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Equilibrium/Non-Equilibrium Wall-Modeled LES of Airfoil Stall Phenomena at High-Reynolds Number[1] YOSHIHARU TAMAKI, SOSHI KAWAI, Department of Aerospace Engineering, Tohoku University — In this talk, we discuss the predictability of the airfoil stall phenomena using the wall-modeled LES with and without the equilibrium assumption. Through the wall-modeled LES of the Aerospatiale A-airfoil at a realistic high Reynolds number (Reynolds number based on the airfoil chord and free-stream velocity $Re_c = 2.1 \times 10^6$), we analyze the behavior of the equilibrium and non-equilibrium wall models by comparing with the wall-resolved LES database. One significant difference between the two wall models is observed near the leading edge, where the flow is accelerated by the favorable pressure gradient. The equilibrium wall model cannot capture the skin friction peak near the leading edge, which results in the underestimation of the streamwise boundary-layer development. It is also indicated that the difference in the boundary-layer development consequently affects the flow separation near the trailing edge and the resultant prediction of the lift coefficient.

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