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FULLY SPACE-TIME METRIC BASED ANISOTROPIC MESH ADAPTATION FOR UNSTEADY PROBLEMS

G. JANNOUN, J. VEYSSET, E. HACHEM, AND T. COUPEZ

MINES ParisTech, Center for Materials Forming (CEMEF),
UMR CNRS 7635, BP 207, 06904 Sophia-Antipolis, France
e-mail: ghina.el_jannoun@mines-paristech.fr, www.cemef.mines-paristech.fr/

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Abstract. This talk focuses on the development of a new fully space-time adaptive meshing algorithm applied to unsteady problems. We start by introducing the anisotropic mesh adaptation. The latter is developed using a posteriori estimates relying on the length distribution tensor approach and the associated edge based error analysis. Then we extend the mesh adaptation technique to contain adaptive time advancing based on a newly developed time error estimator that intends to homogenize the global error over space and time. The main feature of this work is the development of a seek and conquer method that provides optimal space and time meshes that hold for several simulation time subintervals. The advantage of the proposed method relies in its conceptual and computational simplicity as it only requires from the user a number of nodes according to which the mesh and the time-steps are automatically adapted. The objective of this talk is to show that the combination of time and space anisotropic adaptations with highly stretched elements can be used to accurately reproduce high Reynolds number flows within reasonable computational and storage costs. In particular, it will be shown in the numerical experiments that boundary layers, flow detachments and all vortices are well captured automatically by the mesh. The time-step is controlled by the interpolation error and preserves the accuracy of the mesh adapted solution. A Variational MultiScale (VMS) method is employed for the discretization of the Navier-Stokes equations. Numerical solutions of some 2D and 3D time-dependent benchmark problems demonstrate the accuracy and efficiency of the proposed space-time error estimator.