OpenQBMM – Population balance equations for particulate flows with evolving particle size and turbulent mixing

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Training type: Advanced

Session type: Lecture with examples

Software stack:

- OpenFOAM-dev (OpenFOAM Foundation development branch)
- ParaView
- OpenQBMM

OpenQBMM website: http://www.openqbmm.org

Full description

Population balance equations describe the spatial and temporal evolution of a particle population in flows where the particle size changes due, for example, to aggregation, breakup, growth. These flows often involve chemical reactions, where mixing plays a key role, and often represents the limiting factor in terms of yield of the chemical reaction, due to the fact that the mixing time scale is larger than the reaction time scale.

Both population balance equations and turbulent mixing problems can be addressed studying on one hand, the evolution of the particle size distribution of the particle population, and, on the other hand, the evolution of the joint-composition probability distribution function. A computationally efficient method to address these types of problems in industrial applications is the extended quadrature method of moments.

The course will briefly introduce the fundamental concepts of quadrature-based moment methods, and how they have been implemented into OpenQBMM, an open-source implementation of these methods for OpenFOAM®. The structure of OpenQBMM will be illustrated, showing how the implementation of the extended quadrature method of moments has been abstracted to allow a generic evolution equation for a distribution function to be solved. Examples of how new sub-models for the population balance equation and mixing models can be implemented will be shown. Applications illustrating how to how to set up cases involving population balances and turbulent mixing will be explained.