Applied Mathematics Seminar
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The Application of Nonstandard Analysis to the Study of Inviscid Shock Wave Jump Conditions

by

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Abstract

The use of conservation laws in nonconservative form for deriving shock jump conditions by Schwartz distribution theory leads to ambiguous products of generalized functions. Nonstandard analysis is used to define a class of Heaviside functions where the jump from zero to one occurs on an infinitesimal interval. These Heaviside functions differ by their microstructure near x = 0, i.e., by the nature of the rise within the infinitesimal interval it is shown that the conservation laws in nonconservative form can relate the different Heaviside functions used to define jumps in different flow parameters. There are no mathematical or logical ambiguities in the derivation of the jump conditions. An important result is that the microstructure of the Heaviside function of the jump in entropy has a positive peak greater than one within the infinitesimal interval where the jump occurs. This phenomena is known from more sophisticated studies of the structure of shock waves using viscous fluid assumption. However, the present analysis is simpler and more direct.