6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

Discontinuous Galerkin Method for incompressible Two-Phase Flows

J. Gerstenberger[*,1], **S. Burbulla**[2], **M. Nolte**[2], **D. Kröner**[2]

[1]Albert-Ludwigs-Universität Freiburg, Hermann-Herder-Straße 10, 79104 Freiburg i. Br., Germany. janick.gerstenberger@mathematik.uni-freiburg.de

[2]Albert-Ludwigs-Universität Freiburg, Hermann-Herder-Straße 10, 79104 Freiburg i. Br., Germany.

Keywords: *Two-Phase Flow, Discontinuous Galerkin, Volume-of-Fluid, PLIC, DUNE*

The Volume-of-Fluid methods is one of the widely used approaches to track moving interface in two-phase flows. Its main appeals are the strict conservation of mass and the ability to handle topology changes. Volume-of-Fluid methods are often used in conjunction with Finite Volume methods for simulating two-phase flows. We consider a Discontinuous Galerkin scheme for incompressible two-phase flows coupled with a Volume-of-Fluid method.

We implement several algorithms for piecewise linear interface reconstruction and curvature approximation within the software framework DUNE. Using virtual cut cells constructed from the linear interface reconstructions provided by the Volume-of-Fluid scheme, we extend an existing Discontinuous Galerkin scheme to two-phase flows. Two ways to solve the resulting system are discussed, a solver for the coupled saddle point problem and a pressure-correction scheme. While the saddle-point solver provides mass conservsation of the fluid phases, its parallel efficiency is lacking. The pressure-correction scheme shows excellent parallel efficiency, but time step sizes are restricted due to the jumps in density and the surface tension.

REFERENCES

[1] W. J. Rider und D. B. Kothe, Reconstructing Volume Tracking *J. Comp. Phys.*, Vol. **141**, pp 112–152, 1998

[2] Bernardo Cockburn and Guido Kanschat and Dominik Schötzau, A Locally Conservative LDG Method for the Incompressible Navier-Stokes Equations *Math. Comp.*, Vol. **74**, pp 1067–1095, 2005

[3] Hysing, S. and Turek, S. and Kuzmin, D. and Parolini, N. and Burman, E. and Ganesan, S. and Tobiska, L., Quantitative benchmark computations of two-dimensional bubble dynamics *Int. J. Numer. Meth. Fluids*, Vol. **60**, pp 1259–1288, 2009