Toro, E. F.; **Billet, S. J.**
Centred TVD schemes for hyperbolic conservation laws. (English) ｜Zbl 0943.65100｜
IMA J. Numer. Anal. 20, No. 1, 47-79 (2000).

Centred, first- and high-order schemes for hyperbolic conservation laws are presented. The spurious oscillations of the high-order methods are dealt with via the total variation diminishing (TVD) concept, mostly associated with upwind-based high-order methods. Some theoretical results for the model equation are first proved and then used to construct high-order TVD centred methods; these are extended to nonlinear systems in a more or less empirical fashion, as is usually done for upwind-based TVD schemes. The numerical results for the Euler equations are almost as good as those obtained by good upwind-based TVD methods.

The great attraction of presented centred schemes is their simplicity, which makes them suitable for scientists who do not wish to get involved in the intricacies of Riemann solvers and related topics. They are also suitable for very complicated problems for which the Riemann problem solution is unavailable or is simply too complicated. Of the two families of centred schemes presented here the SLIC scheme appears to be more robust than FLIC; it also has the potential for higher-order extensions, with orders of accuracy greater than 3.0.

Further work on a number of aspects of the methods presented in this paper is desirable. Two possible topics of further study are the extension of the third-order schemes to nonlinear systems and the extension of the finite volume upwind scheme with upwind sloping of Appendix A to multidimensional nonlinear systems.

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MSC:

65M06	Finite difference methods for initial value and initial-boundary value problems involving PDEs
65M12	Stability and convergence of numerical methods for initial value and initial-boundary value problems involving PDEs
35L65	Hyperbolic conservation laws

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