A parallel FE solver for the NSE with adaptive grid refinement using PU-DWR

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An ongoing trend in Computational Fluid Dynamics the usage of the adaptive finite element method. A common problem arises in the evaluation of specific goal functionals. These functionals could be technical quantities like drag or lift coefficients as well as point-values or (local) averages. The Dual Weighted Residual Method (DWR) described in [3] is successful in solving these problems and has been used in many different CFD applications e.g. [1],[2]

In [4] a different approach to error localization using a partition of unity (PU) for the DWR method was proposed. In this work the PU-DWR is used for goal oriented mesh adaptivity. For this the formulation of the error estimator is derived. Since practical problems - especially in 3D - require a considerable amount of degrees of freedom - regardless of the discretization - a focus in this talk lies in the parallel solution. To validate the method the 2D-1, 3D-1Z and 3D-1Q (steady) test cases as described in [5] are computed. These test cases allow for effectivity analysis on drag, lift and pressure difference goal functionals.

References:

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[3] https://www.researchgate.net/profile/Roland_Becker2/publication/2615233_Weighted_A_Posteriori_Error_Control_in_FE_Methods/links/0f31752de623968697000000/Weighted-A-Posteriori-Error-Control-in-FE-Methods.pdf

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