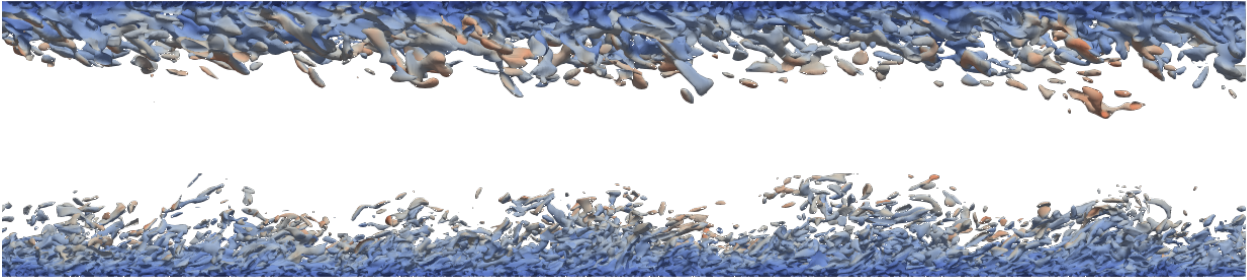# Project/Bachelor Thesis

## Analysis of time-filtering methods for wall-stress models in LES at high Reynolds numbers



At high Reynolds numbers in the order of $10^7$, which are frequently encountered in aerospace applications, the size of turbulent structures is so small that high-fidelity large-eddy simulations (LES) become unfeasible even on modern supercomputers. However, high resolution of the near-wall region is necessary to accurately predict wall-shear stress and guarantee a proper development of the boundary layer. To overcome this problem various wall-modeling approaches have been developed, that compute the correct wall-shear stress from the outer boundary layer and therefore allow for a significant reduction of the number of cells in the computational mesh.

Simply computing the local wall-shear stress based on instantaneous data from the outer boundary layer transfers the dynamics of the outer layer turbulence to the boundary surface. In reality, however, the dynamics at the wall are suppressed significantly by the viscous sublayer. Therefore, the wall-model introduces a modeling error in the instantaneous behaviour of the wall-shear stress while giving correct predictions with respect to the temporal mean.

In this thesis various time-filtering procedures with respect to the sampled data from the outer boundary layer and their effect on the predicted wall-shear stress will be analyzed. This requires the implementation of the filtering procedures into the multiphysics framework m-AIA. The implemented filtering strategies will then be evaluated by conducting multiple LES of a turbulent channel flow on the RWTH High Perfomance Computer CLAIX and analyzing characteristic properties of the boundary layer flow with respect to the literature.

**You ...**

- ... are interested in flow physics and computational fluid dynamics.
- ... have experience programming in C++/Python or are motivated to learn it.
- ... are able to work independently and communicate progress and difficulties clearly.

**If you are interested, please contact:**

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