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Simulations of High-Reynolds Number Turbulent Boundary Layers PHILIPP SCHLATTER, QIANG LI, GEERT BRETHOUWER, ARNE V. JOHANSSON, DAN S. HENNINGSON, KTH Mechanics — Direct and large-eddy simulations (DNS and LES) of spatially developing turbulent boundary layers under zero pressure gradient up to relatively high Reynolds numbers ($Re_\theta = 3000$ and above) are performed. The computational quantities include the velocity plus passive scalar fields at Prandtl numbers between 0.2 and 2. The inflow is located at $Re_{\delta^*} = 450$, a position where natural transition to turbulence can be expected. In addition to fully-resolved DNS, several carefully validated and promising subgrid-scale closures shall be applied together with a well-resolved, spectral numerical method. The results are extensively compared to available measurements, e.g. the ones obtained by Österlund et al. (1999). Additionally, quantities difficult or impossible to measure, e.g. pressure fluctuations and complete Reynolds stress budgets, shall be presented. The goal of the project is to provide the research community with reliable numerical data for high- Reynolds number, spatially evolving wall-bounded turbulence. In addition, it shall be shown that with today's computer power Reynolds numbers relevant for industrial application can be within reach for DNS/LES.

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