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Turbulent inflow information generation for compressible boundary layers[1] GUILLERMO ARAYA, HPCVLab, U. of Puerto Rico-Mayaguez, KENNETH JANSEN, U. of Colorado-Boulder — In this study, the dynamic rescaling-recycling approach for incompressible flows (J. Fluid Mech., 670, pp. 581-605, 2011) is extended to compressible spatially-developing turbulent boundary layers (SDTBL) for turbulent inflow conditions. Since the inlet boundary layer thickness is fixed, the inlet friction velocity is computed based on a power function of the momentum thickness, where the power exponent is calculated "on the fly" according to the flow solution downstream. Thus, there is no need of an empirical correlation as in other recycling methodologies. Additionally, the Morkovin's Strong Reynolds Analogy (SRA) is used in the rescaling process of thermal fluctuations. The methodology is validated in a suite of Direct Numerical Simulation (DNS) of isothermal Zero-Pressure Gradient (ZPG) boundary layers at a Mach number of 2.86. The Reynolds number range is approximately 400-800, based on the freestream density, momentum thickness, freestream velocity and wall viscosity. Low/high order flow statistics are compared with wind tunnel experiments from the literature. Focus is given to the assessment of wall temperature on the thermal transport phenomena and the dynamics of thermal turbulent coherent structures.

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