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01/09/2014

E I N L A D U N G

zu einem Vortrag im Rahmen des

Kolloquiums Thermo- und Fluiddynamik

Datum: ***>> Dienstag, 9. September 2014 <<***

Zeit: ***>> 11:00 Uhr <<***

Ort: Maschinenlaboratorium ETH Zürich
Hörsaal ML H 44

Referent: **Dr. Helen Yee**
NASA Ames Research Center, Moffett Field, CA, USA

Titel: **Numerical Dissipation and Wrong Propagation Speed of Discontinuities for Stiff Reactive Flows (Problems Containing Stiff Source Terms & Discontinuities)**

The goal of this work is to relate numerical dissipations that are inherited in high order shock-capturing schemes with the onset of wrong propagation speed of discontinuities. For pointwise evaluation of the source term, previous studies indicated that the phenomenon of wrong propagation speed of discontinuities is connected with the smearing of the discontinuity caused by the discretization of the advection term. Studies show that the degree of wrong propagation speed of discontinuities is highly dependent on the accuracy of the numerical method. The manner in which the smearing of discontinuities is contained by the numerical method and the overall amount of numerical dissipation being employed play major roles. Depending on the numerical method, time step and grid spacing, the numerical simulation may lead to

(a) the correct solution (within the truncation error of the scheme),
(b) a divergent solution,
(c) a wrong propagation speed of discontinuities solution or
(d) other spurious solutions that are solutions of the discretized counterparts but are not solutions of the governing equations.

The study also investigates the difference in spurious behavior in solving the fully coupled reactive equations (without the fractional step method), comparing with the commonly used fractional step method using the Strang splitting of the reactive equations. Studies indicate that both procedures may cause an incorrect propagation speed of discontinuities if the reactive source terms are stiff. However, the Strang splitting, while introducing splitting error into the numerical procedure, is more stable than the fully coupled approach. In addition, the Strang splitting procedure exhibits more complex spurious behavior than solving the fully coupled reactive equations. The present study also includes two different ways of formulating the reactive equations. These are using all the species variables vs. using the total density and N_S-1 number of species variables (N_S is the total number of species). Solution behavior using a cut off safeguard if densities are outside the permissible range with the no safeguard option is included.

Joint work with D.V. Kotov, W. Wang, and C.-W. Shu.

Lecture 2 with Abstract:

High Order Numerical Methods for LES of Turbulent Flows with Shocks

Simulation of turbulent flows with shocks employing explicit subgrid-scale (SGS) filtering may encounter a loss of accuracy in the vicinity of a shock. In this work we perform a comparative study of different approaches to reduce this loss of accuracy within the framework of the dynamic Germano SGS model. One of the possible approaches is to apply Harten's subcell resolution procedure to locate and sharpen the shock, and to use a one-sided test filter at the grid points adjacent to the exact shock location. The other considered approach is local disabling of the SGS terms in the vicinity of the shock location. In this study we use a canonical shock-turbulence interaction problem for comparison of the considered modifications of the SGS filtering procedure. For the considered test case both approaches show a similar improvement in the accuracy near the shock.

Joint work with D.V. Kotov, A. Hadjadj, A. Wray and B. Sjogreen.

Host: Prof. P. Koumoutsakos

Gäste sind willkommen!

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