EXTENDED FINITE ELEMENT METHOD APPLIED TO AERO-ELASTIC PROBLEMS

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In the last decades, much effort has been adressed to the development of computer codes to simulate the coupled problem of Fluid-Structure Interaction (FSI). Its practical applications are of great importance to Engineering, concerning since aeroelasticity to biomechanical problems. Additionally, there are several numerical methods and techniques to solve the problem that it is not possible to assert that a specific approach is better in all classes of problems. Due to that, many available approaches, commercial or academic, fail in robustness in some situations. This work proposes an alternative approach to treat the conjoined interface between fluid and structure domains in coupled problem of FSI based on the extended finite element method (XFEM). Classical approaches are based on Arbitrary Lagrangean-Eulerian (ALE) description and became very popular due to its availability in many commercial codes. However, in situations where the structural domain undergoes large and complex motion, the ALE approach may be replaced by better suited techniques. The XFEM was first introduced to deal with discontinuities in problems of fracture mechanic but has also shown to be suitable for problems of FSI [1], where the fluid shape functions are enriched in order to impose the physical discontinuity in velocity and pressure at the interface between the fluid and structural domain. Therefore, it is possible to generate two non-matching overlapping meshes for the structural and fluid fields and to overcome difficulties which arise from ALE approaches, as mentioned above. As an example to validate the formulation, this work presents a 2D computational simulation of a bridge transverse section subjected to the wind flow.

References

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