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FAKULTÄT FÜR MATHEMATIK
Dekan Univ.-Prof. Dr. Christian Krattenthaler

Einladung zur öffentlichen Defensio von

Dipl.-Phys. Blies Patrick

Thema der Dissertation:

A 3D Helmholtz solver and efficient time integration methods for viscous flows in the ANTARES framework

Abstract:
The overarching topic of my thesis was the development and implementation of a strong-stability preserving method to overcome time step restrictions for the case when the overall time step of hydrodynamical simulations of incompressible flows is limited by diffusion and viscosity. The developed method is based on a SSP-IMEX Runge-Kutta scheme introduced by Kupka et al. (2012) with the following advancements: first of all, the IMEX equations have been extended to be used for viscosity limited flows. Secondly, the method was advanced to three dimensions. Thirdly, the assumption that the thermal conductivity and the concentration diffusivity are constants was dropped.
A consequence of this is that the partial differential equation which results from the implicit part of the IMEX scheme has now non-constant coefficients. To solve these arising three-dimensional, (non-) linear equations of Helmholtz type, I have derived and implemented a multigrid method for both the linear and nonlinear equation and used this new solver to implement the IMEX method for viscous flows into the ANTARES code.

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