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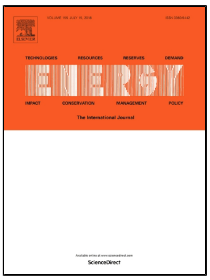

Optimization of Automotive Diesel Engine Calibration Using Genetic Algorithm Techniques

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Abstract

Although the advancements in automotive diesel engines in the last two decades have resulted in the possibility of achieving better performance with lower pollutant emissions and fuel consumption, the increased complexity of the system and the high number of control parameters require the solution of optimization problems of high dimensionality. It is of crucial importance to identify suitable methodologies, which allow achieving the full exploitation of the potential of these powertrains. In this paper, an original methodology for optimizing the latest generation of common rail automotive diesel engines has been presented.

Random optimization methods along with surrogate models were firstly used to generate a population of engine calibrations, which then served as an initial population to a specifically conceived Genetic Algorithm (GA) based optimizer, which was finally applied on a real data set for a particular engine operating point. The results were compared with a calibration optimized using a traditional local approach method. A simultaneous reduction of about 20% in NO_X and 1% in Brake Specific Fuel Consumption was achieved, with no significant increase in other emissions. The methodology described in the paper has the potential to reduce the calibration time and effort by half, while obtaining better calibrations.

Keywords: Diesel Engine Calibration, Genetic Algorithm, Surrogate Models, Multi Objective Optimization