Shock Propagation in the Presence of Time-Dependent Perturbations

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Abstract
This talk will report work, part of a joint investigation with G. I. Barenblatt, on shock wave propagation when small-amplitude time-dependent fluctuations are created behind the shock. The analysis is carried out in the framework of Burgers' equation, and we seek a self-consistent theory in a two-parameter plane (perturbation amplitude, Reynolds number) showing how the perturbations are convected towards the shock, and how they significantly distort the shock profile while being absorbed by the shock. A closed equation is found, within a self-consistent framework, for the mean shock profile, and this is solved by singular perturbation techniques to show that in certain regions of parameter space it is possible for small perturbations to cause a great broadening of the shock width, and a splitting of the shock itself into three regions. Two of these are conventional Taylor shocks, in which convection and thermoviscous diffusion balance; and in the region between them there is a much less rapid transition, deep within the shock, controlled by the fluctuations themselves.