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Direct and Large-Eddy Simulation of Turbulent Flow in a Plane Asymmetric Diffuser by the Spectral Element Method JOHAN OHLSSON, PHILIPP SCHLATTER, PAUL F. FISCHER, MCS, ANL, USA, DAN S. HENNINGSON, KTH Mechanics, Sweden — Turbulent flow in a plane asymmetric diffuser is simulated by the spectral element method (SEM) as a direct numerical simulation (DNS) and with large-eddy simulation (LES) using an adapted version of the dynamic Smagorinsky model. The SEM, which is a high-order numerical method, has opened the possibility to accurately simulate fluid phenomena known to be very sensitive to numerical discretization errors, e.g. flows exhibiting separation. In addition, SEM exhibits favorable parallelization properties. Due to the development of tools for numerical stabilization specific for SEM, SEM is now suitable for turbulence simulations at moderate to high Reynolds numbers. Results from investigations on the influence of such stabilization tools are presented. For the turbulent diffuser flow case, results are presented for Re=4,500 and Re=9,000 (based on bulk velocity and channel half-height) and compared to results by Herbst et al. (2007). Quantities of interest include e.g. the size of the separation bubble and turbulent stresses.

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