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Large Time Asymptotics for Partially Dissipative Hyperbolic Systems

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Abstract

In this lecture we present recent results obtained in collaboration with K. Beauchard on (n-component) hyperbolic systems of balance laws in m space dimensions.

First we consider linear systems with constant coefficients and analyze the possible behavior of solutions as time goes to infinity. Using Fourier transform we exhibit the role that control theoretical tools, such as the classical Kalman rank condition, play. We build Lyapunov functionals allowing to establish explicit decay rates depending on the frequency variable. In this way we extend the previous analysis by Shizuta and Kawashima (SK) under the so-called algebraic condition (SK). In particular we show the existence of systems exhibiting a more complex behavior than the one that the (SK) condition allows. We also discuss the link of this analysis with previous literature in the context of damped wave equations, hypoellipticity and hypocoercivity. To conclude we analyze the existence of global solutions around constant equilibria for nonlinear systems of balance laws. Our analysis of the linear case allows proving existence results in situations that the previously existing theory does not cover.

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