Prof. Dr.-Ing. Heinz Pitsch

Templergraben 64
52056 Aachen
phone +49 241 80 94607
fax +49 241 80 92923
email office@itv.rwth-aachen.de

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Bachelor Thesis

A Reduced-Order Model for Multiphase Simulation of Inert Multicomponent Sprays in the Context of Compression Ignition Engines

Reducing greenhouse gas emissions, especially CO_2 from the transportation sector, is one of the main global challenges to achieve a more sustainable future. Within the “Cluster of Excellence- The Fuel Science Center”, concerted efforts are being made to develop sustainable synthetic pathway to carbon-reduced fuels by the combined utilization of CO_2 as carbon sources and ‘green hydrogen’ from water electrolysis. A fundamental understanding of the spray and mixing performance of the newly developed fuel candidates in the engine is necessary to design and develop the fuels for advanced combustion concepts.
In this context, a fast, reduced-order model for inert multicomponent sprays (McCAS) has been developed based on the cross-sectionally averaged spray (CAS) model [1,2]. In this work, a detailed analysis of the McCAS model should be carried out with respect to various operating conditions. This analysis is expected to contribute to the understanding of underlying spray formation processes, such as breakup, evaporation, and mixing of the new fuel candidates and their blends developed within the cluster.

Tasks

- Implementation of the McCAS model in the in-house code CAS
- Model validations
- Analysis of results and writing

Prerequisites/Requirements

- Programming knowledge, preferably Fortran
- Fluent in English
- Multiphase Flows class is desirable
- Self-motivation and commitment

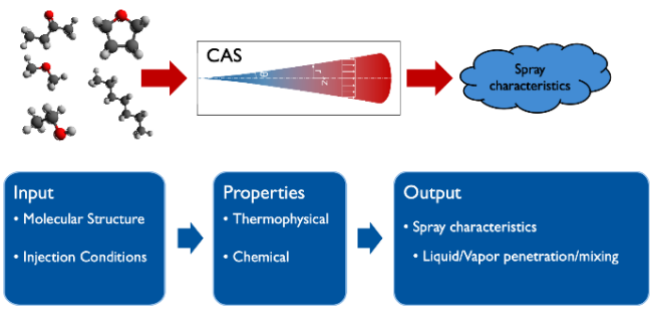

Fig. 1: Schematic of McCAS model.

References

[1] Y.P. Wan, Numerical Study of Transient Fuel Sprays with Autoignition and Combustion under Diesel-Engine Relevant Conditions (Ph.D. thesis), RWTH Aachen University (1997).

[2] A. Y. Deshmukh et al., A reduced-order model for multiphase simulation of transient inert sprays in the context of compression ignition engines. Int. J. Multiph. Flow, vol. 147, pp. 103872, 2022.

Contact

Avijit Saha
Tel. +49 241 80-97592
a.saha@itv.rwth-aachen.de

Abhishek Deshmukh
Tel. +49 241 80-94622
a.deshmukh@itv.rwth-aachen.de