be obtained from a mesh generator.

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