To resolve microscale mechanisms in depth filters, we study a single fiber in a flow channel. Specifically, we examine how droplets interact with a vibrating fiber. Picolitre-scale droplets are deposited on the fiber and their subsequent behavior—attachment, deformation, coalescence, and transport—is

Karlsruhe Institute of Technology

GPS

Master or Bachelor Thesis

Investigating Droplet-Fiber Interactions under Vibrational Conditions Using High-Speed Cameras and MATLAB

Motivation:

In mist filtration, fiber-based coalescers are a well-established method for filtering droplets present in mist. The filtration process involves distinct steps, outlining the interaction of droplets with fibers, the formation of fluid structures, and the transport of liquid. Coalescence, where smaller droplets merge to form larger ones, is a key mechanism in the development of these fluid structures, giving rise to the term "coalescing filter."

The industrial relevance of coalescers has increased with the need to protect downstream equipment, ensure product purity, and meet tighter environmental regulations. Properly designed media combine high separation efficiency for fine aerosols with low pressure drop, enabling energy-efficient operation and, in many processes, liquid recovery.

Contents:

To investigate the mechanisms within depth filters at a microscopic level, studies often focus on single fibers. In this study, the interaction between droplets and a vibrating fiber in a flow channel will be examined. Tiny droplets, in the picolitre range, will be placed on the fiber for this purpose. Handling these media on a microscopic scale presents a significant experimental challenge.

State-of-the-art high-speed imaging, coupled with custom MATLAB analysis (object tracking and static/dynamic contact-angle extraction), will quantify the mechanisms of droplet–fiber interaction.

If you are interested in microfluidics, filtration, or image and data postprocessing with MATLAB, I would be happy to hear from you via email or phone. Together, we can align the thesis to suit your interests and preferences.

What I can offer you:

- I maintain an intensive mentoring relationship with my students with regular appointments (if requested) and I'm always available to support with problems
- I give my students the freedom to contribute their own ideas to the final project
- The thesis is your work and not mine, which is why I prefer to be your advisor and not to interfere too much

What should you bring to the job

- Having fun to try and learn new things
- Ability to communicate
- Goal-oriented working
- Basic knowledge of MATLAB is beneficial

Start time: now

Type of work: Experimental (& Programming)

Your tasks

- Developing an understanding for optical systems
- Using tools for image analysis
- Creation and tracking of a project plan for your thesis

Contact

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