Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Rapid distortion analysis of compressible turbulence in ideal gas: Part 1 – Reynolds averaged moments TUCKER LAVIN, HUIDAN YU, SHARATH GIRIMAJI, Aerospace Engineering Department, Texas A&M University, College Station, TX 77843 — We solve the inviscid, compressible linearized Reynolds-averaged Navier-Stokes equations, invoking the ideal gas law rather than employing the simpler but less practical isentropic assumption. The formulation involves 26 ordinary differential equations. At the zero-Mach number limit, the incompressible RDT solutions are recovered for various mean velocity gradients. At the high-Mach number limit, the Burgers solution is recovered for the homogeneous mean shear case. For intermediate Mach numbers the pressure dilatation term is found to be influential in transferring energy between the kinetic and internal modes. The exchange causes high frequency oscillations in Reynolds stresses which are absent in the incompressible limit. The effects of compressible initial conditions are also examined. Initially compressible velocity field is found to be more conducive to internal energy conversion. Nearly half of the total energy is in the form of internal energy at large times. In comparison about 25 percent of energy is in the form of internal energy for the case of the initially- incompressible field.

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Date submitted: 14 Aug 2006 Electronic form version 1.4