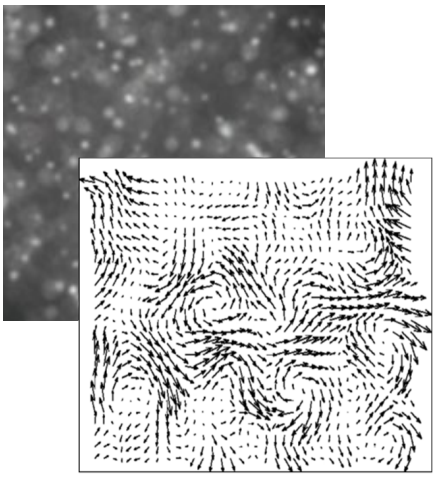
Targeted correlation analysis in spray diagnostics

Background



High-speed imaging diagnostics are essential for visualization of spray formation and liquid penetration of fuel sprays in modern engine applications. Continuing research at the division of Combustion and Propulsion Systems is centered on the expanding the use of time-resolved imaging data to extract higher order dynamics (velocity and acceleration) of resolved fluid structures.

Low-error structure tracking and determination of velocity across a range of scales in a developing spray requires efficient selection of targets and image regions for use in optical flow analysis. This project will implement new targeting approaches based on spatial distribution and texture energy metrics to improve the velocity characterization of fuel spray image data.

Project description

This project will be carried out by a team of two students. The goal of project is to improve the targeting methods used to initiate correlation analysis of fuel injection sprays.

The project is expected to proceed roughly in three phases:

1. Setup an OpenCV development environment and learn how to use the in-house code for correlation analysis of sprays.
2. Literature survey of image data metrics and application to image motion tracking.
3. Starting from the targeting framework of the in-house code, implement one or more targeting and data filtering methods to improve correlation results of the in-house code.
4. Compare the effect of targeting and filter methods on high-speed imaging data analysis from recent experiments in the CaPS spray lab.

In addition, documentation of the full project and recommendations for further work will be summarized in a final report.

Formalities

The project (30 credit points, two students) is a master thesis project which is coupled to ongoing research at CaPS. Good candidates for the position should have a solid background in programming, and some experience with image processing and statistical data analysis. Experience with fluid dynamics and scientific measurements is also desirable. Please contact Dr. David Sedarsky (sedarsky@chalmers.se, +46 31-772 8360) for more information.