Bachelor/Masterthesis, Research Internship:

Design of Photoreactors: CFD Simulation of Mass- and Heat Transfer, Hydrodynamics and Radiation

Scope of the Project:
The development of highly efficient photoreactors takes great interest in the current research of chemical engineering. A profound understanding for the relevant physical effects occurring in photoreactors to derive general design criteria for photochemical processes is crucial. New degrees of freedom open up when using LEDs as radiation source in photoreactors, enabling the installation of devices to intensify mass- and heat transfer. Therefore, these reactors can be used to perform highly complex photochemical reactions.

The numerical analysis of continuum mechanics problems in science and engineering represents a research field and is called Computational Fluid Dynamics (CFD). The current challenge of modeling photochemical processes is the coupling of physical effects at the same time and space. OpenFOAM® offers a toolbox to solve multi-physics problems. During the course of the project, simulations as well as experimental investigations of photochemical processes for various applications will be conducted.

Current scientific work and possible working packages:
Within the research group of Prof. Ziegenbalg, we are beginning to establish an simulation environment to predict the behaviour of photochemical processes. In order to obtain the coupled transport phenomena properly, the open source software OpenFOAM® is used to develop a program that contains a sophisticated simulation model. The model will be built up step by step, starting with the basic evaluation of hydrodynamics and heat transfer. Further development of the code is scheduled, therefore it is necessary to implement not only the radiation field, but also the photochemical reaction.

As part of a possible thesis the work packages can contain the following:

- Construction of reactor geometries with CAD software,
- Mesh generation of reactor geometries,
- CFD simulation with OpenFOAM®.

Furthermore experimental investigations of a modular conti-flow photoreactor will serve as validation for the existing simulation model.

Qualification
The work requires handling of the Unix operating system, programming skills and fun in solving mathematical-physical problems.

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