

Dafermos, Constantine M.

Hyperbolic conservation laws in continuum physics. (English) [Zbl 0940.35002](#)
Grundlehren der Mathematischen Wissenschaften. 325. Berlin: Springer. xvi, 443 p. (2000).

Hyperbolic conservation laws had been in the center of mathematical research in the last decades due to both the mathematical challenges they offer and their relevance in applied science. Constantine Dafermos was and is one of the leading experts in the field and therefore a monograph “Hyperbolic conservation laws in continuum physics” authored by him is welcome with great expectations. To cut it short right in the beginning: We encounter a masterpiece. A carefully written book, well ordered material (including new results of the author) and a profound discussion of the relevant literature which shows a great scholar.

The contents: Chapter I–V (the titles are Balance Laws, Introduction to Continuum Physics, Hyperbolic Systems of Balance Laws, The Initial Value Problem: Admissibility of Solutions, Entropy and the Stability of Classical Solutions) give a clear introduction to the physical background and the mathematical problems which we should expect when dealing with hyperbolic conservation laws (non-smooth solutions, shocks, non-uniqueness, etc.). Chapter VI handles the L^1 -theory of scalar conservation laws, and Chapter VII–IX discuss shocks (the headlines are: Hyperbolic Systems of Balance Laws in One-Space Dimension, Admissible Shocks, Admissible Wave Fans and the Riemann Problem). A short chapter informs about Generalized Characteristics, then we learn about “Genuinely Nonlinear Scalar Conservation Laws” (Chapter XI) and “Genuinely Nonlinear Systems of Two Conservation Laws” (Chapter XII). The remaining three chapters are more devoted to certain methods: The Random Choice Method, The Front Tracking Method and Standard Riemann Semigroups, Compensated Compactness. Each chapter is followed by notes and a large bibliography is supplied.

More introductory chapters are written with great care for beginners, the more advanced results are presented in a clear manner requiring some experiences. The monograph is devoted to the analysis of hyperbolic conservation laws, but in this field the numerics gives often enlightening examples and ideas for results and theoretical concepts. Although the author does not handle numerical results, he certainly points out their relevance.

The mathematical community (not only the specialists in the field) owes much to C. Dafermos, and Springer is to congratulate to a further superb Grundlehrenband.

Reviewer: [N.Jacob \(Erlangen\)](#)

MSC:

- [35-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to partial differential equations
- [35-02](#) Research exposition (monographs, survey articles) pertaining to partial differential equations
- [35L65](#) Hyperbolic conservation laws
- [35L67](#) Shocks and singularities for hyperbolic equations

Cited in **7** Reviews
Cited in **264** Documents

Keywords:

[entropy](#); [Riemann problem](#); [random choice method](#); [front tracking method](#); [Riemann semigroups](#)