

**Yee, H. C.; Warming, R. F.; Harten, A.**

**Implicit total variation diminishing (TVD) schemes for steady-state calculations.** (English)

[Zbl 0631.76087](#)

*J. Comput. Phys.* 57, 327-360 (1985).

The application of a new implicit unconditionally stable high-resolution TVD scheme to steady-state calculations is examined. It is a member of a one-parameter family of explicit and implicit second-order accurate schemes developed by the third author [ibid. 49, 357-393 (1983; [Zbl 0565.65050](#))] for the computation of weak solutions of one-dimensional hyperbolic conservation laws. This scheme is guaranteed not to generate spurious oscillations for a nonlinear scalar equation and a constant coefficient system. Numerical experiments show that this scheme not only has a fairly rapid convergence rate, but also generates a highly resolved approximation to the steady-state solution. A detailed implementation of the implicit scheme for the one- and two-dimensional compressible inviscid equations of gas dynamics is presented. Some numerical computations of one- and two-dimensional fluid flows containing shocks demonstrate the efficiency and accuracy of this new scheme.

**MSC:**

- [76N15](#) Gas dynamics, general
- [76L05](#) Shock waves and blast waves in fluid mechanics
- [76M99](#) Basic methods in fluid mechanics

Cited in **1** Review  
Cited in **64** Documents

**Keywords:**

implicit unconditionally stable high-resolution TVD scheme; steady-state calculations; explicit and implicit second-order accurate schemes; weak solutions of one-dimensional hyperbolic conservation laws; spurious oscillations; rapid convergence; highly resolved approximation to the steady-state solution; two-dimensional compressible inviscid equations of gas dynamics; two-dimensional fluid flows

**Full Text:** [DOI](#)

**References:**

- [1] Richtmeyer, R.D.; Morton, K.W., *Difference methods for initial-value problems*, (1967), Interscience-Wiley New York · [Zbl 0155.47502](#)
- [2] Harten, A., *J. comput. phys.*, 49, 357, (1983)
- [3] Harten, A., On a class of high resolution total-variation-stable finite-difference schemes, ()
- [4] Arden, A.; Hyman, J.M.; Lax, P.D., *Commun. pure appl. math.*, 29, 297, (1976)
- [5] Leroux, A.Y., *Math. comput.*, 31, 140, 848, (1977)
- [6] Crandall, M.G.; Majda, A., *Math. comput.*, 34, 149, 1, (1980)
- [7] Van Leer, B., *J. comput. phys.*, 32, 101, (1979)
- [8] Sweby, P.K.; Baines, M.J., Convergence of Roe's scheme for the general non-linear scalar wave equation, () · [Zbl 0565.65047](#)
- [9] Harten, A.; Hyman, J.M., A self-adjusting grid for the computation of weak solutions of hyperbolic conservation laws, Los alamos nat. lab. report LA9105, (1981)
- [10] Yee, H.C.; Warming, R.F.; Harten, A., On the application and extension of Harten's high-resolution scheme, Nasa tm-84256, (June 1982)
- [11] Yee, H.C.; Warming, R.F.; Harten, A., A high-resolution numerical technique for inviscid gasdynamic problems with weak solutions, () · [Zbl 0631.76087](#)
- [12] Colella, P.; Woodward, P.R., The piecewise-parabolic method (PPM) for gas-dynamical simulations, LBL report, no. 14661, (July 1982)
- [13] Harten, A., *Commun. pure appl. math.*, 30, 611, (1977)
- [14] Harten, A., *Math. comput.*, 32, 142, 363, (1978)
- [15] Roe, P.L., *J. comput. phys.*, 43, 357, (1981)
- [16] Shubin, G.R.; Stephens, A.B.; Glaz, H.M., *J. comput. phys.*, 39, 364, (1981)

- [17] Steger, J.; Warming, R.F., J. comput. phys., 40, 263, (1981)
- [18] Warming, R.F.; Beam, R.M., On the construction and application of implicit factored schemes for conservation laws, (), New York · Zbl 0392.65038
- [19] {\scH. C. Yee and A. Harten}, Implicit TVD Schemes for Hyperbolic Conservation Laws in Curvilinear Coordinates, to appear.

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.