Engine and Auxiliary Systems

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

IIUM Press
# Table of Contents

Preface iv  
Table of Contents v  

## Chapter 1

*Experimental analysis and comparison of performance characteristics of catalytic converters*  
A.K.M. Mohiuddin  

## Chapter 2

*Experimental analysis and simulation of catalytic converters*  
A.K.M. Mohiuddin  

## Chapter 3

*Thermal design of mechanical devices using expert system*  
A.K.M. Mohiuddin  

## Chapter 4

*Exhaust system optimization using GT- Power*  
A.K.M. Mohiuddin  

## Chapter 5

*Experimental analysis to determine the relationship between noise and back pressure for muffler design – Part I: Muffler design requirements*  
A.K.M. Mohiuddin  

## Chapter 6

*Experimental analysis to determine the relationship between noise and back pressure for muffler design – Part II: Experimental results*  
A.K.M. Mohiuddin  

## Chapter 7

*2nd Generation IIUM Buggy Car – Part I: Design*  
A.K.M. Mohiuddin  

## Chapter 8

*2nd Generation IIUM Buggy Car – Part II: Fabrication*  
A.K.M. Mohiuddin  

## Chapter 9

*Robust design optimization of valve timing using multi-objective genetic algorithm (MOGA)*  
A.K.M. Mohiuddin and Yap Haw Shin  

## Chapter 10

*A study of an aftermarket voltage stabilizer for its performance and emission on passengers vehicle*  
A.K.M. Mohiuddin, Sany Izan Ihsan and Noor Azamni Abd Murat
Chapter 11

Investigation of engine performance using designed swirl adapter
A.K.M. Mohiuddin 67

Chapter 12

Comparison of various types of powertrain used in automotive vehicles in terms of performance and emission
A.K.M. Mohiuddin and Ali Faiz 74

Chapter 13

Automotive catalytic converters: Current status and some future perspectives
A.K.M. Mohiuddin and Jalal Mohammed Zayan 80

Chapter 14

3-Cylinder gasoline direct injection as opposed to 4-cylinder multi-port fuel injection for lower fuel consumption and NOx emission
A.K.M. Mohiuddin and Anwar bin Mohd Sood 86

Chapter 15

Investigation of Spark Ignition Multipoint Engine Using Water Addition - Part I: Simulation
A.K.M. Mohiuddin and Mohammad Edilan Bin Mustaffa 92

Chapter 16

Investigation of Spark Ignition Multipoint Engine Using Water Addition - Part II: Performance and Emission 101
A.K.M. Mohiuddin and Mohammad Edilan Bin Mustaffa

Chapter 17

Thermodynamic Analysis of Combustion of CAMPRO CFE Engine – Part I: Simulation
A.K.M. Mohiuddin, Izzarief Bin Zahari and Abdullah Aiman 109

Chapter 18

Thermodynamic Analysis of Combustion of CAMPRO CFE Engine – Part II: Combustion Analysis
A.K.M. Mohiuddin, Izzarief Bin Zahari and Abdullah Aiman 116

Chapter 19

Development of Low Cost Catalytic Converter from Non-Precious Metals
A.K.M. Mohiuddin 123

Chapter 20

Performance Investigation of Energy Efficient Hybrid Engine towards Green Technology
Ataur Rahman 131

Chapter 21

Production of Aluminum-Silicon Carbide Composites Using Powder Metallurgy at Sintering Temperatures above the Aluminum Melting Point Part II
Yasin Nimir 138

Chapter 22

Comparison between composites reinforced with natural and synthetic fibers: Part I
Yasin Nimir 143
Chapter 23

*Comparison between composites reinforced with natural fibres and synthetic fibres Part II*

Yassin Nimir

151

Chapter 24

*Production of Aluminium reinforced with SiC particulates using powder metallurgy*

Yassin Nimir

156

Chapter 25

*Development of automatic magnetic particle system for automotive parts inspection*

Meflah Hrairi, Mohd Shah Bin Rizal, Salah Echraf

160

Chapter 26

*Performance of an Automatic Magnetic Particle Inspection of Automotive Parts*

Meflah Hrairi, Mohd Shah Bin Rizal, Salah Echraf

166

Chapter 27

*Numerical simulation of complex turbulent flows*

Asif Hoda

172

Chapter 28

*Direct numerical simulation (DNS) and large eddy simulation (LES)*

Asif Hoda

177

Chapter 29

*Reynolds averaged navier stokes (RANS) Simulation*

Asif Hoda

182

Chapter 30

*Film Cooling of Turbine Blades*

Asif Hoda

192
Automotive catalytic converters: Current status and some future perspectives

A.K.M. Mohiuddin and Jalal Mohammed Zayan

Department of Mechanical Engineering, International Islamic University Malaysia

Abstract

Automotive catalytic converters in the last three decades have shown considerable and developments in the development of catalysts. The aim of this chapter is to illustrate technology for abatement of exhaust emissions by analysing the current understanding catalytic converters and also understanding some of the materials that can be used as catal materials replacing the conventional materials, the specific role of the various components of catalytic converters, the achievements and the limitations. The challenges in the development novel automotive catalysts, which can meet future highly demanding and stringent pollut abatement requirements, are also discussed.

Introduction

Air pollution generated from mobile sources is a problem of general interest. In the last years the world vehicle fleet has increased from about 40 million vehicles to over 700 milli this figure has increased to 1.02 billion in the year 2011 (autobeatinsider, 2011). environmental concern originated by mobile sources is due to the fact that the majority engines employ combustion of fuels derived from crude oil as a source of energy. Burning hydrocarbon (HC) ideally leads to the formation of water and carbon dioxide; however, due non-perfect combustion control and the high temperatures reached in the combustion cham the exhaust contains significant amounts of pollutants which need to be transformed in harmless compounds. In this chapter, the control strategies and achievements in automa pollution control will be discussed. Attention is focused on recent developments in the field the three-way of catalysts. This research is to focus essentially on the catalytic aspects pollution abatement, even though the reader should consider that technological solutions such electrically heated catalysts, etc., may heavily affect the converter performan [J.C.Guibet,1999].