Abstract

We are concerned with the Prandtl-Meyer reflection configurations of unsteady global solutions for supersonic flow impinging upon a symmetric solid wedge. Prandtl (1936) first employed the shock polar analysis to show that there are two possible steady configurations: the steady weak shock solution and the steady strong shock solution, when a steady supersonic flow impinges upon the solid wedge – the half-angle of which is less than a critical angle (*i.e.*, the detachment angle), and then conjectured that the steady weak shock solution is physically admissible since it is the one observed experimentally. The fundamental issue of whether one or both of the steady weak and strong shocks are physically admissible has been vigorously debated over the past eight decades and has not yet been settled in a definitive manner. On the other hand, the Prandtl-Meyer reflection configurations are core configurations in the structure of global entropy solutions of the two-dimensional Riemann problem, while the Riemann solutions themselves are local building blocks and determine local structures, global attractors, and large-time asymptotic states of general entropy solutions of multidimensional hyperbolic systems of conservation laws. In this sense, we have to understand the reflection configurations in order to understand fully the global entropy solutions of two-dimensional hyperbolic systems of conservation laws, including the admissibility issue for the entropy solutions. In this monograph, we address this longstanding open issue and present our analysis to establish the stability theorem for the steady weak shock solutions as the long-time asymptotics of the Prandtl-Meyer reflection configurations for unsteady potential flow for all the physical parameters up to the detachment angle. To achieve these, we first reformulate the problem as a free boundary problem involving transonic shocks and then obtain appropriate monotonicity properties and uniform *a priori* estimates for admissible solutions, which allow us to employ the Leray-Schauder degree argument to complete the theory for all the physical parameters up to the detachment angle.