

DECOUPLED STRATEGIES FOR FLOW PROBLEMS AND MULTIPHYSICS

DOUGLAS R. Q. PACHECO^{*} AND RICHARD SCHUSSNIG[†]

^{*} Chair for Computational Analysis of Technical Systems, RWTH Aachen University,
Aachen, Germany.
pacheco@ssd.rwth-aachen.de

[†] Institute of Biomechanics, Graz University of Technology, Graz, Austria, &
Oden Institute for Computational Engineering and Sciences, University of Texas at Austin,
Austin, United States.
schussnig@tugraz.at

ABSTRACT

Fluid flows, whether in a multiphysical context or not, are *always* coupled problems. In incompressible flows, for example, the velocity-pressure coupling is the main source of numerical and computational challenges. Furthermore, most fluid scenarios in engineering and science involve other types of physics, such as structural mechanics or heat transfer. In this context, a major research topic in numerics and scientific computing is how to efficiently decouple the solution of these different quantities without sacrificing numerical stability or accuracy. Decoupling methods include, e.g., linearisation techniques splitting certain quantities within each iterative loop [1]. Other popular examples are semi-implicit schemes that treat coupling terms explicitly, which includes fractional-step/projection methods [2], fast explicit stepping, and IMEX schemes [3]. This mini-symposium aims to bring together researchers from Computational Fluid Dynamics, Fluid-Structure Interaction and Multi-physics, who work on developing decoupling strategies to improve efficiency and/or simplify implementation for such complex problems. Contributions are sought, for instance, involving multiphase flows, non-Newtonian fluids, phase change, partitioned FSI, and thermally coupled problems, ranging from computational aspects to numerical analysis.

REFERENCES

- [1] Deteix J., Yakoubi D., *An iterative split scheme for steady flows with heterogeneous viscosity*, Computer Methods in Applied Mechanics and Engineering, Vol. 432, pp. 117391, 2024.
- [2] Guermond J.L., Minev P., Shen J., *An overview of projection methods for incompressible flows*, Computer Methods in Applied Mechanics and Engineering, Vol. 195, pp. 6011-6045, 2006.
- [3] Barrenechea G.R., Castillo E., Pacheco D.R.Q., *Implicit-explicit schemes for incompressible flow problems with variable viscosity*, SIAM Journal on Scientific Computing, Vol. 46 (4), pp. A2660-A2682, 2024.