XFEM

The eXtended Finite Element Method for flow problems

Institute for Computational Mechanics, Technische Universität München

B. Schott, S. Shahmiri, Y. Sudhakar, U. Rasthofer, A. Wirtz, V. Gravemeier and W.A. Wall

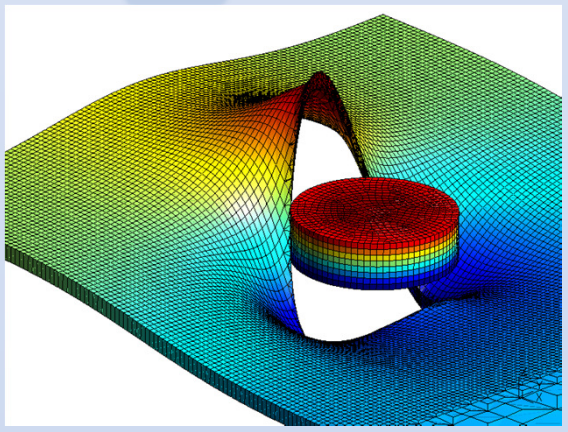

Fig. 1: The extended finite element method allows for sharp representation of discontinuities within finite elements (flow around a cylinder).

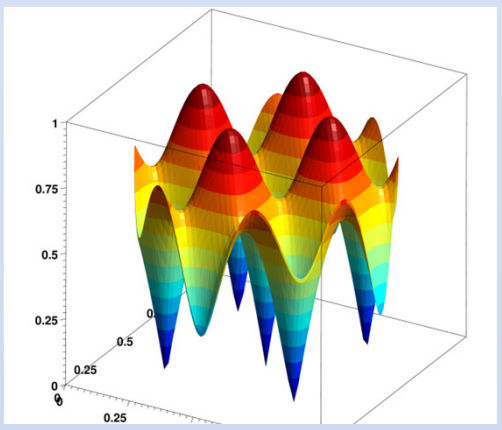

Fig. 2: Kim-Moin flow (Taylor-problem) solved on a cut fixed grid using ghost-penalty stabilized methods.

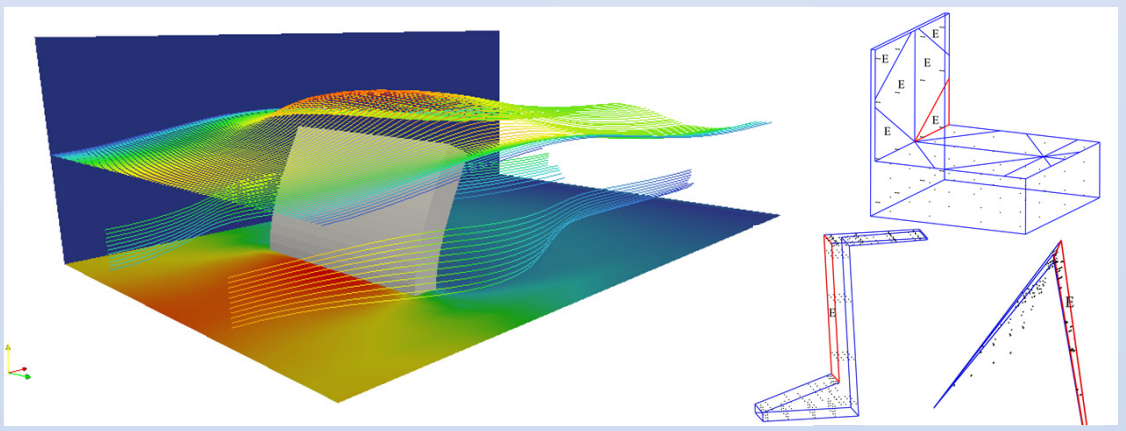

Fig. 3: Bending of a flexible wall: solved with a fixed-grid fluid-structure interaction approach.

