Multi-species kinematic flow models lead to strongly coupled, nonlinear systems of first-order, spatially one-dimensional conservation laws. The number of unknowns (the concentrations of the species) may be arbitrarily high. Models of this class include a multi-species generalization of the Lighthill-Whitham-Richards traffic model [4] and a model for the sedimentation of polydisperse suspensions[1]. Their solutions typically involve kinematic shocks separating areas of constancy, and should be approximated by high resolution schemes.

A fifth-order weighted essentially non-oscillatory (WENO) scheme [6, 5] is combined with a multiresolution technique that adaptively generates a sparse point representation (SPR) [3] of the evolving numerical solution. The adaptivity is obtained through a hard thresholding of the wavelet coefficients from the wavelet representation of the solution at each time step. Thus, computational effort is concentrated on zones of strong variation near shocks. Numerical examples from the traffic flow models demonstrate the effectiveness of the resulting WENO multiresolution (WENO-MRS) scheme[2].

References


