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Effect of injection system characteristics on performance, efficiency and emissions of agricultural tractor Diesel engines

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Abstract

The development and the control of Diesel engines combustion process are fundamentally influenced by the parameters of the injection system, namely by the fuel injection characteristic and the injection rate shape. This work comparatively evaluates, by numerical simulation the influences of the injection system characteristics on performance, efficiency, and emissions of two tractor engine types, with four and three cylinders, with similar energetic configuration and same piston displacement. Therefore, the simulation applied two AVL-BOOST computation models, each of them using the AVL-MCC combustion equations system, with the calibration of the models being based on experimental data obtained by testbed investigations. The corresponding specification of the injection systems, together with those of the fuel spray characteristics simulated by the AVL Hydsim tool and the appropriate injection parameters have been adapted for both engines. The results highlighted that for the 3-cylinders engine, presenting lesser total displacement compared to the 4-cylinders one, it is possible to achieve in the condition of similar performance per cylinder, higher efficiency and lower Soot emissions.

Keywords: Diesel engines, numerical simulations, injection systems, tractor engines

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