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Shock Structure at Moderate and Large Mach Numbers SAMUEL PAOLUCCI, CHRISTOPHER PAOLUCCI, University of Notre Dame — The structure of gas-dynamic shock waves at hypersonic conditions is of great interest. The Navier-Stokes formulation is known to yield incorrect shock profiles even at moderate Mach numbers. This is an excellent test problem for extensions of such equations since excellent experimental results are available. Continuum theories, and indeed most statistical mechanics theories, that have been advanced to reconcile such discrepancies have not been fully successful. Here, we present a second order formulation of the governing stress tensor and heat flux based solely on a continuum formulation. The constitutive equations for the gas, in addition to the known transport properties, also introduce additional viscosity and thermal conductivities which generally depend on density and temperature. Their specific dependence are estimated from kinetic theory. Results of the second-order equations applied to the shock structure are obtained for monatomic and diatomic gases over a large range of Mach numbers and are compared to experimental results.

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