

A Non-Standard Finite Element Method Based on Boundary Integral Operators

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We present a non-standard Finite Element Method that is based on the use of boundary integral operators and that permits polyhedral element shapes as well as grids with hanging nodes. The method can be interpreted as a local Trefftz method, i.e., the method employs element-wise PDE-harmonic trial functions. The construction principle requires the explicit knowledge of the fundamental solution of the partial differential operator, but only locally in every polyhedral element. This allows us to solve PDEs with elementwise constant coefficients. In this talk we consider the diffusion equation as a model problem, but the method can be generalized to convection-diffusion-reaction problems and to systems of PDEs like the linear elasticity system with element-wise constant coefficients.

We give rigorous error estimates for the three-dimensional case under quite general assumptions on the geometrical properties of the elements