



PRESS RELEASE

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Simulation and sustainability – Ricardo focuses on electrification and natural gas at SAE WCX

At the prestigious SAE World Congress (WCX™) to be hosted in Detroit on 9-11 April, Ricardo will present and has co-authored a total of seven papers covering some of the company's latest work on themes related to the creation of new technologies and innovations for advanced mobility

Particular highlights of the seven papers authored and co-authored with customers and research partners at the SAE WCX include the creation of CAE simulation tools for the development of advanced lean-burn automotive natural gas engines, and the evaluation of methods for the thermal modelling and management of EV battery packs.

In the passenger car sector, CNG offers the promise of high performance, low emissions and high efficiency. In order to help realize its full potential environmental and emissions benefits, the multi-partner EU Horizon 2020 project GasOn has been aiming to develop advanced CNG mono-fuel engines that improve on the current state of the art. Within the project, Ricardo is partnering with Volkswagen, Empa, ETH Zurich and Poznan University of Technology, on the development of a new form of pre-chamber ignition (PCI) system that is capable of extending the lean limit of automotive CNG operation, while also enabling the adoption of diesel-like compression ratios.

Ricardo's role within the GasOn project has focused in particular on the development of the computational fluid dynamics (CFD) tools that would enable the fast, accurate and efficient future design of this type of engine. The Ricardo paper *Experimental and*

Numerical Analysis of Pre-Chamber Combustion Systems for Lean Burn Gas Engines will describe some of the latest aspects of this work, along with two further papers by the Swiss Federal Institute of Technology which were also co-authored by Ricardo.



In the area of powertrain electrification, the Ricardo paper *Simulation Based Hybrid Electric Vehicle Components Sizing and Fuel Economy Prediction by Using Design of Experiments and Stochastic Process Model* describes a study to evaluate fuel economy over the drive cycle for a 48 Volt hybrid powertrain vehicle with different ratings of battery and electric machine, using simulation and design of experiments tools. The paper also compares two methods, optimisation and DoE, for calibrating the HEV control strategy to achieve charge neutrality, and discusses the pros and cons of these methods.

The thermal management of EV battery systems is critical to their performance, from electrochemical behaviour, charge acceptance, power availability, trip efficiency, safety and reliability, to the optimization of life-cycle costs. In the paper *A Comparison of Model Order Reduction Techniques for Real-Time Battery Thermal Modelling*, Ricardo outlines an evaluation of three different approaches to the use of Model Order Reduction (MOR) methods to this challenge. MOR focuses on reducing the complexity of modelling large-scale, complex systems in such a way that the models can be efficiently used for design, optimization and sensitivity analysis. The paper evaluates the three mathematical MOR approaches selected with reference to the specific challenges of EV battery pack design and optimization.

Further SAE WCX participation by Ricardo will include a paper co-authored by Ricardo with the University of Brighton concerning the development of an enhanced modelling process for future gasoline engines, *Implementation of a 0-D/1-D/3-D Process for the Heat Release Prediction of a Gasoline Engine in the Early Development Stage*, and an oral presentation on the subject of *Passenger Car Lightweighting: Historical trends, future challenges and potential*. In the area of heavy-duty fuel consumption optimization, the final Ricardo paper, *Modeling and Sizing of a TEG with Half-Heusler TE Legs for Reducing Fuel Consumption in a Heavy Duty Vehicle*, co-authored with TitanX Holding AB and other research partners, covers the use of exhaust waste heat recovery using thermo-electric generator technology.

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NOTES TO EDITORS:

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