

PAID DIPLOMA / MASTER'S THESIS

SPRAY DRYING: A CFD BASED APPROACH TO SCALING

Ref. No. DA195

To dedicated students of Physics, Chemical Engineering, Pharmaceutical Engineering or related fields.

Objective

Computational Fluid Dynamics (CFD) has emerged as a cornerstone in the engineering analysis of complex thermo-fluid systems, providing a virtual laboratory to resolve the governing equations of fluid motion, heat, and mass transfer. By discretizing the Navier-Stokes equations via the Finite Volume Method (FVM), CFD enables detailed visualization of flow patterns otherwise inaccessible through experimental means.

Spray drying is a process producing dry powder from a liquid or slurry through rapid drying with a hot gas. It involves complex coupling of gas-phase turbulence, droplet atomization, evaporation, and particle morphology evolution, governed by the interaction between the continuous phase (heated air) and the dispersed phase (liquid droplets).

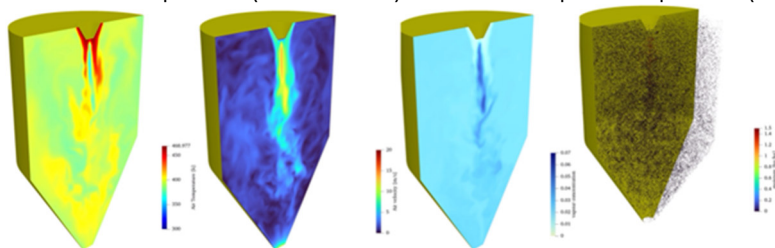


Figure 1: Snapshot of a spray drying simulation. From left to right we show air temperature, air velocity, vapor concentration and particle moisture.

The applicant will develop and run CFD simulations of spray drying using a Lagrangian-Eulerian framework, treating air as a continuum while tracking droplets as discrete parcels. The aim is to accurately predict final powder characteristics (particle size distribution, moisture content, and bulk density) and validate

these against experimental data, which will be provided by the industrial partner. Using OpenFOAM, the applicant will further develop custom constitutive models to capture droplet-wall interactions and crust formation, supporting optimization of dryer operating parameters for energy efficiency and product consistency.

Within the framework of this diploma / master's thesis we offer the following

- Extensive participation in a top-level and industrially relevant research project in an international environment
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- Assistance of experienced staff with the implementation of innovative ideas
- Access to highly modern infrastructure on campus of Graz University of Technology
- Assistance with the publication of results

Financing

- Compensation on the basis of a service contract

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