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ADAPTIVE FEM FOR TIME RESOLVED MULTIPHYSICS IN TURBULENT FLOW

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During the last years the simulation of large problems involving turbulent flow and multiphysics has gained momentum, as the numerical methods, software and hardware have become increasingly powerful. In our work, to be able to resolve the scales of interest we use adaptive finite element methods, but even with the use of goal oriented mesh adaptation the resulting discrete problems are very large. An efficient parallelized implementation of the algorithms is needed to discretize and solve such problems.

In this talk we present our work on turbulent flow multiphysics, including computational aeroacoustics, multiphase flow and fluid-structure interaction [1]. In particular, we focus on the representation of a moving interface in such problems. This can be the interface between two different fluids in a multiphase ocean atmosphere model or the interface in a fluid-structure interaction problem. The main goal is to resolve the interface as accurate as possible without introducing a regularized step function with or without aligning the mesh with the interface.

We discuss this issue in the setting of high performance computing including the devel-

opment of data structures and data decomposition methods for distributed unstructured meshes. We present the basic algorithms and applications for which we analyse scalability and robustness.

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