Oberseminar
Mathematische
Strömungsmechanik

Institut für Mathematik der Julius-Maximilians-Universität Würzburg

Hyperbolic equations - structure preserving methods & other topics

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Well-Balanced Path-Conservative Central-Upwind Schemes Based on Flux Globalization

Abstract:

I will introduce a new approach for constructing robust well-balanced (WB) finite-volume methods for nonconservative one-dimensional hyperbolic systems of nonlinear PDEs. The WB property, namely, the ability of the scheme to exactly preserve physically relevant steady-state solutions is enforced using a flux globalization approach according to which a studied system is rewritten in an equivalent quasi-conservative form with global fluxes. To this end, one needs to incorporate nonconservative product terms into the global fluxes. The resulting system can then be solved using a Riemann-problem-solver-free central-upwind (CU) scheme. However, a straightforward integration of the nonconservative terms would result in a scheme capable of exactly preserving very simple smooth steady states only and failing to preserve discontinuous steady states naturally arising in the nonconservative models.

In order to ameliorate the flux globalization based CU scheme, we evaluate the integrals of the nonconservative product terms using a path-conservative technique. This results in a new WB flux globalization based path-conservative central-upwind scheme (PCCU) scheme, which is much more accurate and robust than its predecessors. This is illustrated on the nonconservative system describing fluid flows in nozzles with variable cross-sections and a variety of shallow water models including the two-layer thermal rotating shallow water equations.

via Zoom video conference (request the Zoom link from klingen@mathematik.uni-wuerzburg.de)

Friday, Apr. 29 at 3 pm CEST

Zu diesem Vortrag sind Sie herzlich eingeladen.

gez. Christian Klingenberg