Parameter tuning of a 5th order Conservative and Non-oscillatory Scheme for Vlasov simulations

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In Vlasov simulations, we treat the distribution function in a position-velocity phase space, resulting in strongly reduced numerical noise. One of the most powerful tools to numerically integrate the distribution function in time is a conservative and non-oscillatory scheme. Here, the limiter function in the scheme has several parameters controlling gradient in the numerical interpolation. The appropriately selected parameter set can suppress both numerical diffusion and oscillations of the profile.Our aim is to construct a conservative and non-oscillatory scheme to sufficiently suppress diffusion using a controlling parameter set and raising the scheme-order much higher. At present, a 5th order conservative and non-oscillatory scheme is proposed, but appropriate parameter set is unknown.So far, we have performed Vlasov simulations of a simple model using a 3rd order conservative and non-oscillatory scheme.As a result, the parameter set affects in the physics of Vlasov simulations.

In this study, we calculated numerical flux varying some parameters at the four points of a Gaussian test profile with the 5th order scheme.To minimize the error between the numerical and analytical solution leads to the construction of the better parameter sets.In particular, we found the parameter sets are sensitive to the error at the tail of the Gaussian profile.By understanding the condition of parameters to be set, we can tune them in the limiter function.