LOGE

LOGEengine

A real time simulation tool specifically designed for analysis and development of Internal Combustion Engines (ICE).

LOGEengine is a real time simulation tool for the engine development and prototyping process. Thanks to the employment of state-of-the-art chemical and physical models for both premixed and non-premixed combustion, LOGEengine is capable of real time predictive engine performance and emission analyses under any combustion mode.

LOGEengine framework accounts for:

- In-homogeneities in the combustion chamber.
- Turbulence chemistry interaction.
- Detailed chemistry for combustion and emissions.
- Advanced mixture formation processes.
- Heat transfer to the cylinder walls.
- Real gas effects.

Using a genetic algorithm (GA), LOGEengine can identify the ideal dataset for compression ratio, initial temperature, fuel/air mass, EGR rate, wall temperature and pressure offset for any set of experimental data. Once experimental data has been analysed, the calculated setup can either be used as a starting point for 3D CFD simulations or for engine parameter mapping where LOGEengine seeks out the most advantageous injection or spark timings for optimal engine operation.

Automated work flows:

- Engine parameters variation such as: sensitivity to spark timing, SOI, mass of injected fuel etc.
- Multi-cylinder analysis.
- Full engine map extrapolation based on few operating conditions.
- Real time engine simulation and hardware-in-the- loop capability.
- Third party software interfaces.

Experimental data assessment and initial conditions optimization via heat release analysis using genetic algorithm.

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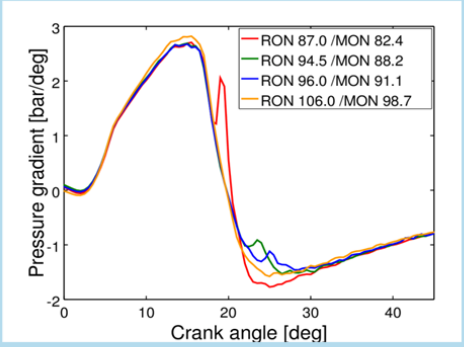
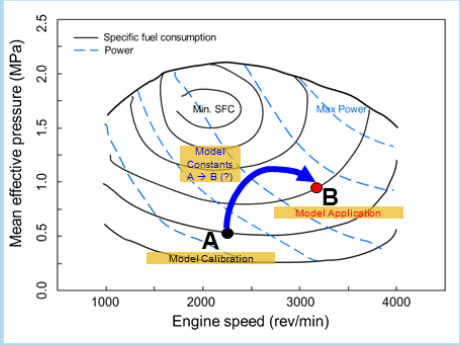
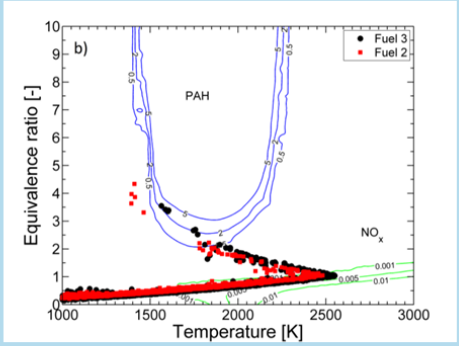
Predictive real time ICE combustion and emissions simulation using detailed chemistry.



Predictive knock analysis for SI engines



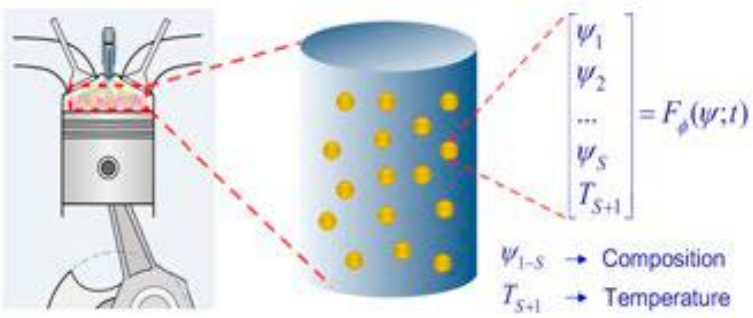
Fully automated engine map extrapolation



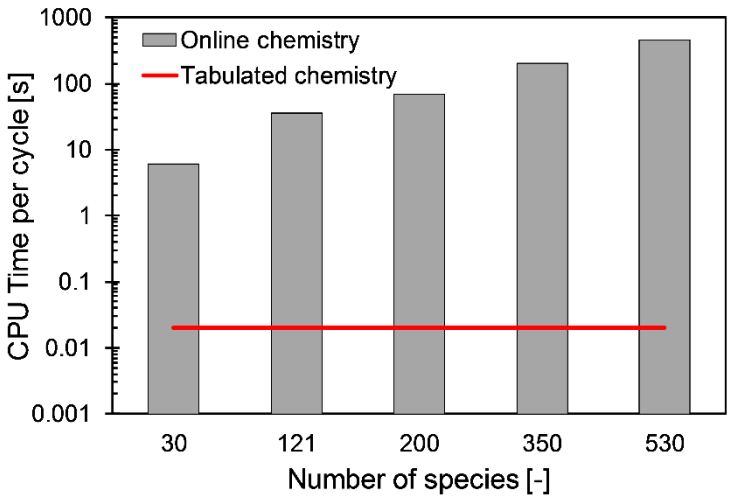
Advanced emission characterization

LOGEengine's backbone is the 0-D Stochastic Reactor model framework where in-homogeneities of the combustion chamber can be taken into account. Complex physical and chemical processes such as mixture formation, turbulent flame propagation or soot formation, are modelled using state of the art methodologies:

- k/epsilon based mixing time model.
- Monte Carlo based flame propagation model.
- Euclidean Minimum Spanning Tree (EMST) based approach for modelling of particle interaction.
- Tabulated chemistry based solver for real time simulation of combustion and complex.



Schematic representation of the SRM modelling concept.



Summary of computational cost reduction thanks to LOGE's tabulated chemistry based solver.

Recent publications

Pasternak, M., "*Simulation of the Diesel Engine Combustion Process Using the Stochastic Reactor Model*", Ph.D. thesis, Brandenburg University of Technology BTU, ISBN 978-3-8325-4310-5

Franken, T. et al., "*Development of Methodology for Predictive Diesel Combustion Simulation Using 0D Stochastic Reactor Model*", SAE Technical Paper 2016-01-0566, 2016, doi: 10.4271/2016-01-0566

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