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Direct Numerical Simulation of a normal shock train with thermal nonequilibrium ROMAIN FIVET[1], VENKAT RAMAN[2], University of Michigan — The role of a normal shock train in a supersonic engine is to convert a sufficient amount of the incoming kinetic energy into internal energy by the entrance of the combustor, in order to guarantee flame ignition. It comprises a succession of compression and expansion waves attached to a turbulent boundary layer. When the molecular collisional process is not fast enough compared to convective and turbulent timescales, thermal nonequilibrium becomes important, which could alter the energy conversion process. By changing the local thermophysical properties and density, nonequilibrium can change the shock structures leading to changes in the energy conversion process. Here, direct numerical simulations are used to study the effect of such nonequilibrium on a Mach 2.0 rectangular isolator. A one-dimensional time-averaged analysis is used to quantify this effect on the pressure work and turbulent kinetic energy evolution.

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