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WEAK COUPLING OF TRIMMED PATCHES IN ISOGEOMETRIC ANALYSIS AND THE FINITE CELL METHOD

Ali Özcan[1], Stefan Kollmannsberger[1], Joan Baiges[2], Alessandro Reali[3] and Ernst Rank[1]

[1] Computation in Engineering, Departmant of Civil Engineering and Surveying, Technische Universität München, Arcisstr. 21, 80333 München Germany ali.oezcan@tum.de and https://www.cie.bgu.tum.de

[2] International Center for Numerical Methods in Engineering, Universitat Politecnica de Catalunya Jordi Girona, 1-3, Edifici C-1, Despatx 102 08034 Barcelona Spain, jbaiges@cimne.upc.edu and https://sites.google.com/site/joanbaiges

[3] Department of Civil Engineering and Architecture, University of Pavia, via Ferrata, 3 27100 Pavia Italy, alessandro.reali@unipv.it and http://www.unipv.it/alereali

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In this work we reconsider the weak imposition of the Dirichlet boundary conditions for low- as well as high-order finite elements. We investigate Nitsche variant parameter-free methods, where the final form of the method contains only primal unknowns, i.e., the approach does not introduce new unknowns at the boundary. Additionally, it does not involve problem dependent parameters which require an estimation. Presented approaches are symmetry-preserving, i.e., the resulting discrete form of an elliptic equation will remain symmetric and positive definite.

We show that these approaches can be extended in order to weakly impose the coupling constraints between domains, that are non-matching, non-conforming, or overlapping. These approaches are applied to the NURBS-version of the Finite Cell Method (FCM) [1], which is a high order fictitious domain approach. This concept provides a way to deal with some of the well-known challenges in Isogeometric analysis (IGA) [2], such as the occurrences of gaps and overlaps between patches and the existence of trimmed surfaces.

The proposed methods are tested and compared on conforming, non-conforming, and overlapping domains with several benchmark solutions. Moreover a material interface problem is constructed to observe the capability of simulating jumps in the solution field. Finally the potential of these approaches is illustrated for problems from engineering practice.

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