

Abstract Submitted  
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**Mean-velocity scaling of compressible turbulent boundary layer flows under non-adiabatic wall conditions**<sup>1</sup> KHALED YOUNES, JEAN-PIERRE HICKEY, University of Waterloo — The Van Driest transformation, commonly considered to be the state-of-the-art in compressible mean-velocity scaling, fails when applied to flows with wall heat transfer. Recent efforts rectified the failure in channel flows and for moderate mean flow Mach numbers. Yet, the performance in boundary layers and in the supersonic/hypersonic regime remains unsatisfactory. Particularly in the log layer, a sizable discrepancy is observed when using modern mapping techniques to scale the profiles. Using physical arguments and a generalized stress balance derivation, in this talk, we investigate the shortcomings of the existing transformations. We identify the buffer layer as the region where the failure arises and provide a possible means to resolve the dilemma. A comment is also given on the validity of Morkovin’s hypothesis and Prandtl’s mixing length theory under those extreme conditions.

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