STUDIES ON THE TURBOCHARGING OF A METHANOL FUELED AUTOMOTIVE SPARK IGNITION ENGINE

by

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Centre for Energy Studies

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CERTIFICATE

This is to certify that the thesis entitled "Studies on the Turbocharging of a Methanol Fueled Automotive Spark Ingnition Engine" being submitted by Mr.P. Mohanan to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy is a record of the bonafide research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which has reached the requisite standard.

The results contained in this thesis have not been submitted, in part or full, to any other University or Institute for any degree or diploma.

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(P. Mohanan)

ABSTRACT

The investigations undertaken to visualise the potential of methanol as a fuel for a turbocharged automotive multicylinder spark ignition engine are reported in this thesis.

A comprehensive computer simulation model for an automotive multicylinder spark ignition engine is formulated for gasoline and methanol operations. The model illustrates the simulation of power cycle, consisting of compression, combustion and expansion processes including the prediction of nitrogen oxide and carbon monoxide emissions. The model also describes the simulation of gas exchange process, comprising of exhaust and intake processes, which predicts the pressure and temperature not only inside the cylinder but also at different locations in the exhaust and intake systems. Further the model also illustrates the scheme of computing the wall temperatures of different surfaces of the engine and also the technique employed for matching the turbocharger and engine. The above studies have been conducted for an original and modified engine designs.

The computed data of the above model has been validated with the available experimental data. The developed computer program has been run for different operating conditions encompassing broad changes in engine

speed, fuel-air equivalence ratio, spark ignition timing, compression ratio and boost pressure. The model predicts the brake power developed by the engine, brake specific fuel and energy consumptions, the peak pressure and temperature of gas in the cylinder and the nitrogen oxide and carbon monoxide emissions, for both the gasoline and methanol operations, corresponding to the original and modified engine designs. The overall analysis of the results show an increase in power output, lower nitrogen oxide and carbon monoxide emissions and improved brake specific energy consumption for the methanol fueled engine as compared to the gasoline version for both the original and modifed engine designs operating on naturally aspirated and turbocharged conditions.

It is anticipated that the above investigations could be employed for developing a multicylinder automotive turbocharged methanol fueled spark ignition engine.

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