Particle Reduced, Efficient Gasoline Engines

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Baseline version of gasoline kinetics including PAH, RANS 3D CFD, soot model and 0D SI-SRM tool

Publishable summary

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The overall objective of WP 1 (Advanced Combustion Technologies) is to establish a solid basis for model-supported design and control based on an in-depth understanding of in-cylinder particle formation processes.

The objective of this task is the development of reduced mechanisms for gasoline fuel combustion and polycyclic aromatic hydrocarbon (PAH) formation applicable in CFD simulations with specific emphasis on soot formation. The chemical mechanisms can be used to gain understanding of in-cylinder combustion and thereby support the design process of low emission gasoline engines.

In this report, the baseline version of the detailed reaction scheme is documented. The model can be used to predict the combustion of mixtures of the following fuels: n-heptane, iso-octane, toluene and ethanol.

A method to define a four-component (n-heptane, iso-octane, toluene, ethanol) surrogate based on properties of commercial gasoline is suggested. The method is verified against experimental data for mixtures of n-heptane, iso-octane and toluene. Different surrogate fuels have been formulated based on available data for commercial gasoline.

The reaction scheme is validated against ignition delay times, laminar flame speeds and speciation data obtained from publications. Further, the impact of water (steam) addition on laminar flame speeds is investigated and compared against experiments. A good agreement between model prediction and measurements is observed for all targets. The reaction scheme contains a growth model for PAH, which is compatible with LOGE soot models.

The report gives an overview of the LOGE soot models (method of moments, sectional method) and the soot formation tendencies of the four surrogate components are compared. Further, the reaction scheme was used to generate a gasoline soot source-term flamelet library. This library can be used via the LOGEsoft API in different 3D computational fluid dynamics software solutions. An extensive documentation of the method and coupling can be found in the report

The stochastic reactor model for SI-engine simulation is explained in detail in this report. The developed reaction scheme is used to predict combustion of different surrogate fuel mixtures using arbitrary engine.

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Project partners:

#	Partner	Partner Full Name
1	RIC	RICARDO UK LIMITED
2	DAI	DAIMLER AG
3	JLR	JAGUAR LAND ROVER LIMITED
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