Realistic Simulation and Reduction of Emissions and Consumption

IPG Automotive's RDX Test Generator enables early RDE tests with virtual test driving

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The consumption and emissions of motor vehicles under real driving conditions have long been the focus of legislative attention and social debate. Since the introduction of the Euro 6d emission standard, it has become mandatory for new cars to comply with emission limits on both the test bed and public roads. The development of propulsion systems that perform this task over the vehicle's entire lifespan is a major challenge at present. Due to a large number of external influences that result from the process, representative real driving conditions, and particularly reproducibility and variability, cannot be achieved for road tests. In addition, only one possible variant of the vehicle (load, shift strategy, data version) can be tested at a time. The RDX Test Generator as an add-on for the simulation solutions of the CarMaker product family enables the straightforward generation of reproducible real driving test scenarios, taking adjustable driver behavior and traffic density into account. This allows the evaluation of emissions and consumption during real operation as well as propulsion system optimization early on with virtual test driving.

The newly developed RDX Test Generator enables the generation and evaluation of RDE tests based on an intelligent driver and a phenomenological traffic model for a known route. To achieve this, an extensive real driving database including a variety of drives on urban, rural and highway routes was compiled, and the traffic scenarios were classified by different criteria such as the average speed. Subsequent to importing the route including traffic signs and lights into the simulation software, the traffic situations are defined along the route according to road type and the selected traffic density. The traffic flow within the traffic scenarios is realized using the driver model and by placing invisible traffic signs. For stop-and-go traffic, for instance, several stop signs are positioned in succession. Within these boundary conditions, the simulated driver, depending on its defined characteristic, is able to move freely. As the driver has a significant influence on the test results, CarMaker offers the possibility to freely configure the lateral and longitudinal control of the vehicle as well as the speed and steering profiles, and to seamlessly parameterize the driver's character in terms of dynamics, energy

efficiency, and nervousness. Users can draw on pre-defined driver characteristics for this – from a defensive up to a sporty driver.

By generating representative traffic scenarios, a variety of RDE-compliant situations and corner cases can be created and tested on the selected routes without having taken measurements on the road as well as to prepare and complement real test drives throughout the development process.

In addition, the RDX Test Generator enables analyses of roughly 20 conventional characteristic variables such as route per category, maximum speed, number of standstills, or standstill time in accordance with Euro 6d RDE standards. Users obtain a classification and overview of their test scenarios as a result and can decide which of these to continue using. “The idea is to use high-performance computing for the parallel generation, simulation and analysis of a large number of scenarios already during the model-in-the-loop stage according to RDE regulations. On engine or powertrain test beds, that is X-in-the-loop, we implement specific test cases and variations that were selected by means of the previous classification,” said Alexander Frings, Product Manager Engineering Services at IPG Automotive.

The result is a more efficient and precise calibration of the engine and transmission control units under real driving conditions. It thus becomes possible to selectively analyze any effects of changes to the calibration, factoring in traffic or driver influences, and to guarantee the reproducibility of the tests. “The advantage of RDE tests with virtual test driving is the reduction of cost-intensive time spent on the test bed as well as real test drives as it allows early testing and optimization without being dependent on the availability of prototypes,” explained Alexander Frings.

RDE tests on the test bed made easy

The RDX Test Generator is part of IPG Automotive’s TestBed product line which enables the interplay of virtual and real prototypes on engine, powertrain and chassis dynamometers, thereby offering a comprehensive software solution for seamless powertrain development. Another option is the individual use as an office-only solution for model-based development.

Find further information on the TestBed product line and the RDX Test Generator at www.ipg-automotive.com.

About IPG Automotive GmbH

As a global leader in virtual test driving technology, IPG Automotive develops innovative simulation solutions for vehicle development. Designed for seamless use, the software and hardware products can be applied throughout the entire development process, from proof-of-concept to validation and release. The company's virtual prototyping technology facilitates the automotive systems engineering approach, allowing users to develop and test new systems in a virtual whole vehicle.

IPG Automotive is an expert in the field of virtual development methods for the application areas of ADAS & Automated Driving, Powertrain, and Vehicle Dynamics, committed to providing support to master the growing complexity in these domains. Together with its international clients and partners, the company is pioneering simulation technology that is increasing the efficiency of development processes.

By taking real test driving into the virtual world as a complement to on-road testing, IPG Automotive contributes significantly to technical progress and shares in shaping the mobility of tomorrow with regard to comfort, safety, economic efficiency and environmental friendliness.

In addition to the company headquarters in Karlsruhe, Germany, IPG Automotive provides innovative development services to its clients and partners at the national offices in Braunschweig and Munich as well as in France, China, Korea, Japan and the USA.

Further information at www.ipg-automotive.com

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Image: The RDX Test Generator enables the early evaluation of emissions and consumption and the optimization of powertrains with virtual test driving.