

EDITORS

ERRY YULIAN TRIBLAS ADESTA

MOHAMMAD YEAKUB ALI

AKM NURUL AMIN

DESIGN FOR MANUFACTURE

Towards Improved Manufacturability



IIUM Press

DESIGN FOR MANUFACTURE

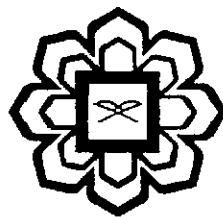
Towards Improved Manufacturability

EDITORS

ERRY YULIAN TRIBLAS ADESTA

MOHAMMAD YEAKUB ALI

AKM NURUL AMIN



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

ISBN: 978-967-418-159-8

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
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

CONTENTS

Preface

PART I: DESIGN

Chapter 1 - Design of a Simple and Affordable Electric Bicycle 04

Tasnim Firdaus Ariff¹, Goey Ewing² and Kam Yee Wah³
1 Faculty of Engineering – International Islamic University Malaysia
2,3 School of Technology, Tunku Abdul Rahman College
✉ : tasnim@iium.edu.my

Chapter 2 - Design of Bicycle Helmet Using FEA 10

Tasnim Firdaus Ariff¹ and Lau Ken Tick²
1 Faculty of Engineering – International Islamic University Malaysia
2 School of Technology, Tunku Abdul Rahman College
✉ : tasnim@iium.edu.my

Chapter 3 - Mould Design for Handphone Casing Using Moldflow 18

Tasnim Firdaus Ariff¹ and Law Siah Yong²
1 Faculty of Engineering – International Islamic University Malaysia
2 School of Technology, Tunku Abdul Rahman College
✉ : tasnim@iium.edu.my

Chapter 4 - Improvement of Typical Hip-Joint Design for Gripping and Fixing 26

Siti Norbadiyah Binti Mohamad Badari¹ and Erry Adesta²
1, 2. Faculty of Engineering – International Islamic University Malaysia
✉ : eadesta@iium.edu.my

Chapter 5 - A Surgical Training Model Manufacture Using Fused Deposition Modeling 44

Hasanudin Hafis Mohamad Ali, Md. Amir Hamzah Md. Shukri, WAY Yusoff
Faculty of Engineering – International Islamic University Malaysia
✉ : hasan.ma86@gmail.com; mdamirhamzah87@gmail.com

Chapter 6 - Reverse Engineering for Rapid Prototyping of Automotive Components 50

WAY Yusoff¹, Muhammad Ridhuan Kamarudin² and Noor Hiana Mohd Salimi³
1, 2, 3 Faculty of Engineering – International Islamic University Malaysia
✉ : yusmawiza@iium.edu.my; wan_ching05@yahoo.com.my; nuriliana@yahoo.com

Chapter 7 - Design and Fabrication of Industrial Welding Robotic Arm 58

Syed Idros Syed Abdullah¹, Mohamad Syatbi Mahamad Puzi², and WAY Yusoff³
1,2,3. Faculty of Engineering – International Islamic University Malaysia
✉ : yusmawiza@iium.edu.my

PART II: QUALITY

Chapter 8 - Application of Statistical Quality Control for Quality Improvement 66

Tasnim Firdaus Ariff¹ and Yap Yee Seng²
1 Faculty of Engineering – International Islamic University Malaysia
2 School of Technology, Tunku Abdul Rahman College
✉ : tasnim@iium.edu.my

Chapter 9 - The Development of Cost Estimation for Quality Assurance System in Die-Casting Processes 72

Nur Hanisah A Hamzah¹ Nurhafizah Azmi² and Erry Yulian Tribblas Adesta³
1, 2, 3 Faculty of Engineering, International Islamic University Malaysia
✉ : eadesta@iium.edu.my

Chapter 10 - Study the Adherence of the Values in The ISO 9001:2000 Certified Companies in Malaysia 84

Dr. Mohd Radzi Bin Haji Che Daud¹ and Rusdi Bin Mat Song²
1, 2. Faculty of Engineering – International Islamic University Malaysia

Chapter 11 - Cost Comparison Analysis between Strip to Coil for Support Brake Pedal at Suria Component (M) Sdn. Bhd 92

Dr. Mohd Radzi Bin Haji Che Daud¹, Shamin Asyrani Bt Alies², Norhayati Bt Saleh³
1,2,3. Faculty of Engineering – International Islamic University Malaysia

Chapter 12 - Performance Measurement of SMEs Manufacturing Sector in Malaysia 98

WAY Yusoff¹, Muhammad Fauzan Md Noraini² and Mohd Norazrul Ismail³
1, 2, 3 Faculty of Engineering - International Islamic University Malaysia
✉ : yusmawiza@iium.edu.my

Chapter 13 - The Introduction of Fit Manufacturing as a Performance Measuring Approach towards Sustainability of Selected Manufacturing Companies in Malaysia 105

WAY Yusoff¹, Aziatul Ashikin Mohd² and Siti Maznah Abdul Rahim³
1, 2, 3 Faculty of Engineering - International Islamic University Malaysia
✉ : yusmawiza@iium.edu.my

