Multi-patch isogeometric analysis with smooth functions

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Isogeometric Analysis (IgA) is a numerical method for solving partial differential equations (PDEs) by using the same (rational) spline function space for representing the geometry of the physical domain and for approximating the solution of the PDE [1]. Many physical problems involve for the numerical simulation high order PDEs such as the analysis of Kirchhoff-Love shells or the phase-field crystal equation, which are 4th or 6th order problems, respectively. Solving these 4th and 6th order PDEs via the weak form and Galerkin discretization as mostly applied in IgA, the use of C^1-smooth or even C^2-smooth functions is required. Moreover, so-called multi-patch geometries are needed to describe complex physical domains, which cannot be obtained from single-patch representations.

The concept of IgA provides the possibility to combine both needs by allowing the construction of globally smooth isogeometric spline spaces over complex multi-patch geometries and to use the generated functions to solve high order PDEs over these multi-patch geometries. In this talk, we first deal with the topic of C^1-smooth and C^2-smooth isogeometric spline spaces over planar multi-patch geometries, and present a couple of our contibutions to this field of research [2, 3, 4, 5]. Finally, we extend some of these results to the case of C^s-smooth multi-patch isogeometric spline spaces of an arbitrary smoothness $s \geq 1$ [6].

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