A fifth order polynomic piecewise harmonic method for hyperbolic conservation laws

In this paper a local fifth order polynomic shock capturing method for hyperbolic conservation laws is presented. A comparation with the classical high order methods is discussed also.

Essential Non-Oscillatory (ENO) methods, constructed by Harten, Osher, Engquist, and Chakravarthy are a class of high accuracy shock capturing numerical methods for hyperbolic systems of conservation laws. These methods have been applied in a great variety of compressible flow problems.

Marquina introduced a new local third order accurate shock capturing method (PHM), the main adventage of this method lies on the property that it is localer than ENO and TVD upwind schemes of the same order, (and, thus, giving better resolution of corners), because numerical fluxes depend only on four variables.

In order to improve the accuracy of ENO methods, Shu and Osher developed the WENO (weight ENO) methods.

Our methods are quiet similar to PHM method, but they are based on simpler reconstructions (polynomic), thus they are local also. From the numerical experiments, the method becomes efficient since it is low cost and it is not sensitive to the Courant-Friedrichs-Lewy (CFL) number and the discretization parameter unlike WENO and ENO methods. Moreover, it is stable and with lower viscosity in presence of dicontinuities.

The primary goal of all these schemes is to develop a general purpose numerical method for system of conservation laws that has high accuracy in smooth regions and captures the motion of unresolved steep gradients spurious oscillations. To complete the schemes, Shu and Osher developed a special family of Runge-Kutta time integration schemes that have a TVD property. The TVD property prevents the time stepping scheme from introducing spurious spatial oscillations into upwind-biased spatial discretization.