

A Variational Inequality Formulation for Transonic Compressible Steady Potential Flows

Eun Heui Kim

South Dakota State University

In this talk, we present a variational method to understand the solution structure of a transonic shock problem. We investigate a steady compressible potential flow for its simplistic setting and show that a transonic shock of the potential flow becomes a variational inequality form. That is, the critical point of the variation satisfies the transonic equation while the associate jump conditions across its free boundary match the Rankine-Hugoniot jump conditions for a shock. We validate our formulation for a simpler problem and present the necessary and sufficient condition for the existence of a transonic shock. .

In Special Session 28 on Recent Trends in Nonlinear Elliptic PDEs at the Mathematical Congress of the Americas 2025.