

Engine and Auxiliary Systems

Edited by
Prof. Dr. A.K.M. Mohiuddin



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Engine and Auxiliary Systems

Edited by Prof. Dr. A.K.M. Mohiuddin



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

A.K.M. Mohiuddin
Engine and Auxiliary Systems
A.K.M. Mohiuddin

ISBN: 978-967-418-216-8

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

Table of Contents

Preface	iv
Table of Contents	v
Chapter 1	
<i>Experimental analysis and comparison of performance characteristics of catalytic converters</i> A.K.M. Mohiuddin	<i>1</i>
Chapter 2	
<i>Experimental analysis and simulation of catalytic converters</i> A.K.M. Mohiuddin	<i>8</i>
Chapter 3	
<i>Thermal design of mechanical devices using expert system</i> A.K.M. Mohiuddin	<i>14</i>
Chapter 4	
<i>Exhaust system optimization using GT- Power</i> A.K.M. Mohiuddin	<i>21</i>
Chapter 5	
<i>Experimental analysis to determine the relationship between noise and back pressure for muffler design – Part I: Muffler design requirements</i> A.K.M. Mohiuddin	<i>29</i>
Chapter 6	
<i>Experimental analysis to determine the relationship between noise and back pressure for muffler design – Part II: Experimental results</i> A.K.M. Mohiuddin	<i>36</i>
Chapter 7	
<i>2nd Generation IIUM Buggy Car – Part I: Design</i> A.K.M. Mohiuddin	<i>42</i>
Chapter 8	
<i>2nd Generation IIUM Buggy Car – Part II: Fabrication</i> A.K.M. Mohiuddin	<i>48</i>
Chapter 9	
<i>Robust design optimization of valve timing using multi-objective genetic algorithm (MOGA)</i> A.K.M. Mohiuddin and Yap Haw Shin	<i>53</i>
Chapter 10	
<i>A study of an aftermarket voltage stabilizer for its performance and emission on passengers vehicle</i> A.K.M. Mohiuddin, Sany Izan Ihsan and Noor Azammi Abd Murat	<i>60</i>

Chapter 11		
	<i>Investigation of engine performance using designed swirl adapter</i>	67
	A.K.M. Mohiuddin	
Chapter 12		
	<i>Comparison of various types of powertrain used in automotive vehicles in terms of performance and emission</i>	74
	A.K.M. Mohiuddin and Ali Faiz	
Chapter 13		
	<i>Automotive catalytic converters: Current status and some future perspectives</i>	80
	A.K.M. Mohiuddin and Jalal Mohammed Zayan	
Chapter 14		
	<i>3-Cylinder gasoline direct injection as opposed to 4-cylinder multi-port fuel injection for lower fuel consumption and NO_x emission</i>	86
	A.K.M. Mohiuddin and Anwar bin Mohd Sood	
Chapter 15		
	<i>Investigation of Spark Ignition Multipoint Engine Using Water Addition - Part I: Simulation</i>	92
	A.K.M. Mohiuddin and Mohammad Edilan Bin Mustaffa	
Chapter 16		
	<i>Investigation of Spark Ignition Multipoint Engine Using Water Addition - Part II: Performance and Emission</i>	101
	A.K.M. Mohiuddin and Mohammad Edilan Bin Mustaffa	
Chapter 17		
	<i>Thermodynamic Analysis of Combustion of CAMPRO CFE Engine – Part I: Simulation</i>	109
	A.K.M. Mohiuddin, Izzarief Bin Zahari and Abdullah Aiman	
Chapter 18		
	<i>Thermodynamic Analysis of Combustion of CAMPRO CFE Engine – Part II: Combustion Analysis</i>	116
	A.K.M. Mohiuddin, Izzarief Bin Zahari and Abdullah Aiman	
Chapter 19		
	<i>Development of Low Cost Catalytic Converter from Non-Precious Metals</i>	123
	A.K.M. Mohiuddin	
Chapter 20		
	<i>Performance Investigation of Energy Efficient Hybrid Engine towards Green Technology</i>	131
	Ataur Rahman	
Chapter 21		
	<i>Production of Aluminum-Silicon Carbide Composites Using Powder Metallurgy at Sintering Temperatures above the Aluminum Melting Point Part II</i>	138
	Yasin Nimir	
Chapter 22		
	<i>Comparison between composites reinforced with natural and synthetic fibers: Part I</i>	143
	Yasin Nimir	

Chapter 23		
	<i>Comparison between composites reinforced with natural fibres and synthetic fibres Part II</i>	151
	Yasin Nimir	
Chapter 24		
	<i>Production of Aluminium reinforced with SiC particulates using powder metallurgy</i>	156
	Yassin Nimir	
Chapter 25		
	<i>Development of automatic magnetic particle system for automotive parts inspection</i>	160
	Mefah Hrairi, Mohd Shah Bin Rizal, Salah Echrif	
Chapter 26		
	<i>Performance of an Automatic Magnetic Particle Inspection of Automotive Parts</i>	166
	Mefah Hrairi, Mohd Shah Bin Rizal, Salah Echrif	
Chapter 27		
	<i>Numerical simulation of complex turbulent flows</i>	172
	Asif Hoda	
Chapter 28		
	<i>Direct numerical simulation (DNS) and large eddy simulation (LES)</i>	177
	Asif Hoda	
Chapter 29		
	<i>Reynolds averaged navier stokes (RANS) Simulation</i>	182
	Asif Hoda	
Chapter 30		
	<i>Film Cooling of Turbine Blades</i>	192
	Asif Hoda	

Thermodynamic Analysis of Combustion of CAMPRO CFE Engine – Part I: Simulation

A.K.M. Mohiuddin, Izzarief Bin Zahari and Abdullah Aiman

Department of Mechanical Engineering, International Islamic University Malaysia

Introduction

The main objective of this part is to perform a simulation analysis of CamPro CFE (Charged Forced Engine) engine to obtain its cylinder pressure data and study the engine losses and its efficiency. The engine is a basic turbocharger engine which has a capacity of 1561cc and installed with a Borg Warner KP39 turbocharger. The bore and stroke dimensions for CamPro CFE are 76 mm and 86 mm respectively. The compression ratio of CamPro CFE is being reduced to 9.5:1 compared to NA CamPro engine.

The engine is being developed by Proton from a naturally aspirated CamPro engine to be a turbocharged engine. This is being done by introducing a turbocharger into the engine system. The 1.6L CamPro CFE engine is expected to meet the performance of a 2.0L natural aspirated engine. Other than introducing the turbocharger component, some improvements have been made to the CamPro engine to accommodate the CamPro CFE engine performance. The engine is expected to meet the torque requirement of 205 Nm at 2000 to 4000 RPM, while the power requirement is expected to be of 103 kW at 5000 rpm.

The virtual engine developed in GT POWER is simulated to gain reference results of its combustion pressure data. The air flow results obtained from the GT POWER is validated using FLUENT simulation software. Then, the actual test is being conducted by using piezoelectric pressure sensor which is known as Kistler plug and the data is being recorded by using an analysis system known as OSIRIS. The combustion pressure data is being used in creating a better CamPro CFE engine model by using simulation software [1].

1.6L CAMPRO CFE Engine

CamPro CFE is a short form of CamPro Charged Forced Engine. The engine is being developed by Proton from a naturally aspirated CamPro engine. This is being done by introducing a turbocharger into the engine system. The 1.6L CamPro CFE engine is expected to