

MECHANICAL AND MANUFACTURING FIELD

Editors ROHANA ABDULLAH MOHD AZLI SALIM

# RECENT ENGINEERING PRACTICES

MECHANICAL AND MANUFACTURING FIELD

Editors ROHANA ABDULLAH MOHD AZLI SALIM

Penerbit UTeM Press Universiti Teknikal Malaysia Melaka 2023

# PERPUSTAKAAN Universiti Teknikal Malaysia Melaka 8 7 5 Universiti Teknikal Malaysia Melaka ISBN: 978-967-2792-67137 6 1 9 SEP 2023 UBLISHED 2023 2003 3

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, electronic, mechanical photocopying, recording or otherwise, without the prior permission of the Penerbit UTeM Press, Universiti Teknikal Malaysia Melaka.

Member of the Malaysian Scholarly Publishing Council (MAPIM) Member of the Malaysian Book Publishers Association (MABOPA)

#### Manuscript Editor Mohd Hafizuddin Yusof

Book Cover Designer and Typesetter Ahmad Masmuliyadi Mohd Yusof

#### Published and Printed in Malaysia by Penerbit UTeM Press

Universiti Teknikal Malaysia Melaka Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia.

Tel: +606 270 1241 Faks: +606 270 1038



Cataloguing-in-Publication Data

Perpustakaan Negara Malaysia

A catalogue record for this book is available from the National Library of Malaysia

ISBN 978-967-2792-67-3

### TABLE OF CONTENTS

VII
List of Contributorsxi
Introductionxvii
Chapter 1
Bottleneck Management for Assembly Line Balancing
and Productivity Improvement at Roof-Tile
Manufacturing Company
Rohana Abdullah, Sharbiza Musa and
Amir Hamzah Abdul Rasib1
Chapter 2
Design and Analysis of Workstation Ergonomics in
Stamping Industry
Seri Rahayu Kamat and Mohammad Firdaus Ani21
Chapter 3
Minimization of Unnecessary Inventory using Pull
System Concept at Food and Beverages Industry
Amir Hamzah Abdul Rasib, Nurniqmah Aziz and
Rohana Abdullah61

Chapter 4	
Effect of hBN, AL <sub>2</sub> O <sub>3</sub> and Graphite 1	Vanoparticle on
Ball Bearing Extreme Pressure Wear	Machanism
Ball Bearing Extreme Pressure Wear	Hale
Muhammad Ilman Hakimi Chua Abdu	ium,
Mohammad Nur Taufiq Mohd Fuad, R	onana Abautun,
Mohammad Rafi Omar and Mohd Fad:	zii Abaoiian91
Chapter 5	
A Review on Biodiesel Performance	and Deposits
Formation in Diesel Engine Applica	
Favian Jikol, Mohd Zaid Akop, Mohd A	
Yusmady Mohamed Arifin	105
Chapter 6	
Digital Image Correlation (DIC) as	Frontier Tool in
Extracting Mechanical Properties of	f Composite Material
Ahmad Fuad Ab Ghani, Norazazi Nga	timan,
Fudhail Abdul Munir, Abdul Rafeq Sa	leman
and Rahifa Ranom	157
Chapter 7	
Mechanical Behavior of Graphene	Conductive Ink for
Wearable Application	
Mohd Azli Salim, Aina Natasha Hosn	ie, Siti Amirah Abdullah,
Adzni Md. Saad, Nurfaizey Abd Ham	id and
Siti Hajar Sheikh Md. Fadzullah	185
Chapter 8	40-076 Ab 2000 Care
Bonding Mechanism of Cold Spray	red Titanium Dioxide
Coating on Annealed Stainless-Ste	el Substrates
Noor Irinah Omar, Toibah Abdul Rah	im, Yusliza Yusuf,
Rohana Abdullah and Zahariah Mana	p215
Conclusion	250
Index	25

## RECENT ENGINEERING PRACTICES

#### MECHANICAL AND MANUFACTURING FIELD

This book explores the recent engineering practices to overcome challenges faced by various manufacturing industries. The aim is to enhance readers' knowledge for better understandings of the management of manufacturing resources and the use of most recent technologies to improve product applications. Hence, this book covers the topics such as bottleneck process management, ergonomics evaluation using CATIA and RULA Analysis, inventory control with Kanban Pulling System, new lubricant additive using nanoparticles technology, review of biodiesel performance and deposits formation in diesel engine, development of full-field kinematic measurement using strain gauges and digital image correlation (DIC), use of graphene in conductive ink and strengthening the adhesion of cold-sprayed TiO<sub>2</sub> coatings using substrate oxidation. In summary, this book will provide the readers an insight on the most recent practices and the new frontier for knowledge to overcome challenges in this new era.



ROHANA ABDULLAH, Ts. Dr. received her Doctor of Philosophy in Manufacturing Engineering majoring in Human System Modelling. She has worked with two multinational electronics firms for twelve years prior to joining the academia. She has successfully managed various manufacturing projects including capacity management, human resource management and space planning. As a Chartered Engineer from the Institution of Mechanical Engineers and professional registration with the

Engineering Council, United Kingdom, she is actively involved with the industries conducting projects and trainings on lean manufacturing and productivity improvement. She is also the developer and copyright owner of the Human Resource Productivity Framework currently being used by Universiti Teknikal Malaysia Melaka to determine the need and balance the work load of the administrative staffs. To share her work, she routinely publishes in the Scopus or WoS journals, book chapters and present papers at the national and international conferences.



MOHD AZLI SALIM, Assoc. Prof. Ir. Ts. Dr. received his Doctor of Philosophy in Mechanical Engineering majoring in Vibration Engineering. Currently, he obtained TRIZ Level 3 Practitioner Certificate and Certified Instructor for TRIZ Level 1. In addition, he holds a Professional Engineers (Ir.) from Board of Engineers, Malaysia and Professional Technologist (Ts.) awarded from Malaysia Board of Technologist. He is also awarded as a Chartered Engineer (CEng.) from the Institution of Mechanical Engineers and

professional registration with the Engineering Council, United Kingdom. His research Interest includes nanotechnology, nanomaterials, vibration and acoustic analysis. He received "Most Cited Paper from Praise Worthy Prize Publication Indexed by SCOPUS". Recently, he is the author of the Materials Science and Materials Engineering modules published by Elsevier and was published more than 10 academic books. Dr. Azli has written more than 100 international journals published in various Indexing including Thomson Reuters and Scopus.



PENERBIT UTeM Press

Website: https://penerbit.utem.edu.my Books Online: https://utembooks.utem.edu.my Email: penerbit@utem.edu.my



