Politechnika Śląska

Wydział Transportu

Katedra Eksploatacji Pojazdów Samochodowych

PRACA DOKTORSKA

TEMAT:

Modelowanie obciążeń cieplnych złożenia gniazdo – zawór doładowanego silnika z zapłonem samoczynnym

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Summary

The development of diesel engines is dictated by many factors such as: constantly rising requirements of their performance (unit power indicator), restricting the emission of toxic exhaust gas components and non–toxic CO_2 (warming effect) and maintaining adequate durability of the engine. The possibility of maintaining the above criteria in keeping the correct technical work of the engine is limited by the durability of its individual parts into variable heat loads. Defining the heat loads is also one of the important issues for further development of the diesel engine. Realizing these above criteria for the modern diesel engines can take place through experimental research as well as model testing. An example of model testing or expanding analysis that are presented in the literature is in this doctoral dissertation, in which on the basis of the laboratory measurements of the performance of the engine's parameters or suggested mathematical modeling method defines and analyzes the physical quantity which characterizes the heat loads of the chosen parts of the combustion chamber (valves and valve-seats). The innovative part of the doctoral dissertation is applying in these calculations changeable values of temperature of the working medium and coefficients of heat exchange for the full working cycle of the engine by using the finite element method, which in turn it allowed for modeling the variable temperature distribution in time in valves and seats. The calculations were done with an accuracy to 0.5 [crank angle] for the engine speed 4250[rpm] and combustion air factor λ=1.69. A heat–treatable constructional steel 40H was used as a material for the inlet valve; however chromium–nickelsteel 5H13N15W2 was used for the exhaust valve. In the case of valve–seats, the same material: aluminum bronze Cu95Al5 was assumed in the calculations. The analysis described in the work concerned a 5 cylindrical high–speed turbocharged diesel engine with electronically steered direct fuel injection to combustion chambers. Moreover, conducted calculations of the work are supposed to simultaneously serve as information for engine designers how computer modeling is possible to conduct as well as what laboratory data and parameters of the engine's operation are used to determine the fields of the temperature throughout time.