The aim of this work is to study the extension of the proposed isogeometric Discontinuous Galerkin method to problems with moving interfaces, for which the computational domain is subject to displacements. Different problems are targeted, such as sensitivity analysis with shape parameters, for which the solution changes due to local geometrical perturbations are estimated, or problems involving deformable or moving (translated, rotated) bodies, for which the global displacement is explicitly imposed. One can also study problems with fluid-structure interactions, for which the displacement is ruled by a physical coupling. The accuracy of the proposed approach will be especially investigated, including comparison with classical mesh-based methods. The gain of using a high-order and geometrically exact computational domain will be quantified.
Main activities

The doctoral student will be part of the Acumes Project-Team at Inria Sophia Antipolis - Méditerranée Research Center. At first, he/she will have to formalize the targeted extensions in the context of the isogeometric Discontinuous Galerkin method. Regarding sensitivity analysis, the development will rely on the continuous sensitivity equation method, which consists in solving additional partial differential equations obtained by differentiating the state equations with respect to the geometry [DP06]. This approach is a priori well adapted to high-order NURBS representations. Regarding analysis with moving computational domains, the work will rely on the ALE (Arbitrary Lagrangian-Eulerian) [PPB09] formulation, which has to be extended to high-order NURBS descriptions.

On the basis of the existing code (C++ language) solving Euler/Navier-Stokes equations on NURBS domains, the doctoral student will implement the proposed approaches and will conduct a set of numerical tests based on academic and then industrial problems, in order to qualify the methods and quantify their accuracy. The targeted applications concern compressible flows around airfoils or turbine blades.


Benefits package

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Remuneration

Duration: 36 months
Location: Sophia Antipolis, France
Gross Salary per month: 1982€ brut per month (year 1 & 2) and 2085€ brut/month (year 3)