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Application of dynamic slip wall modeling to a turbine nozzle guide vane SANJEEB BOSE, Cascade Technologies, CHAITANYA TALNIKAR, PATRICK BLONIGAN, QIQI WANG, MIT — Resolution of near-wall turbulent structures is computational prohibitive necessitating the need for wall-modeled large-eddy simulation approaches. Standard wall models are often based on assumptions of equilibrium boundary layers, which do not necessarily account for the dissimilarity of the momentum and thermal boundary layers. We investigate the use of the dynamic slip wall boundary condition (Bose and Moin, 2014) for the prediction of surface heat transfer on a turbine nozzle guide vane (Arts and de Rouvroit, 1992). The heat transfer coefficient is well predicted by the slip wall model, including capturing the transition to turbulence. The sensitivity of the heat transfer coefficient to the incident turbulence intensity will additionally be discussed. Lastly, the behavior of the thermal and momentum slip lengths will be contrasted between regions where the strong Reynolds analogy is invalid (near transition on the suction side) and an isothermal, zero pressure gradient flat plate boundary layer (Wu and Moin, 2010).

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