Different convergence types of shock-capturing schemes

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A comparative experimental accuracy study of four shock-capturing schemes is carried out by numerically solving a Cauchy problem with smooth periodic initial data for the Euler equations of gas dynamic. For a detailed description this study see the published article [1]. In this report a comparative next schemes: the second-order CABARET [2], third-order Rusanov [3], third-order CWA [4] and fifth-order in space third-order in time A-WENO schemes [5]. It is shown that the CABARET and A-WENO schemes, which are constructed using nonlinear limiters as a stabilization mechanism, have approximately the same accuracy in the areas of shock wave influence, while the nonmonotone Rusanov and CWA schemes has significantly higher accuracy in these areas despite producing noticeable nonphysical oscillations in the immediate vicinities of shock waves.

Also we experimentally study different convergence types this four shock-capturing schemes for the problem if discontinuity decay using the example of the Sod problem. We show that unlike the Rusanov and CWA schemes, the studied nonlinear flux correction based schemes (CABARETM and A-WENO schemes), may converge inside the shock influence area in the weak sense only.

At the same time, the combined scheme obtained based on the Rusanov and CABARET schemes localizes shock wave fronts, which are captured in a non-oscillatory manner, and preserves higher accuracy in the areas of the shock influence.

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