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Assessment of Wall-Modeled LES for Turbulent Boundary Layers with Heated/Cooled Wall[1] RYO HIRAI, SOSHI KAWAI, Department of Aerospace Engineering, Tohoku University — In this talk, we first investigate the effects of wall heat flux induced by heated and cooled walls in zero-pressure-gradient flat-plate turbulent boundary layers by using wall-resolved large-eddy simulation (LES). Based on the wall-resolved LES database, we then assess the capability of the equilibrium wall model (Kawai and Larsson, PoF, 2012) for predicting the thermal turbulent boundary layers. By considering the behaviors of density and viscosity variations in the inner-layer of the thermal boundary-layer, one source of the major errors induced by the existing model is analyzed and a method that allows for the errors to be removed is proposed. Additionally, we also seek the possibility of further improvements in the wall model by modifying the mixing-length model based on the scaling laws derived from the analysis of the wall-resolved LES database.

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