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Predictive Inner-Outer Wall Model for Hypersonic Turbulent Boundary Layers PINO MARTIN, CLARA HELM, University of Maryland — The inner-outer predictive wall model of Mathis et al. (JFM 2011) is modified for hypersonic turbulent boundary layers. The model is based on a modulation of the energized motions in the inner layer by large scale momentum fluctuations in the logarithmic layer. Using direct numerical simulation (DNS) data of Mach 3 and Mach 7 turbulent boundary layers it is shown that this modulating effect exists in compressible conditions and at low Reynolds number. The model is extended to include also spanwise and wall-normal velocity fluctuations and is generalized for compressible flow through Morkovin scaling. Temperature fluctuations are modeled using an appropriate Reynolds Analogy. Density fluctuations are calculated from the temperature fluctuations using an equation of state and a linear scaling with Mach number. DNS data are used to obtain the universal signal and parameters. The model is tested by using the universal signal to reproduce the flow conditions of Mach 3 and Mach 7 turbulent boundary layer DNS data and comparing turbulence statistics between the modeled flow and the DNS data. This work is supported by the Air Force Office of Scientific Research under grant AF/9550-10-1-0164.

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