Master Thesis: 2020-10-09

CFD simulations of mixing processes in Direct Injection SI engines

Background

Even in the future there will be many internal combustion engines as part of electrified vehicle powertrains. In the engines today, the fuel injection process is very important since they are key in controlling both the combustion and the emissions. A really well optimized fuel spray leads to a good mixing of the vaporized fuel and air. This is very much key to clean combustion with a minimum of unwanted emissions such as eg. particulates. The mixing quality is depending on many different parameters and physical processes. Much of this can be studied with advanced optical measurement techniques - but not all.
Even if Computational Fluid Dynamic (CFD) today is far from being predictive in engine simulations, it can still be extremely useful. For example, results from CFD can be used to explain results from experimental data which otherwise would not have been possible.

Project description and objectives

The project aims at performing CFD simulations in SI-engines using a commercial CFD code called Converge. Many CFD codes are very complex and not user friendly. This code however should be easy to use and should not have a too steep learning curve. You will have to learn how to setup a simulation with grid generation (3D), boundary conditions, performing simulation etc. and analyse the results for parameter inputs that will be decided later but preferable parameters related to the fuel injection. You will use a moving grid – so that piston and valve motion can be included in the simulation. Two students are recommended for this really fun and interesting Master Thesis. You must have some theoretical knowhow in CFD and interest in engines.

A rough time plan for the thesis work will be as follows:

2020.11	Learning the CFD code basics
2020.12	Grid generation from engines CAD files
2021.01	Simulations/analysis
2021.03	Writing thesis report
2021.04	Finish writing report

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