

Tadmor, Eitan

Local error estimates for discontinuous solutions of nonlinear hyperbolic equations. (English)

Zbl 0732.65084

SIAM J. Numer. Anal. 28, No. 4, 891-906 (1991).

Author's summary: Let $u(x, t)$ be the possibly discontinuous entropy solution of a nonlinear scalar conservation law with smooth initial data. Suppose $u_\varepsilon(x, t)$ is the solution of an approximate viscosity regularization, where $\varepsilon > 0$ is the small viscosity amplitude. It is shown that by post-processing the small viscosity approximation u_ε , pointwise values of u and its derivatives with an error as close to ε as desired can be recovered.

The analysis relies on the adjoint problem of the forward error equation, which in this case amounts to a backward linear transport equation with discontinuous coefficients. The novelty of our approach is to use a (generalized) E-condition of the forward problem in order to deduce a $W^{1,\infty}$ -energy estimate for the discontinuous backward transport equation; this, in turn, leads to ε -uniform estimate on moments of the error $u_\varepsilon - u$.

The approach presented does not "follow the characteristics" and, therefore, applies mutatis mutandis to other approximate solutions such as E-difference schemes.

Reviewer: [U. Göhner \(Stuttgart\)](#)

MSC:

- [65M06](#) Finite difference methods for initial value and initial-boundary value problems involving PDEs
- [65M15](#) Error bounds for initial value and initial-boundary value problems involving PDEs
- [35L65](#) Hyperbolic conservation laws

Cited in **3** Reviews
Cited in **44** Documents

Keywords:

local error estimates; discontinuous entropy solution; nonlinear scalar conservation law; approximate viscosity regularization; post-processing; backward linear transport equation; discontinuous coefficients; E-condition; E-difference schemes

Full Text: [DOI](#)