Inversely designing boundaries from observed shock fronts in two gas dynamic models

Qianfeng Li
Department of Mathematics, Erlangen-Nuremburg University, Germany.
qianfeng.li@fau.de

Abstract

When supersonic flows past wedges and conical obstacles, or the piston expanding into the static gas, there exists a leading shock in the gas. We aim to design the position of obstacles or the trajectory of pistons with the prescribed leading shock and the incoming flow or initial states. By the method of characteristics and asymptotic analysis, under suitable assumptions on the given shock and the given incoming flows or initial states, we globally determine the smooth boundaries and the piece-wise smooth flow field. Moreover, the obtained flow fields admit large velocity variations.

Keywords: Hyperbolic conservation laws, inverse problems, large variation flow field, supersonic flow past obstacles, piston models.