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TIME ADAPTIVITY AND ANISOTROPIC MESH ADAPTATION FOR CFD APPLICATIONS

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Abstract. In this communication we present some recent results about time adaptivity with applications to fluid-dynamics. In particular, we are interested in phenomena characterized by temporal multiscale as well as strong spatial heterogeneities, e.g., heat flow problems, shallow water flows, hydrogeology, particle diffusion phenomena, etc. The proposed adaptation procedure relies on a theoretical tool, i.e., an a posteriori error estimator, driving the automatic choice of both the spatial and temporal meshes. The key point is to identify, in the error estimator, separate space and time contributions, as discussed, e.g., in [1, 2, 3]. Thus, on the one hand, we devise a sound criterion to update the time step, able to follow the evolution of the problem under investigation. On the other hand, we exploit an anisotropic adapted triangular grid. It is in fact well known that, by better orienting the mesh elements according to the main features of the solution, it is possible to maximize the solution accuracy for a fixed number of elements, rather than reduce the number of degrees of freedom for a fixed solution accuracy (see, e.g., [4, 5]). Application to purely diffusive problems was first provided in [6, 7]. Here we extend our approach to nonlinear problems, such as the shallow water system considered in [8, 9].

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