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INVESTIGATIONS ON THE COMBUSTION OF GASEOUS FUELS

By

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Master thesis abstract

The rapid increasing demand for the energy world wide, increasing fuel consumption, the progressive depletion of fossil fuels and emissions generated from burning of the fossil fuels to the atmosphere such as CO_2, CO and NO, all these have led to an intensive search for alternative fuels such as natural gas, hydrogen and their mixtures. Natural gas and hydrogen are potential alternatives to gasoline vehicles. If these fuels are used, a leaner mixture engine can be run, hence the exhaust concentrations can be reduced and performance is improved.

NO_x concentrations are increased for an engine fuelled with CNG and hydrogen than that for gasoline. Therefore, the current research introduces an analytical study for the effect of adding hydrogen to CNG and its effect on engine performance and exhaust emissions.

In the present research, a quasi dimensional two-zone thermodynamic model is used to predict the effect of fuel-air equivalence ratio and engine speed on the performance and exhaust emissions of the engine using gasoline, CNG, hydrogen and a mixture of hydrogen and natural gas as fuels. Performance parameters (power output, indicated mean effective pressure, torque, indicated thermal efficiency and specific fuel consumption) and emissions concentrations have been studied and compared.

A test rig is designed that consists of a four cylinder four stroke S.I.E operates with both gasoline and CNG. The engine is equipped with instrumentation for measuring intake air flow rate, fuel consumption and exhaust concentrations.

At no load condition, exhaust emissions concentrations are measured at different engine speeds and fuel - air equivalence ratios for gasoline and CNG. A comparison is made between exhaust concentrations from experimental work and theoretical model. This comparison is made to examine the accuracy degree and reliability of the present model.

In conclusion, the study reveals that performance parameters have been improved for S.I.E fueled with a mixture of hydrogen and natural gas more than that CNG. Hydrogen addition up to 20% at equivalence ratio of 0.8 leads to a decrease in specific fuel consumption up to 4%, a decrease in CO_2 concentration up to 4%, a decrease in CO concentration up to 5% and an increase in NO concentration up to 3%.