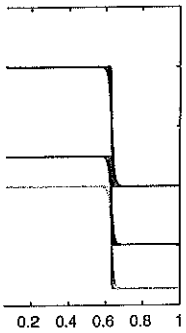

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Flow Calculations using Shock Capturing Schemes Based on Power Limiters

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1 Introduction

In this research work we address the issue of the use of slope limiters to design high order reconstruction procedures when combined with shock capturing schemes for the approximation of hyperbolic conservation laws.

We compare WENO ([JS96]) reconstruction procedure with the Weighted PowerENO one introduced in [SM04] defined as a result of applying a weaker slope limiter (*powereno* limiter) on second order differences than the one (*mineno* limiter) used by WENO. We compute with both methods the solution of the compressible Rayleigh–Taylor instability where complex structure appear. The growth of this instability is sensitive to numerical diffusion; therefore, reduced viscosity and high resolution of the contact discontinuity is important [MOS92, SZS03]. Weighted PowerENO resolves fine structure with reduced viscosity compared with WENO.

2 Power Limiters and Weighted PowerENO Method

The main goal of high order methods is to reduce smearing at discontinuities with high accuracy along smooth regions of the flow avoiding Gibbs phenomena.

ENO procedures [HEOC] use the smoothest polynomial interpolation by choosing the divided differences of smallest size following a tree-like algorithm. This selection procedure consists of a limiter function (*mineno* limiter) acting on the successive divided differences of the data.

For methods of order of accuracy larger than two, as parabolic ENO methods, second order differences need to be limited to ensure local total variation bounded property [HEOC, SM04]. However, when limiting second order differences, small scales may be destroyed if a very strong limiter, like the one used for ENO methods, is applied. The main effect on the numerical solution is the increasingly smearing across contact discontinuities as time advances.