Universität Stuttgart
Institut für Reaktive Strömungen

Bachelor or Master Thesis

Nanoparticle agglomeration in polydisperse systems

Motivation

Agglomeration is widely applicable across a variety of industrial fields, such as pharmaceuticals, materials science, and biotechnology, playing a significant role in enhancing both operational efficiency and product quality. However, most research has primarily concentrated on agglomerating uniform-sized primary particles, with limited attention given to polydisperse primary particle size distributions. It is essential to develop models for understanding the growth dynamics of agglomerates composed of polydisperse primary particle size distributions, as this can ultimately contribute to the enhancement of the final product's quality.

Project description and research goals

The objective of this project is to carry out collision simulations involving agglomerates with differing particle size ratios. These simulations involve two agglomerates of distinct sizes emerging from separate nozzles and merging to create a complex structure, as illustrated in Figure 1. Given that the growth dynamics are influenced by numerous parameters, it is necessary to employ an Artificial Neural Network (ANN) to discern the relationships between these parameters and the growth dynamics. Once the percentage of parameter dependency is determined, formulate a model for the collision kernel of these agglomerates.

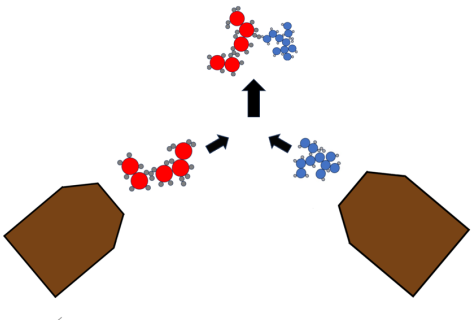

Figure 1: Hetero-agglomeration from a two-nozzle system.

Tasks

- Perform a literature review of agglomeration process and modelling strategies of hetero-agglomerates
- Simulate the agglomeration process of differently sized agglomerates
- Perform the ANN analysis to find the relationship between the parameters
- Evaluate and analyze the simulation results
- Write a thesis and present your results

Prerequisites

- Basic knowledge in fluid dynamics, programming with Matlab, Python or similar
- Beneficial: knowledge in C/C++, experience with computational fluid dynamics (CFD), OpenFOAM

Contact

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