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Unified formulation for thermo-coupled FSI problems using the PFEM

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ABSTRACT

We present a Lagrangian formulation for thermo-coupled Fluid-Structure Interaction (FSI) problems. The numerical strategy is designed to solve the mechanics of a general continuum that may include compressible and incompressible solids and fluids, and also to deal with phase change phenomena.

The solution scheme is based on the Unified formulation proposed in [1]. According to this strategy, fluids and solids are computed monolithically using the same velocity-pressure solver.

The Particle Finite Element Method (PFEM) is used for modeling free-surface Newtonian and non-Newtonian fluids, while the solid parts are solved using the standard Finite Element Method (FEM) and a hypoelastic-plastic constitutive law [2]. In order to deal with incompressible materials, the formulation is stabilized with the Finite Calculus (FIC) technique presented and validated in [3].

It will be shown that the Unified PFEM-based formulation has a great potential for solving thermo-coupled problems involving large deformations processes and phase change of materials.

The numerical solution of several FSI problems, including an industrial application, will be presented and discussed.

REFERENCES

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