Dissertation Project Description

Simon Schröder

Topic: Stochastic Methods for Fiber Dynamics with Flow Interaction

Applying binder to glass wool or for refinement of filaments fibers are sprinkled with a liquid in an air flow. The liquid is injected into the air flow as droplets. In this process, collisions of droplets and fibers occur.

These procedural processes are to be represented in a simulation. For years, the Fraunhofer ITWM develops the simulation tool FIDYST (Fiber Dynamics Simulation Tool) for simulation of fibers in an air flow, and this tool has been successfully used in many research projects. Up to this point, there are no models for the interaction of fibers with droplets.

The goal of this dissertation project is to provide an adequate description of the filaments dynamics with exposure to drop swarms. It is unpromising to detail the whole process as the number of fibers as well as the number of droplets is too much for a detailed simulation. Hence, the detection of fiber-drop-collisions and the modeling of single collisions is not technically feasible in a simulation.

Subject of this dissertation project is
- to describe the fiber-drop-interaction by a suitable substitutional model,
- to realize this model in an algorithm, and
- to visualize the results in an appropriate way

The substitutional model should model collisions as stochastic events. Thus, single collisions are not detected, instead they are determined on the basis of space-local states representing the probability of a collision of fibers and drops. According to this probability collisions are simulated and modeled.

The simulation of the air flow and droplets is done by a commercial fluid simulation tool, and an efficient algorithmic implementation of the stochastic model should be done in FIDYST.

In a simulation the real number of fibers and droplets cannot be realized. Instead, fewer fibers and droplets than contained in the real process are simulated. For visualization of the real process the real amount has to be accounted for. Likewise, the stochastic model (collisions, probabilities, ...) have to be visualized in an appropriate way.