The CWENO reconstruction procedure

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A high order finite-volume scheme puts the following strains on the reconstruction procedure of point values from cell averages: (a) it should compute accurate and non-oscillatory point values of the variables at many locations on the cell boundary (b) many additional internal reconstruction points may be needed for source term approximation and/or grid refinement (c) the reconstruction should handle efficiently the wide variety of neighbors configurations appearing on unstructured grids.

In such situations the traditional WENO technique suffers from the difficulty of computing suitable sets of weights for each reconstruction point (existence, optimality, non-negativity, ...). However the CWENO construction first introduced in [1] is much more flexible since the linear weights need not satisfy accuracy requirements. A second and possibly more important advantage is that CWENO computes, via the nonlinear weights, an analytical expression for the reconstruction polynomial: this has uniform accuracy across the cell and it can be later evaluated at reconstruction points and the computation of nonlinear weights need not be repeated for each reconstruction point.

Many CWENO reconstructions have been considered in the literature. In this talk I will focus on properly defining the “CWENO reconstruction procedure” and on the specific tools needed for the analysis of its behavior on smooth and on discontinuous data. Examples will range from the classical 1D CWENO3 [1, 2, 3], to its extensions to 2D quad-tree meshes [4], to novel 1D CWENO reconstructions of higher order [5] and to the latest CWENOZ schemes.

References


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