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A cut finite element method for two-phase viscoelastic flows

Susanne Claus[1] and Pierre Kerfriden[1]

[1] Cardiff University, School of Engineering, 14-17 The Parade, Cardiff CF24 3AA,
E-mail: ClausS2@cardiff.ac.uk

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In this presentation, we will introduce a cut finite element method for two-phase viscoelastic flows. In our scheme, which is based on CutFEM [1,2], the interfaces between two liquids are described by a level set function whose zero level set cuts arbitrarily through a fixed background mesh.

In intersected elements, the physical boundaries of each liquid phase are respected by integrating the weak formulation only over parts of the elements that are covered by the respective fluids. Additionally, intersected elements are doubled to allow for discontinuities in the pressure and in the elastic stress, and to allow for kinks in the velocity solution inside elements. Our method is stable independent of the cut location due to so-called ghost penalties [3], which are applied along the edges of intersected elements.

In the presentation, we will demonstrate the capability of our method on several flow problems such as microfluidic flows.

REFERENCES

[1] Burman, E., Claus, S., & Massing, A. (2015). A Stabilized Cut Finite Element Method for the Three Field Stokes Problem, SIAM J. Sci. Comput., Vol. 37(4), A1705–A1726.
[2] Burman, E., Claus, S., Hansbo, P., Larson, M. G., & Massing, A. (2014). CutFEM: discretizing geometry and partial differential equations. International Journal for Numerical Methods in Engineering.
[3] E. Burman (2010). Ghost penalty. Comptes Rendus Mathematique, Vol. 348 (21-22), 1217 – 1220.