On the integral convergence of numerical schemes calculating gas-dynamic shock waves

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A comparative analysis of the accuracy of shock-capturing schemes, such as the RBM (Rusanov-Burstein-Mirin) [1], CWA (Compact high order Weak Approximation) [2], and A-WENO (Alternative Weighted Essentially Non-Oscillatory) [3] schemes is carried out by numerically solving a gas-dynamic Cauchy problem with smooth periodic initial data. It is shown that, in the presence of shock waves, the RBM and CWA schemes (which do not involve nonlinear flux correction) have a higher order of integral convergence, which provides significantly higher accuracy to these schemes (compared to A-WENO) in areas of shock wave influence, despite the noticeable nonphysical oscillations at their fronts [4]. This makes it possible to use the RBM and CWA schemes as basic ones in constructing combined schemes that monotonically localize shock fronts and, at the same time, maintain higher order accuracy in shock influence areas.

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References

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