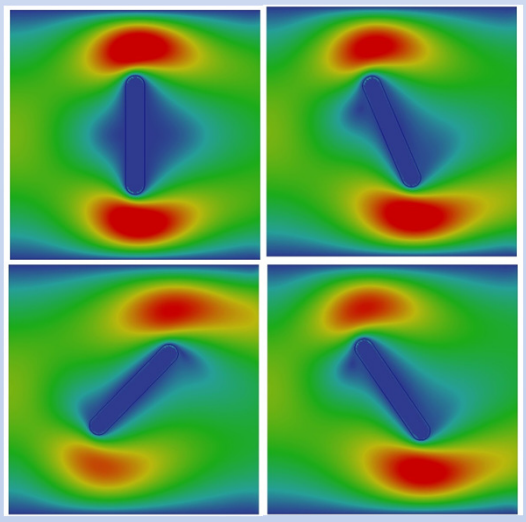

Fig. 4: Beam rotated with constant angular velocity discretized with a fixed-grid fluid mesh: velocity norm at different t.

Fluid–Structure Interaction (FSI) using embedding mesh techniques

Fluid-Structure (-Contact) Interaction (FSCI) using fixed grids

Fluid discretizations using cut elements

Multiphase-flows using unfitted meshes

Premixed Combustion

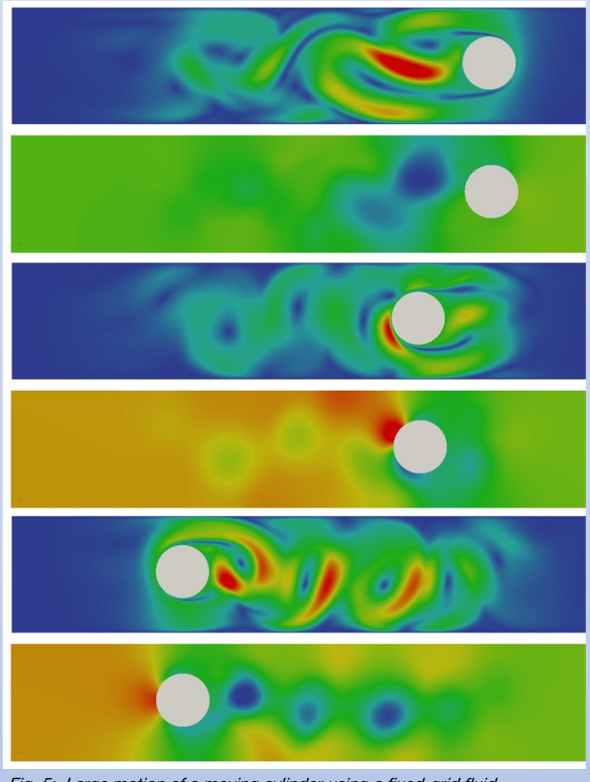

Fig. 5: Large motion of a moving cylinder using a fixed-grid fluid discretization (velocity norm and pressure at different t).

