[JJ] Evening Poster | P (Space and Planetary Sciences) | P-EM Solar-Terrestrial Sciences, Space Electromagnetism & Space Environment

[P-EM17]Space Plasma Physics: Theory and Simulation

convener:Takayuki Umeda(Institute for Space-Earth Environmental Research, Nagoya University), Yohei Miyake(Education Center on Computational Science and Engineering, Kobe University), Yasuhiro Nariyuki(富山大学人間発達科学部, 共同), Tadas Nakamura(Fukui Prefectural University)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
This session focuses on studies of space plasma physics via theoretical and numerical approaches. Papers on a wide variety of topics from natural phenomena to artificial plasma environment as well as theoretical and computational methodologies are welcome.

[PEM17-P02]A large time step weighted essentially non-oscillatory (LTS-WENO) scheme for the advection equation

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Keywords:advection equation, LTS scheme, WENO scheme

Various phenomena concerning flow are well described by hyperbolic conservation laws. In general, since the hyperbolic conservation laws may have discontinuous solutions, a number of numerical methods that suppress numerical oscillations around discontinuities have been developed so far. Higher-order interpolation methods such as weighted essentially non-oscillatory (WENO) scheme [1] have been proposed to obtain highly accurate numerical solutions with realistic computational time, that is, realistic grid points. However, an explicit method severely limits the size of the time step because the Courant-Friedrichs-Lewy (CFL) condition as a necessary condition for the stability must be satisfied. Although an implicit method is not restricted by the CFL condition, we need to efficiently solve a large-scale system of linear equations in every time step.

The large time step (LTS) scheme [2] was introduced as an explicit method to overcome the CFL condition. In the higher-order interpolation methods, information on a wide stencil is used for higher-order accuracy in space. On the other hand, in the LTS scheme, that contributes to the stability in time with the time step exceeding the CFL condition. However, a practical spatially higher-order LTS scheme has not yet been examined sufficiently. In this paper,a new numerical scheme for the advection equation is constructed combining the LTS scheme and the WENO scheme, and accuracy and efficiency of its scheme is discussed.

[1] G.-S. Jiang, C.-W. Shu, J. Comput. Phys., 126, 202-228, 1996
[2] R. J. LeVeque, SIAM J. Numer. Anal., 19, 1091-1109, 1982