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Extended Discontinuous Galerkin Methods for tow-phase flows[1]
FLORIAN KUMMER, Center for Turbulence Resarch, Stanford — Multiphase flows of two (or more) immiscible fluids occur in multiple technical relevant application, e.g. pre-mixed combustion, evaporation or sprays. Since density and viscosity are discontinuous at the interface between the two fluids, the pressure and velocity field contain singularities. For material interfaces, the presence of surface tension will induce a jump in the pressure field. Solutions for non-material interfaces contain jumps in velocity and pressure field, even without any surface tension models. The numerical treatment of these jumps, and the high gradients which are induced by them, is challenging. This is especially true for high-order methods, like the discontinuous Galerkin (DG) method, that usually show their major advantage–the high convergence order–only for smooth solutions. We will present an Extended Discontinuous Galerkin (XDG) method that is able to represent jumps mentioned above with sub-cell accuracy. The interface between the two fluids is represented by a high-order DG-based level set method. In cells which are cut by the interface, separate degrees-of-freedom are employed for both faces. At the interface, the jump conditions are discretized in a weak sense, in order to couple both phases.

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