Theoretical and Experimental Investigations On Combustion, Performance and Emission Characteristics Of a Methanol Fueled Spark Ignition Engine

by
KURRI SUBBA REDDI

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CERTIFICATE

We, the undersigned, are satisfied that the thesis entitled 'Theoretical and Experimental Investigations on Combustion, Performance and Emission Characteristics of a Methanol Fueled Spark Ignition Engine' presented by Shri K. Subba Reddi, is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the candidate's original bonafide research work carried out under our guidance and supervision. The matter embodied in this thesis has not been submitted in part or full, elsewhere for the award of any degree/diploma.

M. K. Gajendra Babu

Dr. M.K. GAJENDRA BABU
Assistant Professor
Centre of Energy Studies
Indian Institute of Technology
Delhi

H. B. Mathur

Dr. H.B. MATHUR
Professor
Department of Mechanical Engineering
Indian Institute of Technology
Delhi

Supervisors of the Candidate

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K. Subba Reddi

K. SUBBA REDDI

ABSTRACT

The theoretical and experimental investigations undertaken to visualise the potential of methanol as a spark ignition engine fuel are reported in this thesis.

The analytical study contemplates the simulation of all the engine processes in a four stroke, single cylinder, spark ignition engine. The salient features of the simulation include 1) a two zone thermodynamic combustion model to evaluate combustion properties, 2) a kinetic model to predict pollutant species such as nitric oxide and carbon monoxide, 3) a gas exchange model based on a finite difference scheme for evaluation of properties in exhaust and intake systems, 4) estimation of the wall temperatures, and 5) evaluation of frictional and brake power output. Significant parametric studies have also been conducted to indicate the capabilities of the model.

Extensive experiments have been conducted on a single cylinder engine, not only to obtain data to validate the model but also to generate comprehensive combustion, performance and emission characteristics of methanol fuel relative to gasoline over the entire range of engine operating conditions encompassing changes in speed, fuel-air equivalence ratio, ignition timing, load and compression ratio. Two approaches for utilising methanol in its neat form have been investigated : 1) by conventional carburetion and 2) by fuel injection into the manifold. Ionisation probe technique has been employed to analyse the combustion characteristics of the engine.

A very good correlation has been found between the theoretically predicted and experimentally obtained combustion, performance and exhaust emission data generated for both methanol and gasoline fuels.

These comprehensive theoretical and experimental studies show that methanol - an unstored fuel, can be very profitably employed in spark ignition engines and its use can go a long way to mitigate the twin problems of fuel oil scarcity and growing engine exhaust pollution.

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