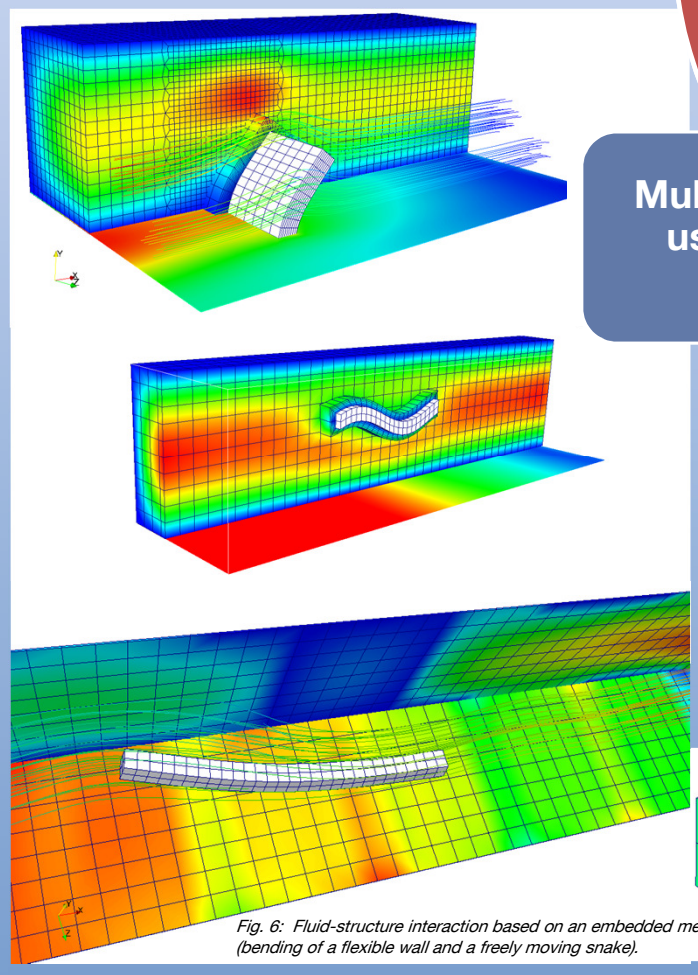

Fig. 6: Fluid-structure interaction based on an embedded mesh fluid formulation (bending of a flexible wall and a freely moving snake).

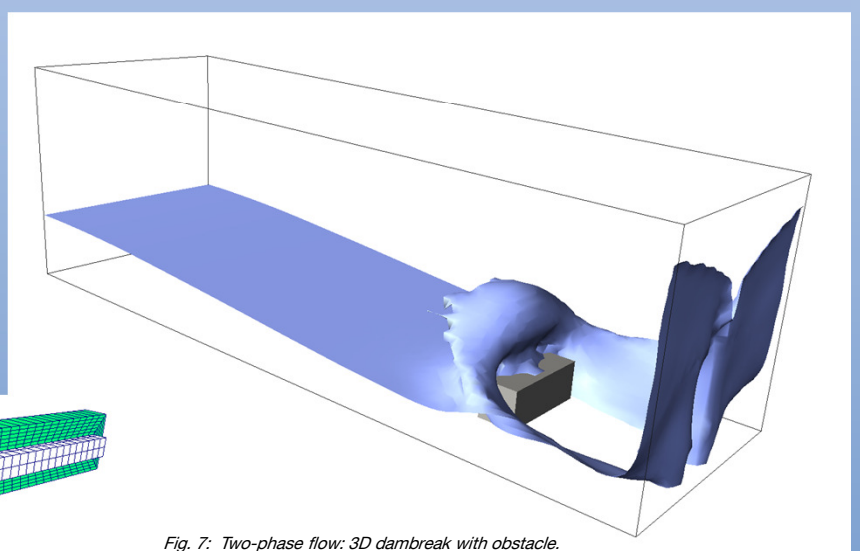

Fig. 7: Two-phase flow: 3D dambreak with obstacle.

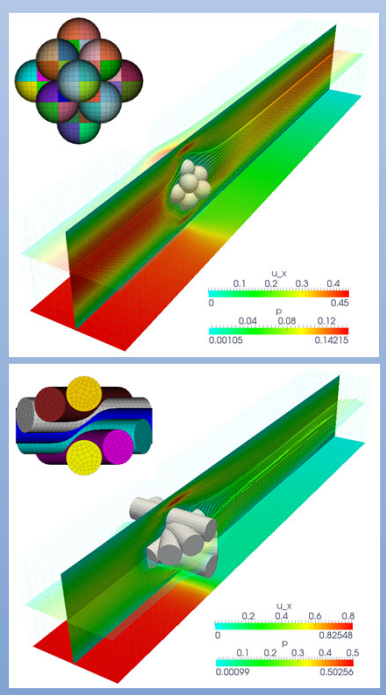

Fig. 8: 15 balls and 7 cylinders example: Selfcut for Fluid-Structure-Contact Interaction.

