Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Progress in Algebraic Reynolds Stress Model development for compressible flows CARLOS GOMEZ, SHARATH GIRIMAJI, Texas A&M University — The standard algebraic Reynolds stress modeling (ARSM) approach is used to develop closures for compressible turbulence. A new rapid-pressure strain correlation model that is sensitive to gradient (Ma_g) and turbulent (Ma_t) Mach numbers is employed in the closure development. At low Ma_g, the pressure-strain correlation model assumes its standard incompressible form and the ARSM of Girimaji (1996) is recovered. Based on the analysis of the Navier-Stokes equation in the rapid distortion limit, it is suggested that at intermediate Ma_g the effects of pressure, on an average, is to counter that of inertia. This leads to a balance between production and pressure-strain correlation leading to no temporal change in Reynolds stresses in this regime. In the high Ma_g regime, the effect of pressure is negligible compared to inertia thus yielding a fully explicit algebraic Reynolds stress model. The complete proposed model is tested in a 2D supersonic mixing layer. Similarity profiles of mean streamwise velocity and turbulence quantities are compared with the experimental data of Goebel and Dutton (1991). Numerical mixing layer spreading rates are found to be in relatively good agreement with experimental data.

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Date submitted: 10 Aug 2009 Electronic form version 1.4