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DNS study of a separation bubble in a turbulent boundary layer
HIROYUKI ABE, YASUHIRO MIZOBUCHI, YUICHI MATSUO, Japan Aerospace Exploration Agency — Direct numerical simulations (DNSs) of a separated turbulent boundary layer have been performed in which blowing and suction are imposed at the upper boundary in order to produce a separation bubble. The inlet data are prescribed by DNSs of a zero-pressure gradient turbulent boundary layer with the rescaling-recycling method. The Reynolds numbers at the inlet are set to be $Re_\theta = 300$ and 600 where Re_θ is the Reynolds number based on the free stream velocity and the momentum thickness. Particular attention is given to the difference between large and small separation bubbles and also the Reynolds-number dependence. The present results indicate that large-scale structures of velocity and pressure fluctuations are more dominant in a large separation bubble than in a small separation bubble, which becomes more apparent with increasing Reynolds number. The relationship between the large-scale structures and the oscillatory behavior of the detachment and reattachment regions will also be discussed.

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