Fluid-Structure Interactions with Contact using Nitsche's Method

Stefan Frei[1]   Erik Burman[2]   Miguel A. Fernández[3]

In this presentation we develop a Nitsche-based contact formulation for fluid-structure interaction (FSI) problems with contact. Our approach is based on the works of Chouly and Hild for contact problems in solid mechanics. Using a suitable extension of the fluid equations below the contact surface, we are able to formulate the FSI interface and the contact conditions simultaneously in equation form on a joint interface-contact surface $\Gamma(t)$. Due to the continuous switch between interface and boundary conditions, the so-called "chattering" phenomenon known in the engineering literature, is prevented. We show a stability result and present some numerical examples to investigate the performance of the method.

References:

[1] F. Chouly and P. Hild, *A Nitsche-based method for unilateral contact problems: Numerical analysis*, SIAM Journal on Numerical Analysis 2013, 51(2), pp. 1295–1307

[2] E. Burman, M. A. Fernández, and S. Frei, *A Nitsche-based formulation for fluid-structure interactions with contact*, Research Report RR-9172, Inria (2018), hal-01784841

[1]University College London, Department of Mathematics
`s.frei@ucl.ac.uk`

[2]University College London, Department of Mathematics
`e.burman@ucl.ac.uk`

[3]Inria de Paris
`miguel.fernandez@inria.fr`