# Modeling of polydisperse sprays using a high order size moment method for the numerical simulation of advection and evaporation

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**Abstract**

This article investigates the critical issue of stable Eulerian high order size moment methods in the numerical modeling of polydisperse evaporating sprays. Polydispersity has to be modeled in order to reproduce the physics of dispersion and evaporation in most practical devices. Eulerian size moment methods are well suited for such problems but the design of numerical algorithms usually faces two difficulties: numerical diffusion and stability. The vector of successive size moments of a number density function (NDF) over a given size interval belongs to what is called the moment space, the geometry of which is complex. Any numerical method has to preserve this property and it has been shown to be a critical issue in the literature. In this paper we use a high order size moment method and design a new numerical scheme for transport in physical space, which is shown to be second order in both time and space and provides stability in the sense that it allows to preserve the ground property of a size moment vector, that is, to belong to the moment space. We also introduce operator splitting techniques and show how this new algorithm can be coupled to an evaporation module which models the disappearing droplet flux with high precision and also preserve the moment space. Such an accurate and stable scheme able to transport and evaporate a polydisperse particle/droplet flow might be of great interest for all applications where the knowledge of the size distribution of a population is an issue, in particular for engine spray applications.

Key words: multiphase flow, kinetic theory, polydispersion, moment method, moment space

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