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Constrained Large Eddy Simulation of Separated Turbulent Flows ZHENHUA XIA, YIPENG SHI, JIANCHUN WANG, ZUOLI XIAO, YANTAO YANG, SHIYI CHEN, State Key Laboratory for Turbulence and Complex System, College of Engineering, Peking University, China — Constrained Large-eddy Simulation (CLES) has been recently proposed to simulate turbulent flows with massive separation. Different from traditional large eddy simulation (LES) and hybrid RANS/LES approaches, the CLES simulates the whole flow domain by large eddy simulation while enforcing a RANS Reynolds stress constraint on the subgrid-scale (SGS) stress models in the near-wall region. Algebraic eddy-viscosity models and one-equation Spalart-Allmaras (S-A) model have been used to constrain the Reynolds stress. The CLES approach is validated *a posteriori* through simulation of flow past a circular cylinder and periodic hill flow at high Reynolds numbers. The simulation results are compared with those from RANS, DES, DDES and other available hybrid RANS/LES methods. It is shown that the capability of the CLES method in predicting separated flows is comparable to that of DES. Detailed discussions are also presented about the effects of the RANS models as constraint in the near-wall layers. Our results demonstrate that the CLES method is a promising alternative towards engineering applications.

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