MAX-PLANCK-INSTITUT
FÜR DYNAMIK KOMPLEXER
TECHNISCHER SYSTEME
MAGDEBURG

CSC Seminar

SPEAKER

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WWU Münster

TITLE

Higher order implicit schemes for compressible flow

ABSTRACT

We consider numerical schemes for compressible fluid flow, usually modelled by the Euler equations (inviscid flow) or the Navier-Stokes equations (viscous flow). At first glance, the numerical treatment of hyperbolic conservation laws (such as the Euler equations) seems straight forward by means of the Finite Volume (FV) method, which relies on an approximation of the systems inviscid fluxes by numerical ones and a representation of the solution by piecewise constant averages. By a careful analysis of the analytical fluxes, the numerical fluxes can be designed to yield stable approximations fulfilling desired properties (such as local conservation or discrete maximum principles), which makes FV schemes perfectly suited for hyperbolic problems. The insights obtained from the approximation of these inviscid fluxes are also key to considering other hyperbolic problems or the Navier-Stokes equations.

However, basic FV schemes are only first-order accurate in space, and an explicit time integration of the resulting system of ODEs has to obey strict time-step restrictions (which is usually the main bottle-neck in the simulation of interesting real-world problems). In addition, since the solution is approximated piecewise constant, higher order derivatives are not immediately available (as required for the Navier-Stokes equations).

In this talk, we discuss several options to obtain higher order spatial accuracy (to allow for higher order time integration), give examples concerning the implementation of such schemes, and highlight some of the associated difficulties.

Tuesday, February 5, 2019 at 2 pm
Seminar room Prigogine V0.05-2+3