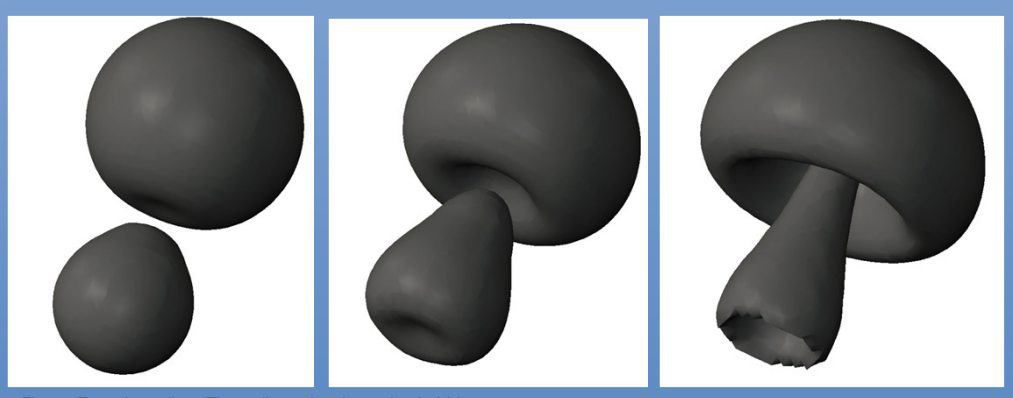

Fig. 9: Two-phase flow: Three-dimensional merging bubbles.

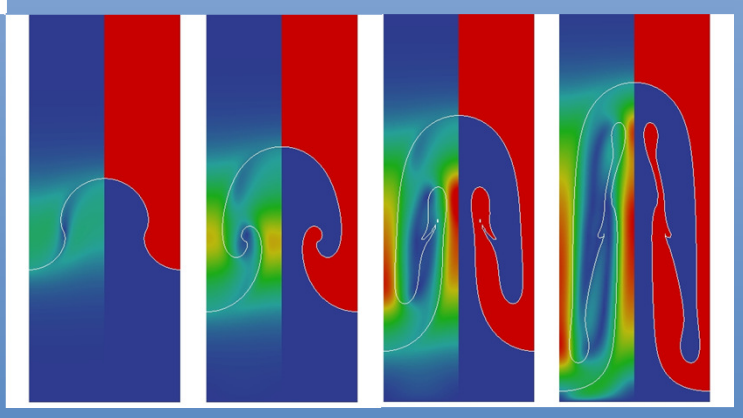

Fig. 10: Two-phase flow: Rayleigh-Taylor instability.

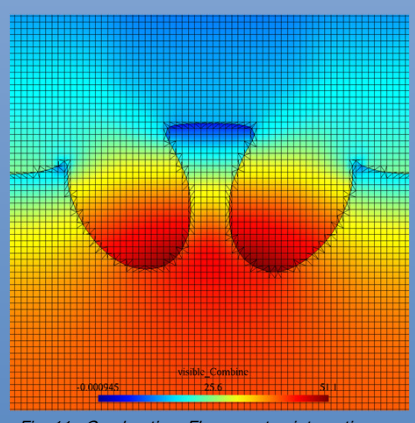

Fig. 11: Combustion: Flame-vortex interaction.

[1] B. Schott and W.A. Wall, A new face-oriented stabilized XFEM approach for 2D and 3D incompressible Navier-Stokes equations. Accepted for publication in *Comp. Methods in Appl. Mech. Engng.*, 2014.

[2] B. Schott*, U. Rasthofer*, V. Gravemeier and W.A. Wall, A face-oriented stabilized Nitsche-type extended variational multiscale method for incompressible two-phase flow. (* co-first authorship) Submitted for publication in *Int. J. Numer. Meth. Engng.*, 2014.

[3] A face-oriented stabilized XFEM-based embedding mesh approach for 3D incompressible Navier-Stokes equations. In preparation, 2014.

[4] F. Henke, M. Winklmaier, W.A. Wall and V. Gravemeier. A semi-Lagrangean time-integration approach for extended finite element methods, *Int. J. Numer. Meth. Engng.*, 98(3):174-202, 2014.

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[7] U.M. Mayer, A. Popp, A. Gerstenberger and W.A. Wall. 3D fluid-structure-contact interaction based on a combined XFEM FSI and dual mortar contact approach. *Comp. Mech.*, 46:53-67, 2010.

Dipl.-Math. Benedikt Schott,
Prof. Dr.-Ing. Wolfgang A. Wall
Institute for Computational Mechanics,
Technische Universität München

lnM
Lehrstuhl für Numerische Mechanik