



CLEAN COMBUSTION MODELLING

Fluid Dynamics



MAXIMISING THE POTENTIAL OF CLEAN COMBUSTION ENGINES

Realising the full potential of ICEs begins with a deep understanding of combustion processes, leading to cleaner combustion, superior propulsion efficiency, emissions reduction, and more sustainable propulsion units.

Combustion modelling extends from inception with correct property definition using complex fuel blends through modelling of combustion kinetics with flame propagation and onto the analysis of the combustion effects on power, thermal and emissions response of the powertrain.

DETAILED COMBUSTION PROCESS MODELLING FOR CARBON, NON CARBON, SYNTHETIC AND BIOFUELS

In the early stages of development, physical prototype modelling is expensive requiring virtual simulation tools to answer many of the 'What ifs' before committing to a given design path.

Simulation offers extensive modelling capability – from conventional gasoline, diesel, and kerosene blends to next generation biodiesels, synthetic hydrocarbon e-fuels as well as non-carbon fuels including hydrogen, ammonia and ethanol. Enabling an overall assessment of different fuel types.

FIND OUT HOW WE CAN HELP YOUR PRODUCT DEVELOPMENT

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The toolchain provides accurate fuel composition, kinetics, and combustion modelling for all commercially available hydrocarbons, as well as sustainable hydrocarbon alternatives. It incorporates specialised models tailored to address hydrogen and multi-fuel combustion across the entire spectrum of engine operating conditions. The analysis ranges from detailed 3D kinetics simulations and thermal modelling to 1D engine modelling, extending to real-time and systems-level evaluations.

The toolsets quickly and accurately provide answers to the 'What ifs' - vital to the overall assessment of different fuel types.

WAVE is a 1D Computational Fluid Dynamics (CFD) tool that solves the Navier-Stokes equations governing the transfer of mass, momentum and energy for compressible gas flows, and includes sub-models for combustion and emissions.

VECTIS is a 3D Computational Fluid Dynamics (CFD) tool that uses cutting edge kinetics, flame propagation and emissions models for conventional hydrocarbons, e-fuels and synthetic fuels including hydrogen.

FEARCE-Vulcan uses a unique iterative Finite Element (FE) solution that considers all the heat paths in detail to deliver a reliable and accurate predictive tool for conclusive structural investigations.

KEY BENEFITS

Advanced injection / combustion models

Accurate simulation of combustion phenomena, specific models for lean unstable hydrogen

Model calibration for complex fuel analysis

Applications for conventional / real-time, includes lean hydrogen thermo-diffusive instability

Predicting thermal loading on structures

Fast, accurate calculation of thermal boundary conditions across all fuels including hydrogen

Reduced development time and costs

Fast model setup and rapid simulation times reducing need for physical prototype builds

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Interested in learning more? Our experts are ready to discuss your current challenges and work with you to find the optimal solution.

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