Chapter 14 - The Study of the Implementation of OHSAS: 18001 at Kulliyah of Engineering 113

WAY Yusoff¹, Muhammad Fakhrani Hayyun² and Mohd Fairus bin Abdullah³
1, 2, 3 Faculty of Engineering - International Islamic University Malaysia
✉ : yusmawiza@iium.edu.my

Chapter 15 - Implementation of FMECA on Fixed Assembly Cell (FAC) 121

WAY Yusoff¹ and Paul Roberts²
1. Faculty of Engineering - International Islamic University Malaysia , 2. Warwick Manufacturing Group- Warwick University, United Kingdom
✉ : yusmawiza@iium.edu.my

Chapter 16 - Implementation of FMECA on Computer Integrated Manufacturing (CIM) 129

WAY Yusoff¹ and Azmil Soleh²
1,2 Faculty of Engineering – International Islamic University Malaysia
✉ : yusmawiza@iium.edu.my

PART III: MATERIALS

Chapter 17 - The Effect of Stucco System in Ceramic Shell Investment Casting 139

Siti Norbahiyah Binti Mohamad Badari¹ and Erry Adesta²
1, 2. Faculty of Engineering – International Islamic University Malaysia
✉ : eadesta@iium.edu.my

**Chapter 18 - Casting Investigation of Heat Treated Biocompatible Materials
for Total Hip Bone Replacement 151**

Siti Norbahiyah Binti Mohamad Badari¹ and Erry Adesta²
1, 2. Faculty of Engineering – International Islamic University Malaysia
✉ : eadesta@iium.edu.my

**Chapter 19 - Pultrusion of Pineapple Leaf Fibre (PALF)-reinforced Vinyl Ester
Composites: Water Absorption Property 162**

Mohamed Abd. Rahman, M. Kamarul Helmi M. Nawawi
Faculty of Engineering – International Islamic University Malaysia
✉ : mrahman@iium.edu.my

**Chapter 20 - Effects of Austempering Treatment on Mechanical Properties of
Ductile Iron 170**

Belal Ahmed Ghazal¹ and Erry Yulian Triblas Adesta²
1, 2 Faculty of Engineering – International Islamic University Malaysia
✉ : belalghazal88@gmail.com ; ✉ : eadesta@iium.edu.my

Chapter 21 - Microwave Sintering of Metallic Materials 179

Tasnim Firdaus Ariff
Faculty of Engineering – International Islamic University Malaysia
✉ : tasnim@iium.edu.my

Chapter 22 - Microwave Sintering of Ceramic Materials 185

Tasnim Firdaus Ariff
Faculty of Engineering – International Islamic University Malaysia
✉ : tasnim@iium.edu.my

PART IV: MODELLING

**Chapter 23 - Numerical Analysis to Characterize Triaxiality Value of Adhesive Joint
due to Particular Load Configuration. Part 1: Butt Joint 194**

Irfan Hilmy
MME Dept., Faculty of Engineering – International Islamic University Malaysia
✉ : ihilmy@iium.edu.my

Chapter 24 - Numerical Analysis to Characterize Triaxiality Value of Adhesive Joint due to particular Load Configuration. Part 2: Cleavage and Scarf Joint 202

Irfan Hilmy
Faculty of Engineering – International Islamic University Malaysia
✉ : ihilmy@iium.edu.my

Chapter 25 - Metabolic Energy of Manual Lifting in Manufacturing Industry 213

Mohammad Iqbal¹
1. Faculty of Engineering – International Islamic University Malaysia
✉ : mohammad_iqbal@iium.edu.my

PART V: MANAGEMENT

Chapter 26 - Value Stream Mapping: an Important Footstep for Value Analysis and Value Engineering 223

A. N. Mustafizul Karim and Nurul Husna Binti Azon
Faculty of Engineering, International Islamic University Malaysia
Email: mustafizul@iium.edu.my

Chapter 27 - The Project Management Challenges in Technology Innovation 231

Mahmood Hameed Mahmood¹ and Erry Yulian Triblas Adesta²
1, 2. Faculty of Engineering – International Islamic University Malaysia
✉ : mahmoodfattah@yahoo.com / ✉ : eadesta@iium.edu.my

Chapter 28 - Critical Chain in Project Management 239

Erry Yulian Triblas Adesta¹, Asfana Banu Mohamad Asharaf², Nur Atiqah Abdul Rahman Azmil³
1, 2, 3 Faculty of Engineering – International Islamic University Malaysia
✉ : eadesta@iium.edu.my

PART VI: MACHINING

Chapter 29 - Engineering Project Management in Automotive Industry 247

Mohamed Konneh¹, and Abdul Halim
Faculty of Engineering - International Islamic University Malaysia

Chapter 30 - Surface Study when Finish Grinding Silicon using Resin Bonded Diamond Cup Wheel..... 257

Mohamed Konneh¹, and Muhammad Mukhtar
Faculty of Engineering, International Islamic University Malaysia
✉: mkonneh@iium.edu.my

Chapter 31 – Surface Roughness Studies in Die-sink EDM of Tungsten Carbide using Copper Tungsten Electrode 264

