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The Power Law and Log-law Behaviors of the Accelerated Thermal Turbulent Boundary Layer LUCIANO CASTILLO, Texas Tech University, GUILLERMO ARAYA, Mechanical Engineering Department, University of Puerto Rico - Mayaguez, FAZLE HUSSAIN, Texas Tech University — DNS of spatially evolving thermal turbulent boundary layers with strong favorable pressure gradient (FPG) is performed by employing a multi-scale dynamic approach for generating realistic inflow turbulent information. Results reveal that the thermal fluctuation, θ' and the Reynolds shear stress, $<u'v'>$, both exhibit a logarithmic behavior in the meso-layer region (e.g., $30 \leq y^+ \leq 300$). The thickness of the log-region increases in the flow direction and with the strength of the acceleration. Moreover, the mean temperature profiles do not exhibit a log behavior even in the ZPG region, rather they show a power law. Furthermore, the maxima of the streamwise heat flux, $<u'\theta'>$, increases linearly in the FPG region but remains constant in the ZPG region. On the contrary, the wall-normal heat flux remains frozen over the ZPG and acceleration regions. Meanwhile, v', w', and $<u'v'>$ continue to decay along the flow direction. However, a surprising result is observed in the θ' and $<u'\theta'>$ components which change from constant in ZPG to linear rise as the FPG increases. This increase occurs in spite the fact that turbulence production is drastically reduced in the accelerated region.

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