
Bounding the Round-Off Error of the Upwind Scheme for Advection

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Résumé

Numerical simulations are carefully-written programs, and their correctness is based on mathematical results. Nevertheless, those programs rely on floating-point arithmetic and the corresponding round-off errors are often ignored. This article deals with a specific simple scheme applied to advection, that is a particular equation from hydrodynamics dedicated to the transport of a substance. It shows a tight bound on the round-off error of the 1D and 2D upwind scheme, with an error roughly proportional to the number of steps. The error bounds are generic with respect to the format and exceptional behaviors are taken into account. Some experiments give an insight of the quality of the bounds.

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