Construction of a WENO scheme based on the exponential approximation space enhancing the third-order WENO scheme

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ABSTRACT

The goal of this study is to develop a novel weighted essentially nonoscillatory (WENO) finite difference scheme that improves the ability of the various third-order WENO methods. The approximation space is spanned by exponential polynomials and the shape parameter in the exponential polynomials can be regulated to adjust the local data feature, showing in better results compared to the algebraic polynomial-based schemes. We suggest an explicit form of the shape parameter and one can see that is enables the proposed scheme achieves the improved approximation order (that is, fourth-order accuracy) in smooth regions without loss of accuracy at critical points. Through several well-known benchmark numerical experiments, the our new WENO scheme captures complex shapes better near discontinuities than other third-order WENO schemes.

REFERENCES