Invariant domain preserving method for solving Lagrangian Hydrodynamics equations

Authors:

- Jean-Luc Guermond, Dept. of Mathematics, Texas A&M University (`guermond@tamu.edu`)

- Bojan Popov, Dept. of Mathematics, Texas A&M University (`popov@math.tamu.edu`)

- Laura Saavedra Lago, Dept. de Matemática Aplicada a la Ingeniería Aeroespacial, Universidad Politécnica de Madrid (`laura.saavedra@upm.es`)

- Madison Sheridan, Dept. of Mathematics, Texas A&M University (`sheridanm@tamu.edu`)

Abstract: In this talk I am going to describe a new explicit approximation technique for the Lagrangian hydrodynamics equations equipped with an arbitrary equation of state. The approximation of the state variable is done with piecewise constant finite elements and the approximation of the mesh motion is done with higher-order continuous finite elements. This method is invariant domain preserving and exactly mass conserving. I will illustrate numerically the robustness of our method on various benchmark problems.

References:

[1] J.-L. Guermond, B. Popov, L. Saavedra, and Y. Yang. Invariant domains preserving arbitrary Lagrangian Eulerian approximation of hyperbolic systems with continuous finite elements. SIAM J. Sci. Comput., 39(2):A385-A414, 2017.

[2] J.-L. Guermond, B. Popov, and L. Saavedra. Second-order invariant domain preserving ale approximation of hyperbolic systems. J. Comput. Phys., 401:108927, 2020.

[3] J.-L. Guermond, B. Popov, and L. Saavedra. Second-Order Invariant Domain Preserving ALE Approximation of Euler Equations. Commun. Appl. Math. Comput, 2021.