An Unfitted Finite Element Method using Discontinuous Galerkin

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In the simulation of physical, biological and chemical processes one often has to deal with complex shaped domains. In such simulations a good approximation of the geometrical shape is crucial in order to obtain reliable numerical results. At the same time the interest often lies in a solution on a coarser scale, which would allow a smaller number of unknowns.

A new discretization scheme for solving PDEs in complex domains, e.g. on the pore scale, was developed. It combines the idea of Unfitted Finite Elements with a Discontinuous Galerkin (DG) Finite Elements discretization. The degrees of freedom are determined by the structured grid, while the fine structures of the domains shape are preserved by limiting the support of the shape functions to the intersection of the structured grid cells and the domain. This method allows the minimal number of unknowns to be independent of the shape of the domain, even if their size is significantly bigger than that of the structures in the shape of the domain.

In this talk an introduction into the Unfitted Discontinuous Galerkin Method will be given. Examples show the stability of the method even for pathologic cases. The method itself is easily applicable to different DG discretizations and different types of PDEs. Within this talk computations are shown for an elliptic model problem.

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