Parallel-in-Space-and-Time Simulation of the Three-Dimensional, Unsteady Navier-Stokes Equations for Incompressible Flow

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Abstract: In this talk we investigate the combination of the $Parareal$ algorithm, which enables parallel time-computation using a decomposition of the time-interval, with the well established parallel in space algorithm via $Domain\text{-}Decomposition$. To this end, we combine both highly parallel algorithms on a fully distributed memory architecture to efficiently solve the challenging three-dimensional Navier-Stokes equations for incompressible fluid flow. The Navier-Stokes equations are discretized with a standard finite volume/finite difference approach via a projection method.

We will demonstrate several results of numerical experiments performed on a Cray XE6 which show that parallelization in time leads to further substantial speedup especially when parallelization in space is already saturated.

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