A NEW DISCONTINUITY-DETECTING METHOD AND APPLYING TO CONSTRUCT 3RD-ORDER HYBRIDIZED WENO SCHEME

Shengping Liu[1,2] and Yiqing Shen[1,2]

[1] State Key Laboratory of High Temperature Gas Dynamics, Institute of Mechanics, Chinese Academy of Sciences, Beijing, China, 100190, liushengping@imech.ac.cn
[2] School of Engineering Science, University of Chinese Academy of Sciences, Beijing, China, 100049, yqshen@imech.ac.cn

Key Words: *Discontinuity-detecting method, hybridized WENO scheme, shock-capturing, complicated flow structures.*

Compared with WENO schemes, the hybridized WENO schemes have several advantages, such as the higher-order accuracy, lower numerical dissipation and higher efficiency. The performance of the hybridized schemes is determined mainly by the discontinuity detector. In this paper, a discontinuity detecting method for a four-point stencil, which is actually used in the third-order WENO scheme, is proposed and used to develop the high order accurate hybrid scheme of the third-order WENO scheme combining with a third-order compact upstream scheme. In order to demonstrate the advanced performance of the present detecting method, this paper also compares the schemes with the same hybrid form but using different detectors in references, the results show that, the hybrid scheme with the new method has least numerical dissipation, due to the new method can correctly treat the stencils containing critical points, while the others most possibly misjudge those stencils as discontinuous ones.

REFERENCES

[1] Y-Q Shen and G-C Zha, Generalized finite compact difference scheme forshock/complex flowfield interaction. *J. Compu. Phys.*, Vol. **230**,pp. 4419-4436, 2011.

[2] G Li and J-X Qiu. Hybrid weighted essentially non-oscillatory schemes with different indicators. *J. Compu. Phys.*, Vol. **229**, pp. 8105-8129, 2010.

[3] Y-Q Shen and G-W Yang, Hybrid finite-compact-WENO schemes for shock calculation. *Int. J. Numer. Meth. in Fluids*, Vol. **53**, pp. 531-560, 2007.

[4] B. Costa, W-S Don, High order hybrid central-WENO finite difference scheme for conservation laws. *J. Compu. App. Math.*, Vol. **204**, pp. 209-218, 2007.

[5] H. M. Darian, V. Esfahanian, K. Hejranfar, A shock-detecting sensor for filtering of high-order compact finite difference schemes. *J. Compu. Phys.*, Vol. **230**, pp.494-514, 2011.