Shock waves in 2D compressible elastodynamics

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Talk Abstract

We study the two-dimensional structural stability of shock waves in a compressible isentropic inviscid elastic fluid in the sense of the local-in-time existence and uniqueness of discontinuous shock front solutions of the equations of compressible elastodynamics in two space dimensions. By the energy method based on a symmetrization of the wave equation and giving an a priori estimate without loss of derivatives for solutions of the constant coefficients linearized problem we find a condition sufficient for the uniform stability of rectilinear shock waves. Comparing this condition with that for the uniform stability of shock waves in isentropic gas dynamics, we make the conclusion that the elastic force plays stabilizing role. In particular, we show that, as in isentropic gas dynamics, all compressive shock waves are uniformly stable for convex equations of state. Moreover, for some particular deformations (and general equations of state), by the direct test of the uniform Kreiss–Lopatinski condition we show that the stability condition found by the energy method is not only sufficient but also necessary for uniform stability. As is known, uniform stability implies structural stability of corresponding curved shock waves.
The result obtained is a joint work with Alessandro Morando and Yuri Trakhinin.

Keywords: elastodynamics, shock waves, free boundary problem.