Micro-macro parallel-in-time computations for turbulent flow with OpenFOAM

Thomas Slawig, Christian-Albrechts-Universität zu Kiel

We realized the micro-macro parareal algorithm for turbulent channel flow around a circular cylindrical body.

The parareal algorithm, introduced by Lions Madam Turinici, is the most popular algorithm to realize a parallelization in time for initial-boundary value problems of PDEs. In the micro-macro version, a coarse propagator on a coarser spatial grid is used as predictor, whereas a fine propagator on the finer target grid is applied in parallel on different time slices. In every iteration, a coarse solver is applied as corrector or update. Using two different grids requires a mapping procedure. In theory, this procedure is straight-forward. However, in practical implementations (as for example OpenFOAM), one has to struggle with several technical difficulties. We show how these difficulties can be addressed and what results we obtained.