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Composition du Jury

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Résumé

Designing structural parts against the material limits, the impact of loads, and many other constraints, is a standard interest in engineering. However, improving the design of a structure can be long and drawn out, especially when a clear understanding of cause-effect relationships is missing. Finding the best possible design, namely the optimal design, is a complex task because it requires several competences. Usually, efficient geometric modeling is needed to accurately represent the structure. Conjointly, the geometric model should provide high flexibility during the design exploration. In addition, structural analysis must be fast enough to shorten the overall process. Besides, for the sake of compactness, a close connection between the geometric model and the structural analysis seems essential. Finally, the geometric models and the analysis models should be adequately defined for mathematical optimization algorithms. At this point, we understand that all modeling choices are deeply related. In order to build an efficient and robust overall procedure, each stage should be thought and built accordingly to the others. Therefore, IsoGeometric Analysis appears as a powerful tool for structural optimization since it uses a unique model with both high quality geometric and analysis properties. Here, we present a compact framework built on the core idea of IGA. We strive to construct unified models with new opportunities for structural design with a direct application to stiffened Aerostructures. More specifically, we present a solid-shell approach to impose continuous thickness variations. We formulate analytical sensitivities for standard and shell formulations. Then, we introduce an embedded technique that enables to impose complex shape updates. From the analysis point of view, we design a specific solver based on Domain Decomposition methods and Mortar approach for the coupling of non-conforming discretizations. Different examples with increasing level of complexity show the performances of the adopted methodologies.