COMPUTATIONAL MESH MOVING SCHEMES FOR ALE–BASED FLUID STRUCTURE INTERACTION SIMULATIONS

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Computational approaches for complex fluid structure interaction (FSI) problems involving large structural deformations currently attain a lot of interest because they still offer a number of interesting challenges. One such challenge is associated with the moving mesh, i.e. with Computational Mesh Dynamics (CMD), that is needed when ALE–based approaches are adopted. Although the moving mesh is only an artificial field in the coupled three–field problem FSI (CFD+CSD+CMD) it strongly influences performance, robustness and also accuracy of the overall approach. This importance is also proven through the number of approaches that have been proposed in recent literature (see e.g. [1]–[8]). Criteria for a good CMD approach are that it should: – avoid remeshing as long as possible; – keep a good mesh quality over the whole simulation time; – be able to deal with heavily inhomogeneous and anisotropic meshes; – contain no problem dependent parameter; – works for 2d as well as for 3d.

In our contribution we will discuss a new robust approach for CMD that is somehow based on a pseudo–structural philosophy. The performance of the suggested scheme will be demonstrated along with some two–dimensional and three–dimensional numerical test examples and also along with fluid structure interaction examples involving thin flexible structures showing large deformations and instationary incompressible viscous flows. The different approaches will be compared with respect to aspects like largest possible deformation, mesh quality evolution along deformation (and its' implication on the overall solution) and computational costs. Comparisons will be done both for structured and unstructured meshes.

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