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AN UPDATED LAGRANGIAN APPROACH FOR FLUID-STRUCTURE PROBLEMS BASED ON NATURAL ELEMENTS AND THE METHOD OF CHARACTERISTICS

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ABSTRACT

We present advances regarding a novel approach for simulating fluid-structure interactions in the presence of free surfaces. This method is based on a staggered coupling between a solid formulation and an updated Lagrangian Natural Element Method (NEM) for solving the Navier-Stokes equations. The fluid problem is discretized in time by using a second-order method of characteristics. The fluid-solid coupling is solved by means of an implicit Picard iteration.

Improved, anisotropic, α-shapes are employed in order to tackle the problem posed by the free surface detection. Traditional problems encountered with this technique when simulating merging flows can thus be avoided.

The interpolant character of the Natural Element Method enables to obtain, in addition, a true interpolation along the boundary of both domains, thus enabling the use of traditional, FE, techniques to transmit the boundary conditions at the interphase.

Finally, some case studies are presented in order to avail this technique's feasibility.