Cacace, S.; Ferretti, R.
Efficient implementation of characteristic-based schemes on unstructured triangular grids.
(English) [Zbl 07453281]

Summary: Using characteristics to treat advection terms in time-dependent PDEs leads to a class of schemes, e.g., semi-Lagrangian and Lagrange-Galerkin schemes, which preserve stability under large Courant numbers, and may therefore be appealing in many practical situations. Unfortunately, the need of locating the feet of characteristics may cause a serious drop of efficiency in the case of unstructured space grids, and thus prevent the use of large time-step schemes on complex geometries. In this paper, we perform an in-depth analysis of the main recipes available for characteristic location, and propose a technique to improve the efficiency of this phase, using additional information related to the advecting vector field. This results in a clear improvement of execution times in the unstructured case, thus extending the range of applicability of large time-step schemes.

MSC:
65-04 Software, source code, etc. for problems pertaining to numerical analysis
65D18 Numerical aspects of computer graphics, image analysis, and computational geometry
65M06 Finite difference methods for initial value and initial-boundary value problems involving PDEs
65M25 Numerical aspects of the method of characteristics for initial value and initial-boundary value problems involving PDEs

Keywords:
large time-step schemes; unstructured grids; point location; computational complexity

Full Text: DOI

References:


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