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A MULTIRATE-IN-TIME FRAMEWORK FOR COUPLED TRANSPORT AND FLOW WITH GOAL-ORIENTED SPACE-TIME ADAPTIVITY

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In recent years, the numerical simulation of coupled systems of multi-physics involving multiple time scales has attracted researchers' interest. A multirate approach that decouples the time scales of the subproblems within the simulation is desirable to increase computational efficiency or let simulations become feasible at all. Here, adaptive strategies become even more crucial since one does not only need indicators that tell in which part of the domain the solutions have to be improved, but also which of the subproblems contributes more to the error. The Dual Weighted Residual (DWR) method offers the potential and flexibility for the derivation of such error control mechanisms for multirate discretizations and automatic mesh control. The implementation of the DWR approach and space-time adaptivity faces vast challenges in the design of data structures and in the software engineering.

In this talk we present our overall framework for space-time adaptive multirate solvers, implementational details as well as the underlying DWR based error estimation. This is presented for a system coupling incompressible viscous flow with a transport equation. The results of the error estimation are illustrated by numerical experiments. The potential of the implementation is demonstrated by challenging numerical experiments that are related to real-world problems.

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