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Studien- / Bachelor- / Masterarbeit / HiWi

Modeling of Combustion in Direct-Injected CNG Engines

Compressed Natural Gas (CNG) engines with direct injection (DI) systems are a promising technology for future internal combustion engines, especially as the emission norms become stricter. Therefore, design and analysis of DI-CNG engines become increasingly important. However, direct gas injection and its impact on combustion and emissions has not been fully understood due to complexity arising from compressible nature of gases and resulting shocks from supersonic flow in the injector. Building on the previous work on the simulation and modeling of direct gas injection, the aim of this work is to develop predictive models for laminar burning velocity (LBV) for fuel/air mixtures based on asymptotic theory at high pressures and temperatures, for a wide range of equivalence ratios, and for different fuel compositions of natural gas (CH_4,CH_4+H_2,CH_4+C_3H_8/C_2H_6). The accurate modeling of LBV for relevant operating conditions is expected to enable accurate prediction of combustion in the simulations of spark-ignited DI-CNG engines for homogeneous as well as stratified mixtures.

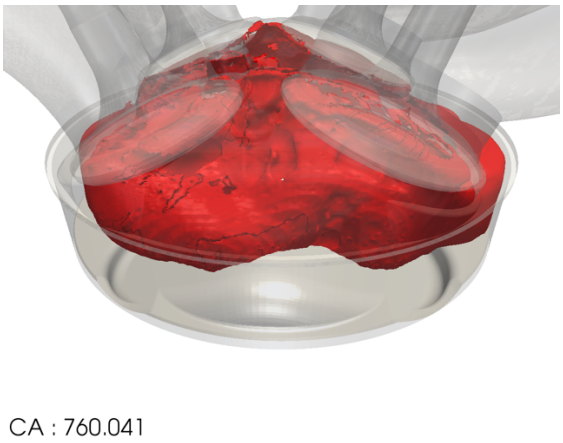

Fig. 1: Flame surface at crank angle of 760°

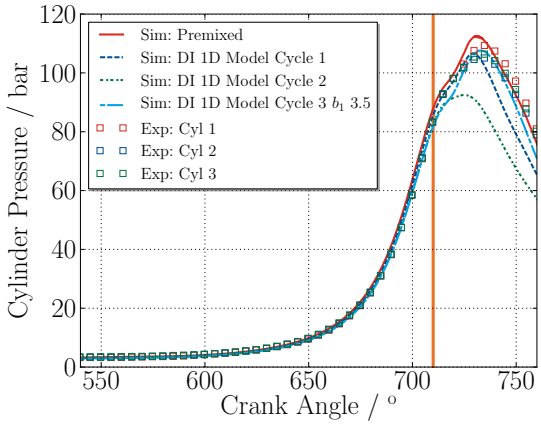

Fig. 2: In-cylinder pressure at full load 6200 RPM

Tasks

- Simulations in FlameMaster for prediction of LBV using detailed kinetic mechanisms
- Fitting asymptotic models for the LBV
- Implementation of LBV models in a commercial 3D-CFD software, CONVERGE
- Full cycle engine simulations in CONVERGE

Prerequisites/Requirements

- Programming knowledge, preferably C/C++
- Technical Combustion I/II is desirable
- Self-motivation and commitment

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**** There is a possibility to combine thesis work with HiWi**