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FULLY INTEGRATED MESH GENERATION IN FLUID-STRUCTURE INTERACTION

Thomas-Peter Fries[1], Domagoj Bošnjak[2], Richard Schussnig[3]

Institute of Structural Analysis, Graz University of Technology,
Lessingsstr. 25, 8010 Graz, Austria, www.ifb.tugraz.at
[1]fries@tugraz.at, [2]bosnjak@tugraz.at, [3]schussnig@tugraz.at

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Fluid-structure interaction (FSI) is characterized by the interplay of fluid flows with deforming structures. The fluid exerts a load on the structure resulting in its deformation and, vice versa, the moving structure changes the fluid domain and, hence, the loading. This two-way coupling of physical fields is observed in many applications in wind engineering, biomechanics, aeroelasticity, etc. [1, 2, 3]. The computational modelling and simulation of FSI is notoriously challenging [1].

In FSI, the update of the fluid domain, i.e., in the numerical context, the mesh update is critical for the robust and efficient solution [4]. Many research activities have been invested which adapt and maintain meshes generated *before* the simulation (pre-processing step) with different levels of generality and applicability. Herein, we propose to inherently embed the mesh generation into the simulation. The FSI domain is defined based on structured building blocks that imply all the relevant information needed for the automatic mesh generation: Topology, geometry, and grading information. Transfinite maps play a crucial role for the definition of sub-meshes with any desired order and resolution in each building block. In each time step, a new mesh is generated taking into account the deforming FSI interface. This generation is fast compared to the overall work load in each time step which is still dominated by the solution of the system of equations. It is also very robust and removes any mesh tangling by construction provided that suitable building blocks are selected once initially. Numerical results confirm the success of the proposed FSI strategy with integrated mesh generation.

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