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Error Estimates for Well-Balanced Schemes on Simple Balance Laws

One-Dimensional Position-Dependent Models

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- Surveys both analytical and numerical aspects of 1D hyperbolic balance laws
- Presents a strategy for proving the accuracy of well-balanced numerical schemes
- Compares several practical schemes, including wavefront tracking and 2D Riemann problems

This monograph presents, in an attractive and self-contained form, techniques based on the L1 stability theory derived at the end of the 1990s by A. Bressan, T.-P. Liu and T. Yang that yield original error estimates for so-called well-balanced numerical schemes solving 1D hyperbolic systems of balance laws. Rigorous error estimates are presented for both scalar balance laws and a position-dependent relaxation system, in inertial approximation. Such estimates shed light on why those algorithms based on source terms handled like "local scatterers" can outperform other, more standard, numerical schemes. Two-dimensional Riemann problems for the linear wave equation are also solved, with discussion of the issues raised relating to the treatment of 2D balance laws. All of the material provided in this book is highly relevant for the understanding of well-balanced schemes and will contribute to future improvements.

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