A stabilized, lagrangian, meshless method for the simulation of incompressible flows and fluid/solid interaction

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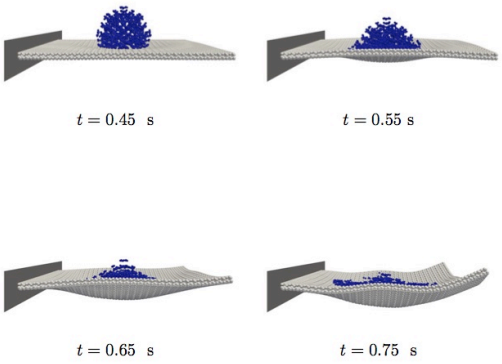
ABSTRACT

A fully lagrangian method is presented for the solution of the Stokes and Navier-Stokes flows. The method is based on a Galerkin approximation of the governing equations by means of local maximum entropy functions [1]. To ensure the stability of the method, a consistent stabilization is employed, guaranteeing the discrete coercivity of the formulation. For the integration in time, a Discontinuous Galerkin in Time method is employed which, in addition, guarantees the unconditional energy stability of the formulation, even in the nonlinear regime.

The resulting formulation does not require a mesh, and since all material points are explicitly represented, the interaction between a fluid and a structure is relatively simple to model. By using the same approximation scheme for solids, a robust numerical framework is obtained capable of simulating viscous flows and inelastic solids.

In the talk, the theoretical foundations of the method will be presented as well as numerical validations and simulations of fluid/solid interactions.



Impact of a spherical fluid droplet on a hyperelastic slender plate

REFERENCES

[1] Arroyo, M., & Ortiz, M. (2006). Local maximum-entropy approximation schemes: a seamless bridge between finite elements and meshfree methods. *International Journal for Numerical Methods in Engineering*, *65*, 2167–2202.