

CutFEM: Discretizing Geometry and PDEs

Peter Hansbo

School of Engineering, Jönköping University, Sweden

ABSTRACT

We present a developing technology, Cut Finite Element Methods (CutFEM), that enables high order representation of both the geometry and the solution to a physical problem on the same background mesh. CutFEM can handle different geometry description and partial differential equations in both a given domain and on its surface. CutFEM is based on the ideas in two different approaches: (1) XFEM on cut finite elements. In this method, the elements are cut by a real or artificial interface, and the approximation is allowed to be discontinuous across a discretisation of the interface, inside the elements. Only zero order operators were initially considered on the discrete interface; the next step (2) to allow for discretisations of differential equations on the interface was taken by Reusken and co-workers in recent work. Their approach employs a three dimensional background mesh cut by an interface, and a problem, in the form of a surface partial differential equation, is posed and solved on the discretised interface only.

We will discuss some theoretical problems with this approach, and their solution, as well as give applications to surface diffusion and surface elasticity problems coupled to equations inside/outside the interface.