

Geometry plus Simulation Modules: Versatile implementation of isogeometric methods

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ABSTRACT

Isogeometric analysis (IGA), introduced by Hughes and collaborators in 2005 [1], requires the seamless integration of Finite Element Analysis (FEA) and Computer-aided Design (CAD) software. Towards the realization of this revolutionary goal, we have initiated in the year 2012 the development of the open-source, collaborative software project “Geometry + Simulation Modules” (for short, gismo, <http://gs.jku.at/gismo>), which aims at providing a unified development framework for IGA [3]. In this talk we present some highlights of the on-going development of the library towards the forthcoming Beta release. G+Smo is an object-oriented, template C++ library, that implements a generic concept for IGA, based on abstract classes for geometry map, discretization basis, assemblers, solvers and so on. It makes use of object polymorphism and inheritance techniques in order to support a variety of different discretization bases, namely B-spline, Bernstein, NURBS bases, hierarchical and truncated hierarchical B-spline bases of arbitrary polynomial order [2], and so on. Our design allows the treatment of geometric entities such as surfaces or volumes through dimension independent code, realized by means of template meta-programming. Available features include simulations based on continuous and discontinuous Galerkin approximation of PDEs, over conforming and non-conforming multi-patch computational domains [4], efficient algorithms for IGA based on tensor-product splines [5] and a convenient framework for inserting variational formulations based on expression templates. The code-base, currently in Alpha development stage, focuses on both the efficiency and ease of use, promotes code quality and cross-platform compatibility and encourages the exploration of new strategies potentially better suited for isogeometric analysis over adopting known FEA practices.

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