Abstract Submitted
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Turbulent boundary layer control at moderate Reynolds numbers by means of uniform blowing/suction[1] YUKINORI KAMETANI, The University of Tokyo, KOJI FUKAGATA, Keio University, RAMIS ORLU, PHILIPP SCHLATTER, Kungliga Tekniska Hogskolan KTH — The effect of uniform blowing or suction from the wall on a spatially developing turbulent boundary layer has been studied in order to use them ultimately for flow control on the surface of high-speed vehicles. In the present study, a series of large eddy simulations is performed to investigate the effects of uniform blowing/suction on the skin friction drag as well as the scale of turbulent structures at moderate Reynolds numbers up to $Re_\theta = 2500$, based on free-stream velocity, U_∞, and momentum thickness, θ. The amplitude of blowing or suction is fixed to 0.1% of U_∞ with different streamwise ranges of the control region. While the Reynolds shear and normal stresses and their spectral energy distributions are increased by blowing and decreased by suction, in particular, in the outer region, the FIK identity reveals that drag reduction (DR) or enhancement (DE) are mainly linked to changes in the spatial development of the mean wall-normal convection term rather than the contribution from the Reynolds shear stress. Despite the weak amplitude of the control, over 10% of DR and DE are achieved by blowing and suction, respectively. In case of blowing, the mean DR rate increases as the blowing region extends because the local reduction rate grows in the streamwise direction.

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Yukinori Kametani
The University of Tokyo

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