6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 15 June 2018, Glasgow, UK

ISOGEOMETRIC ANALYSIS IN FLUID-STRUCTURE INTERACTION PROBLEMS CONSIDERING STRUCTURAL CONTACT

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Key words: *Isogeometric Analysis (IGA), Fluid-Structure Interaction (FSI) problems, Contact Mechanics, NURBS*

This work is set in the scope of fluid-structure (FSI) interaction problems with contact. One important aspect in the analysis of such problems is the representation of the FSI interface. It is beneficial to the coupling, if a common interface description can be employed on both sides. Specifically for this purpose, a coupling method based on Isogeometric Analysis (IGA) for the structure and NURBS enhanced finite elements (NEFEM) for the fluid has been presented in [2].

The two single-field solvers used within this method have been extended in two directions: (1) On the structural side, they now contain a contact formulation, and (2) on the fluid side, a mesh deformation method for periodic translational deformations has been added.

In the scope of this talk, the results of an FSI problem are presented, in which a solid ring is falling through a fluid until it hits a contact surface and rebounds in the opposite direction. The FSI problem is solved within a staggered solution approach, successively calling the two single-field in-house finite element solvers XNS and FEAFA. XNS is based on the deforming spatial domain/stabilized space-time (DSD/SST) procedure in combination with NEFEM [2, 3]. FEAFA makes use of the IGA approach employing NURBS basis functions to solve the elasto-dynamics contact problem, where the penalty method accounts for the contact interaction [1]. The finite element grid is adapted to the movement of the ring by a new mesh update approach, allowing large translational mesh movements.

REFERENCES

[1] I. Temizer, P. Wriggers, and T.J.R. Hughes *Contact Treatment in Isogeometric Analysis with NURBS.* Computer Methods in Applied Mechanics and Engineering, (2011), Vol. 200, pp. 1100–1112.

[2] N. Hosters, J. Helmig, A. Stavrev, M. Behr, and S. Elgeti *Fluid-Structure Interaction with NURBS-Based Coupling.* Accepted to Computer Methods in Applied Mechanics and Engineering.

[3] A. Stavrev, P. Knechtges, S. Elgeti, and A. Huerta *Space-Time NURBS-Enhanced Finite Elements for Free Surface Flows in 2D.* International Journal for Numerical Methods in Fluids, Vol. 81. pp 426–450.