

# A mechanically consistent model for fluid-structure interactions with contact including seepage

Stefan Frei, Erik Burman, Miguel A. Fernández, Fannie M. Gerosa

We present a new approach for a mechanically consistent modelling and simulation of fluid-structure interactions (FSI) with contact. The fundamental idea consists of combining a relaxation of the contact conditions with the modelling of seepage through a porous layer of co-dimension one during contact. For the latter, a Darcy model is considered in a thin porous layer attached to a solid boundary in the limit of infinitesimal thickness. The resulting computational model is both mechanically consistent and simple to implement. The FSI coupling and the contact conditions are imposed weakly by means of a unified Nitsche approach. We analyse the approach in detailed numerical studies with both thick- and thin-walled solids, within a fully Eulerian and an immersed approach and using fitted and unfitted finite element discretisations.

## References

- [1] E. Burman, M.A. Fernández, S. Frei: *A Nitsche-based formulation for fluid-structure interactions with contact*, ESAIM M2AN 54(2) 531-564 (2020)
- [2] E. Burman, M.A. Fernández, S. Frei and F.M. Gerosa: *A mechanically consistent model for fluid-structure interactions with contact including seepage*, arXiv eprint 2103.11243 (2021)