## Contributions of Early Muslim Scientists to Engineering Sciences and Related Studies

# Contributions of Early Muslim Scientists to Engineering Sciences and Related Studies

**Editors** Abdi O. Shuriye Waleed F. Faris



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



#### Preface

Early Muslim thinkers surpassed others in various fields of knowledge including engineering sciences. They derived their strength from the conception that all duties performed are part of devotion to Allah and political and educational environment provided by the system. However, it is an unfortunate fact that early Muslim contributions to engineering sciences are not widely recognized as in other disciplines, although in Islamic history of knowledge engineering ranked high. It is undeniable that Muslims have made immense contributions to this field. Engineering is the practical application of science and math to solve problems related to human life. Islam itself as a religion has in diverse places spoke on this fact. For instance, the Qur'an, as the main source of human life, focused on infrastructure, sustainability and the necessity of clean water to sustain every living being on the planet. That is not possible without theoretical and practical knowledge of engineering sciences. Individual writers of each chapter are responsible for the accuracy of the content, references, and the citations contained in these chapters. Editors of this volume will not check facts, or references and the main author of each chapter accept full responsibility for the accuracy of their work. Finally, early Muslim scholars including Al-Battani, Al-Biruni Al-Razi Jabir Ibn Hayyan and Al-Zarqali have mastered engineering sciences for the service of mankind and contemporary Muslim engineers should be proud of their predecessors.

### Acknowledgement

Our gratitude is expressed to all the contributors, external reviewers and other scholars for their valuable work, comments and suggestions. Our appreciation is also indebted to the Faculty of Engineering IIUM, for its continuous and unremitting encouragement. We are also thankful to the Research Management Centre of IIUM, for the procedural support.

#### Lists of Contributors

Abdi O. Shuriye. International Islamic University Malaysia (IIUM) Abdul Hakim Javid. International Islamic University Malaysia (IIUM) Abdullateef Ayodele Isqeel. International Islamic University Malaysia (IIUM) Adib Hamdani B Rosli. International Islamic University Malaysia (IIUM) Ahmad F. Ismail. International Islamic University Malaysia (IIUM) Ahmad Hilmi Khalid. International Islamic University Malaysia (IIUM) Ali Hussein Al-Obaidi. International Islamic University Malaysia (IIUM) Amir A. Shafie. International Islamic University Malaysia (IIUM) Aous Naji Rasheed. International Islamic University Malaysia (IIUM) Azhar Bin Mohd Ibrahim. International Islamic University Malaysia (IIUM) Azizullah Saleem. International Islamic University Malaysia (IIUM) Bashir Ahmed Danzomo. International Islamic University Malaysia (IIUM) Belal Ahmed Ghazal. International Islamic University Malaysia (IIUM) Imama Karim Manba Ushama. International Islamic University Malaysia (IIUM) Jamal I. Daoud. International Islamic University Malaysia (IIUM) Khairul Affendy Md Nor. International Islamic University Malaysia (IIUM) Masturah Mohamad. International Islamic University Malaysia (IIUM) Mohamad Ghazali B. Ameer Amsa. International Islamic University Malaysia (IIUM) Mohamed E. S. Mirghani. International Islamic University Malaysia (IIUM) Mohammad Salah Aldin Abdullatif. International Islamic University Malaysia (IIUM) Mohd Hafizuddin Bin Mohd Aziz. International Islamic University Malaysia (IIUM) Mohd Hider Kamarudin. International Islamic University Malaysia (IIUM)

Mohd Romainor Manshor. International Islamic University Malaysia (IIUM)
Musa Abdulwaheed. International Islamic University Malaysia (IIUM)
Nassereldeen A. Kabashi. International Islamic University Malaysia (IIUM)
Nazmus Saquib. International Islamic University Malaysia (IIUM)
Nazwan Ghazali. International Islamic University Malaysia (IIUM)
Nurul Azhani Yunus. International Islamic University Malaysia (IIUM)
Phirdaous Bin Abbas. International Islamic University Malaysia (IIUM)
Raihan Othman. International Islamic University Malaysia (IIUM)
Shafie Kamaruddin. International Islamic University Malaysia (IIUM)
Sofiane Larbani. International Islamic University Malaysia (IIUM)
Suliman Mohamed Mohamed Ali Suliman. International Islamic University Malaysia (IIUM)
Waleed F. Faris. International Islamic University Malaysia (IIUM)

Wan Luqman Hakim Wan Abdul Hamid. International Islamic University Malaysia (IIUM)

Zahratu Hilall Mohamad. International Islamic University Malaysia (IIUM)

### Contents

TITLE	
Preface	V
Acknowledgment	vi
Lists of Contributors	
Introduction	
Chapter 1 Al-Battani's Contribution to Astronomy	3
Chapter 2 Safiha by Al-Zarqali	8
Chapter 3 Ibn Al Shatir's Influence on Modern Astronomy	12
Chapter 4 l-Zarqali on Instrumentation	19
Chapter 5 Contributions of Al-Razi on Alchemy in Terms of Metal and Substance	24
Chapter 6 Jabir Ibn Hayyan's Work on Sulphur-Mercury Theory	30
<ul><li>Chapter 7 The Contribution of Hassan Al-Rammah to Gunpowder and Rocket Technology</li><li>Chapter 8 The Contribution of Ibn Al-Awwam in Botany</li></ul>	36
and Agriculture	41
Chapter 9 Al-Battani Contributions in Astronomy and Mathematics	45
Chapter 10 Al-Biruni's Views on the Discovery of the Spherical Earth	49
Chapter 11 Al-Kashi and Access to the Arithmetic & Astronomy	53
Chapter 12 Nasir Al-Din Al-Tusi's Understanding of Trigonometry	58
Chapter 13 Al-Biruni's Experimental Scientific Methods in Mechanics	65
Chapter 14 Al-Haytham's Understanding of Physical Nature of Light	70
Chapter 15 Contributions of Ibn Al-Haytham on Optics	74
Chapter 16 Energy Particle-Physics: The Efforts of Abdel Nasser Tawfik	80
Chapter 17 Mahmoud Hessaby's Contribution to the Infinitely Extended Particles Theory in Quantum Physics	86
Chapter 18 The Contribution of Ibn Ishaq Al-Kindi to Light, Optics and Cryptology	91
Chapter 19 The Contribution of Ibn Sahl in Refraction of Light	95
Chapter 20 Al Kindi on Pharmacology	103
Chapter 21 Contributions of Kerim Kerimov in Aerospace Engineering	110
Chapter 22 Fazlur Rahman Khan's Understanding of Tube Structural System of Skyscrapers	115

Chapter 23	Contribution of Lofti Asker Zadeh to Fuzzy Logic	121
Chapter 24	The Nano World of Munir Nahfey	127
Chapter 25	Abbas Ibn Firnas's Contribution in Aviation	135
Chapter 26	Al- Jazari Contribution to the Development of Water Supply System	139
Chapter 27	Contribution of Tipu Sultan to Rocket Technology	143
Chapter 28	The Contributions of Al - Khazini in the Development of	
	Hydrostatic Balance and its Functionality	147
Chapter 29	The Contribution of Banu Musa Brothers in the Self Changing	
	Fountain	155
Chapter 30	The Invention of the Helium-Neon Gas Laser by Ali Javan	160
Chapter 31	Al-Jazari on Automata	165