PRESS RELEASE

Research on clean diesel engine technology: Reduce nitrogen oxide emissions and consumption

Frankfurt/Main, 6 October 2015 – ***The developers of modern advanced diesel engine technologies face a significant tradeoff when it comes to reducing both greenhouse gas and air emissions: Many measures which reduce nitrogen oxide emissions lead to a significant increase in fuel consumption. At the Autumn Meeting of the Research Association for Combustion Engines (FVV) in Würzburg scientists presented new approaches to reconcile both objectives.***

To further improve the overall emissions characteristic of a diesel engine it is not sufficient to ensure the perfect functioning of the emission control system only. The utmost goal of engine developers is to even reduce raw emissions in the engine. In addition to design measures, the engine control system thereby plays a crucial role: Different variable systems need to be aligned so that the emission limit values set by the legislator are met by the engine while consuming as little fuel as possible. Three of the most important interdependant calibration factors in a typical passenger car diesel engine are the injection time, the amount of exhaust gas recirculated into the cylinder and the air flow within the cylinder which can be influenced, for example, through connecting or disconnecting an inlet channel.

Scientists at ETH Zurich reported on a FVV research project proposing an optimised feedback emissions control system for diesel engines

The new technique is to calculate the combustion process in the engine by means of the so-called “heat curve” and to control the engine based on the results of this calculation. The emission control system of modern advanced diesel engines relies on the feedback of physical emission sensors, for instance for determining the NOx content in the exhaust gas. "Even though our new calculation model could do perfectly without such physical sensors, we do not want to replace but supplement them by a virtual sensor network", explained Professor Dr Konstantinos Boulouchos, ETHZ Institute for Energy Technology. Together with his colleagues from the Institute for Dynamic Systems and Control (IDSC), his research team validated the calcualtion results at the test bench: The emissions control system based on feedback via the virtual sensors delivered similar high quality results as were achieved by using an heuristic control strategy. This also includes dynamic test cycles as the WLTC (World Light-Duty Cycle Test), the introduction of which is currently under discussion.

An optimised high-performance engine control system may in the future also solve another problem of modern diesel engines: The combustion process is very dynamic – thus enabling a vehicle to react instantly when the driver steps on the accelerator pedal.

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Physical sensors detecting the raw emissions always respond with a delay of up to two seconds on the change in the engine operating conditions. Add to this the inertia of the exhaust gas aftertreatment systems. This leads for very short periods to increased emissions. “We are confident that we can halve these latency periods with modern control methods" said Boulouchos.

Japan and Europe researching together

Not only Europe but also Japan focuses its research activities on how the emissions of the diesel engine can be further reduced. Professor Dr Jin Kusaka from Waseda University in Tokyo presented to the auditorium the research priorities of the Japan Research Association of Automotive Internal Combustion Engines (AICE). AICE, too, is looking for ways to control the regeneration of the particle filter more accurately. Since for each cleaning operation, additional fuel is injected, an exact knowledge of the actual load status over the life of the vehicle may result in significant fuel savings. For both oxidation as well as for SCR catalysts different concepts are examined that work at lower temperatures. This is important to reduce cold start emissions which are always increased. Another approach is to reduce the deposits caused by the exhaust gas recirculation in the engine. This would allow to permanently operate at higher exhaust gas recirculation rates, and the resulting drop in temperature would lead to lower NOx formation.

The AICE Research Association, founded in 2014 by the Japanese vehicle manufacturers, is a FVV partner organisation. Dietmar Goericke, Managing Director of the German Research Association for Combustion Engines (FVV) concluded: "The fact that we in Europe as well as our partners in Japan continue our intense research activities on the diesel engine, shows the potential that lies in this combustion principle. The diesel engine is the most climate-friendly drive system designed for mobile applications. By means of further research efforts it will be possible cutting emissions even further even in real driving conditions."

About the FVV

The FVV was established in 1956 and has become a one-of-a-kind network for engine and turbo machinery research. The FVV promotes pre-competitive joint research in the sector and brings together industry experts and researchers with the goal to improve the efficiency ratios and emissions of engines and turbo machinery – for the benefit of the economy, the environment and society in general. The FVV also actively supports junior researchers. FVV members are small, medium-sized and large companies in the manufacturing sector: automobile, engine and turbine manufacturers and their suppliers. The FVV is a member of the German Federation of Industrial Research Associations (AiF), which is a research network for small and medium-sized companies in Germany.

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