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Modern Infinitesimals and the Entropy Jump Condition for an Inviscid Shock Wave ROY BATY, LEN MARGOLIN, Los Alamos National Laboratory — This presentation applies nonstandard analysis to derive jump function solutions for energy and entropy across one-dimensional shock waves in a compressible, inviscid, perfect gas. Nonstandard analysis is an area of modern mathematics that studies number systems containing both infinitely small and infinitely large numbers. In the current work, it is assumed that the shock wave thickness occurs on an infinitesimal interval and the jump functions associated with energy and entropy vary smoothly across the shock layer. The classical jump functions for the equilibrium thermodynamic energy and entropy are reviewed with emphasis on the entropy peak in the shock layer. Jump functions are then constructed and analyzed for a functional form of nonequilibrium entropy that has been shown by Margolin et al. to remove the entropy peak and closely estimate the gas kinetic nonequilibrium entropy found across a shock wave with realistic statistical mechanics properties.

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