Towards Embedded Fluid-Structure Interaction Simulations Based on CAD-Integrated Thin-Walled Structures

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ABSTRACT

Thin-walled structures, such as membranes, are well-known and have been used in many engineering and architectural applications thanks to their efficient load-carrying behavior and elegant free-form shapes, resulting in cost efficiency and little material use for even large spans. In the past years, Isogeometric Analysis (IGA) and its extension towards CAD-based B-Rep representation (IBRA) [1] have been established as an excellent tool for modeling and simulating even more complex trimmed multipatch models. However, these structures are prone to large deformations caused by external loads such as wind.

To assess and estimate the structures' response to these fluctuating loads, fluid-structure interaction (FSI) plays a significant role. The embedded FSI approach is applied because of its flexibility to robustly capture the large deformation of these structures, which benefits from the exact representation obtained by CAD. The embedded FSI method has been studied and applied to the membrane structure using the classical finite element meshing and level-set technique [2]. It will be enhanced towards a trimmed multipatch CAD-integrated model, avoiding time-consuming meshing. Thus, a novel approach combining an embedded fluid solver with IBRA for membrane structures is the primary goal of this study. The developments will be demonstrated and assessed by various benchmarks and real-world applications.

REFERENCES

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