Isogeometric Immersed Methods

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In engineering applications, the description of the geometry and the mesh generation process are often bottlenecks in finite element approximations of elliptic boundary value problems. Some efforts have been made to develop meshless methods. However a central problem of such methods is to incorporate boundary conditions of Dirichlet type.

This motivates the interest in immersed boundary and interface methods, also known as fictitious domain or embedded domain methods. The traditional philosophy of immersed boundary methods is to embed the computational domain in a structured grid and employ simple, mesh-aligned numerical schemes. Clearly, immersed methods require a proper treatment of the cells that are cut by boundaries and/or interfaces with some special, and often ad hoc, technique to achieve acceptably accurate results.

Moreover, one of the current challenges both in CAD and IgA is dealing with trimmed geometries. Indeed, the most common description of CAD models is the B-rep, where an object is represented by its boundary surfaces, described by suitable geometry maps on the parametric domain. Often only certain regions of a surfaces are supposed to be part of the actual object and the unused areas are trimmed away. Trimming results in identifying complex geometries in the parametric domain which can be treated following an immersed approach.

In this talk we aim to present our ongoing results on immersed boundary Isogeometric analysis based on B-splines/NURBS defined in both rectangular and triangular regular meshes, for general, non-constant coefficients, elliptic problems.

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