Data and Range-Bounded Polynomials and their Derivatives in ENO Methods

Martin Berzins (University of Utah)

Essentially Non-Oscillatory (ENO) methods and Weighted Essentially Non-Oscillatory (WENO) methods are of fundamental importance in the numerical solution of hyperbolic equations. A key property of such equations is that the solution must remain positive or lie between bounds. A modification of the polynomials used in ENO methods to ensure that the modified polynomials are either bounded by adjacent values (data-bounded) or lie within a specified range (range-bounded) is considered. It is shown that this approach helps both in the range boundedness in the preservation of extrema in the ENO polynomial solution. An additional consideration with ENO methods is that to ensure boundedness of the pde solution it is important to bound the derivative of the reconstruction function. We derive a new limiter for the reconstruction function that bounds its derivative between values at mesh points and compare this approach with the new limiter of Zhang and Shu.