

Fast and Accurate Finite-Difference Method Solving Multicomponent Smoluchowski Coagulation Equation

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Abstract : We propose a new computational technique for multidimensional (multicomponent) Smoluchowski coagulation equation. Using low-rank approximations in Tensor Train format of both the solution and the coagulation kernel, we accelerate the classical finite-difference Runge-Kutta scheme keeping its level of accuracy. The complexity of the taken finite-difference scheme is reduced from $O(N^{2d})$ to $O(d^2 N \log N)$, where N is the number of grid nodes and d is a dimensionality of the problem. The efficiency and the accuracy of the new method are demonstrated on concrete problem with known analytical solution.

Keywords : tensor train decomposition, multicomponent Smoluchowski equation, runge-kutta scheme, convolution

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