Mixed Hyperbolic-Elliptic Systems in Self-Similar Flows

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From the observation that self-similar solutions of conservation laws in two space dimensions change type, it follows that for systems of more than two equations, such as the equations of gas dynamics, the reduced systems will be of mixed hyperbolic-elliptic type, in some regions of space. We derive mixed systems for the isentropic and adiabatic equations of compressible gas dynamics and show that the mixed systems which arise exhibit complicated nonlinear dependence. In a prototype system, the nonlinear wave system, this behavior is much simplified, and we outline the solution to some typical Riemann problems.

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