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MATHEMATICAL MODELING OF NEWTONIAN AND VISCOPLASTIC FREE SURFACE FLOWS USING DYNAMIC OCTREE MESHES

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We present an approach for numerical simulation of free surface flows of Newtonian and viscoplastic incompressible fluids. The approach is based on the level set method for capturing free surface evolution and features compact finite difference approximations of fluid and level set equations on locally refined and dynamically adapted staggered octree grids. A discretization, constitutive relations, a surface reconstruction, a surface tension forces evaluation: these and other building blocks of the numerical method providing predictive and efficient simulations will be discussed in the talk. In particular, we shall address a finite difference approximation of the advective terms on staggered grids which is stable and low dissipative alternative to semi-Lagrangian methods to treat the transport part of the equations. Numerical examples will demonstrate the performance of the approach for several benchmark and complex 3D Newtonian and viscoplastic fluids with free surfaces.

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