

Shock Formation at the Sonic Line

Analysis of Self-Similar Solutions of Multidimensional Conservation laws

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Abstract

In classical pictures of steady transonic flow (for example, a compression wave over an airfoil), it appears that the shock forms exactly on the sonic line. However, careful numerical simulations on this and on a corresponding situation in unsteady two-dimensional flows reveal that the shock actually forms at a point where the underlying system (steady or self-similar) is strictly hyperbolic. What is in fact the case? I will talk about joint work with Allen Tesdall that shows (by means of a simple example) that a transonic shock can indeed be created on the sonic line. However, the set-up appears to be structurally unstable, and a small perturbation will displace it into the hyperbolic region. This explains both the appearance of such shocks and the fact that under sufficient numerical resolution they appear to move off the sonic line.