Mohamed Konneh¹, and Abdul Halim
Faculty of Engineering - International Islamic University Malaysia
✉: mkonneh@iium.edu.my

Chapter 32 – Study of the Effect of different Electrodes on Material Removal Rate, Electrode Wear Rate and Surface Roughness in the EDM of S-STAR 272

Mohamed Konneh¹, Nur Jannah Shad and Noor Fazlin Saharudin
Faculty of Engineering - International Islamic University Malaysia
✉: mkonneh@iium.edu.my

Chapter 33 – Kerf in Micro Wire Electro Discharge Machining 279

Abdus Sabur¹ and Mohammad Yeakub Ali
Department of Manufacturing and Materials Engineering
Faculty of Engineering, International Islamic University Malaysia
✉: asbur72@yahoo.com

Chapter 34 - The Effect of Deep Cryogenic Treatment on the Properties of AISI D2 Tool Steel 286

Belal Ahmed Ghazal¹ and Erry Yulian Triblas Adesta²
1, 2. Faculty of Engineering – International Islamic University Malaysia
✉: belalghazl88@gmail.com; ✉: eadesta@iium.edu.my

Chapter 35 - Effect of Welding Process on Formability of Tailor Welded Blanks 294

Umer Mushtaq¹ and Erry Yulian Triblas Adesta²
^{1, 2} Faculty of Engineering – International Islamic University Malaysia
✉ : mirkaz9@hotmail.com ; mirkaz9@yahoo.com / ✉ : eadesta@iium.edu.my

Chapter 30 Surface Roughness Studies in Die-sink EDM of Tungsten Carbide using Copper Tungsten Electrode 257

Mohamed Konneh¹, and Muhammad Mukhtar
Faculty of Engineering, International Islamic University Malaysia
✉: mkonneh@iium.edu.my

Chapter 31 - Study of the Effect of different Electrodes on Material Removal Rate, Electrode Wear Rate and Surface Roughness in the EDM of S-STAR..... 264

Mohamed Konneh¹, and Abdul Halim
Faculty of Engineering - International Islamic University Malaysia
✉: mkonneh@iium.edu.my

Chapter 32 - Kerf in Micro Wire Electro Discharge Machining..... 272

Abdus Sabur¹ and Mohammad Yeakub Ali
Department of Manufacturing and Materials Engineering
Faculty of Engineering, International Islamic University Malaysia
✉ : asbur72@yahoo.com

Chapter 33 - Engineering Project Management in Automotive Industry 279

Mohammed Kaleemullah¹, Erry Yulian Triblas Adesta¹, Waleed F. Faris¹
¹ Faculty of Engineering, International Islamic University Malaysia
mkalim@gmail.com, eadesta@iium.edu.my, waleed@iium.edu.my

Chapter 34 - The Effect of Deep Cryogenic Treatment on the Properties of AISI D2 Tool Steel 286

Belal Ahmed Ghazal¹ and Erry Yulian Triblas Adesta²
1, 2. Faculty of Engineering – International Islamic University Malaysia
✉: belalghazl88@gmail.com; ✉: eadesta@iium.edu.my

Chapter 35 - Effect of Welding Process on Formability of Tailor Welded Blanks 294

Umer Mushtaq¹ and Erry Yulian Triblas Adesta²
^{1, 2} Faculty of Engineering – International Islamic University Malaysia
✉ : mirkaz9@hotmail.com ; mirkaz9@yahoo.com / ✉ : eadesta@iium.edu.my

Design of a Simple and Affordable Electric Bicycle

Tasnim Firdaus Arifl¹, Goey Ewing² and Kam Yee Wah³

1 Faculty of Engineering – International Islamic University Malaysia

2,3 School of Technology, Tunku Abdul Rahman College

✉ : tasnim@iium.edu.my

1. Introduction

The all time favorite vehicle throughout the world is always the bicycle. Bicycles were introduced in the 19th century and now there are over one billion worldwide, twice as many as automobiles. In China alone, there are almost 400 million bicycles [1]. They are the principal means of transportation in many regions. They also provide a popular form of recreation, and have been adapted for such uses as children's toys, adult fitness, military and police applications, courier services and sports [2]. Electric bicycles can go further and faster than conventional bicycles. The electric bicycle is easier to pedal and requires less energy from the rider. The batteries can be recharged almost anywhere, or can be exchanged instantly like cellular phones. They can be serviced by any bicycle repair facility, from the high end bike shops of Europe to the street corner repairmen of India and China. The look is nice, the price, performance, quality and comfort of existing electric bikes make them very attractive to consumers.

Some of these electric bicycles may seem ridiculous. They are meant to be improvements on the standard bicycle, but it is clear that a near-perfect design evolved several decades ago. The 1970s bike made of flexible plastic might have won design awards, but it is terrifyingly shaky. Then, there is the bike with two wheels on its rear axle which is unstable when cornering. The electric bikes, though fun, have a tendency to zoom away as soon as the rider starts to pedal, leaving them uncontrollable [3]. Over the last decade, the main focus of development on mountain bikes has been on the suspension. Paul Turner's Rock Shox suspension forks led the way (aided by a World Championship win by Ned Overend in 1990)