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Hybrid RANS/LES simulation of a flow with mild separation[1]
UGO PIOMELLI, SENTHIL RADHAKRISHNAN, University of Maryland — The flow past a ramp with mild separation zone has been computed using LES and hybrid approaches. In the hybrid calculations, the RANS equations are solved throughout the boundary layer in the equilibrium region of the flow, while a wall-resolved LES is used to compute the separation and recovery regions. The LES results are used to assess the accuracy of hybrid RANS/LES approach. The accuracy of the hybrid approach depends on the generation of resolved fluctuations at the RANS/LES interface and often needs a long transition region before realistic turbulent fluctuations are generated. When the RANS/LES interface is near the separation point, forcing provided by the addition of synthetic turbulence at the interface results in faster generation of turbulent fluctuations, which is aided by the inflectional instability of the mean velocity profile. When the RANS/LES interface is in the equilibrium boundary layer region, on the other hand, even the addition of synthetic turbulence does not cause fast generation of turbulence fluctuations, resulting in reduction of skin-friction and early separation of the flow. Strategies that promote the fast generation of realistic eddies in the equilibrium region, resulting in a short transition zone, will be discussed.

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