

Lecture Notes in Networks and Systems 850

Wan Hasbullah Mohd Isa ·  
Ismail Mohd Khairuddin ·  
Mohd Azraai Mohd Razman ·  
Sarah 'Atifah Saruchi · Sze-Hong Teh ·  
Pengcheng Liu *Editors*

# Intelligent Manufacturing and Mechatronics


Selected Articles from iM3F 2023,  
07–08 August, Pekan, Malaysia

 Springer

# Lecture Notes in Networks and Systems

Volume 850

## Series Editor

Janusz Kacprzyk , Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

## Advisory Editors

Fernando Gomide, Department of Computer Engineering and Automation—DCA, School of Electrical and Computer Engineering—FEEC, University of Campinas—UNICAMP, São Paulo, Brazil

Okyay Kaynak, Department of Electrical and Electronic Engineering, Bogazici University, Istanbul, Türkiye

Derong Liu, Department of Electrical and Computer Engineering, University of Illinois at Chicago, Chicago, USA

Institute of Automation, Chinese Academy of Sciences, Beijing, China

Witold Pedrycz, Department of Electrical and Computer Engineering, University of Alberta, Alberta, Canada

Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

Marios M. Polycarpou, Department of Electrical and Computer Engineering, KIOS Research Center for Intelligent Systems and Networks, University of Cyprus, Nicosia, Cyprus

Imre J. Rudas, Óbuda University, Budapest, Hungary

Jun Wang, Department of Computer Science, City University of Hong Kong, Kowloon, Hong Kong

The series “Lecture Notes in Networks and Systems” publishes the latest developments in Networks and Systems—quickly, informally and with high quality. Original research reported in proceedings and post-proceedings represents the core of LNNS.

Volumes published in LNNS embrace all aspects and subfields of, as well as new challenges in, Networks and Systems.

The series contains proceedings and edited volumes in systems and networks, spanning the areas of Cyber-Physical Systems, Autonomous Systems, Sensor Networks, Control Systems, Energy Systems, Automotive Systems, Biological Systems, Vehicular Networking and Connected Vehicles, Aerospace Systems, Automation, Manufacturing, Smart Grids, Nonlinear Systems, Power Systems, Robotics, Social Systems, Economic Systems and other. Of particular value to both the contributors and the readership are the short publication timeframe and the world-wide distribution and exposure which enable both a wide and rapid dissemination of research output.

The series covers the theory, applications, and perspectives on the state of the art and future developments relevant to systems and networks, decision making, control, complex processes and related areas, as embedded in the fields of interdisciplinary and applied sciences, engineering, computer science, physics, economics, social, and life sciences, as well as the paradigms and methodologies behind them.

Indexed by SCOPUS, INSPEC, WTI Frankfurt eG, zbMATH, SCImago.

All books published in the series are submitted for consideration in Web of Science.

For proposals from Asia please contact Aninda Bose ([aninda.bose@springer.com](mailto:aninda.bose@springer.com)).

Wan Hasbullah Mohd Isa ·  
Ismail Mohd Khairuddin ·  
Mohd Azraai Mohd Razman ·  
Sarah 'Atifah Saruchi · Sze-Hong Teh ·  
Pengcheng Liu  
Editors

# Intelligent Manufacturing and Mechatronics

Selected Articles from iM3F 2023, 07–08  
August, Pekan, Malaysia

 Springer

*Editors*

Wan Hasbullah Mohd Isa  
Faculty of Manufacturing and Mechatronic  
Engineering Technology  
Universiti Malaysia Pahang Al-Sultan  
Abdullah  
Pekan, Malaysia

Ismail Mohd Khairuddin  
Faculty of Manufacturing and Mechatronic  
Engineering Technology  
Universiti Malaysia Pahang Al-Sultan  
Abdullah  
Pekan, Malaysia

Mohd Azraai Mohd Razman  
Faculty of Manufacturing and Mechatronic  
Engineering Technology  
Universiti Malaysia Pahang Al-Sultan  
Abdullah  
Pekan, Malaysia

Sarah 'Atifah Saruchi  
Faculty of Manufacturing and Mechatronic  
Engineering Technology  
Universiti Malaysia Pahang Al-Sultan  
Abdullah  
Pekan, Malaysia

Sze-Hong Teh  
School of Intelligent Manufacturing  
Ecosystem  
Xi'an Jiaotong-Liverpool University  
Suzhou, China

Pengcheng Liu  
Department of Computer Science  
University of York  
York, UK

ISSN 2367-3370

ISSN 2367-3389 (electronic)

Lecture Notes in Networks and Systems

ISBN 978-981-99-8818-1

ISBN 978-981-99-8819-8 (eBook)

<https://doi.org/10.1007/978-981-99-8819-8>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2024

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.

The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Paper in this product is recyclable.

# Preface

We are pleased to present the proceedings of the fourth edition forum of The Innovative Manufacturing, Mechatronics and Materials Forum 2023 (iM3F 2023), organized by Universiti Malaysia Pahang Al-Sultan Abdullah through its Faculty of Manufacturing and Mechatronic Engineering Technology. The conference took place on August 7th and 8th, 2023, with a primary focus on manufacturing, mechatronics, and materials.

During iM3F 2023, we received a total of 70 submissions for mechatronics and partially manufacturing tracks, which underwent a rigorous single-blind review process. Our dedicated reviewers recommended 50 papers for publication in this Springer Proceedings of Materials. We extend our sincere gratitude to all the authors who contributed their valuable research to this volume. The papers included in this proceeding have undergone thorough evaluation by our esteemed technical review committee, comprising experts in the fields of materials and manufacturing engineering.

The conference provided a platform for the exchange of cutting-edge insights, highlighted by keynote speeches from distinguished speakers, including Assoc. Prof. Ir. Dr. Haji Nik Mohd Zuki Nik Mohamed (Universiti Malaysia Pahang Al-Sultan Abdullah, Malaysia), Prof. Eng Hwa Yap (Xi'an Jiaotong-Liverpool University, China), and Prof. Gian Antonio Susto (Universita Degli Studi, Italy).

In closing, we hope that readers will find this volume informative and valuable. We would like to express our appreciation to Springer Proceedings in Materials for their support in publishing this volume. Additionally, we extend our thanks to

the conference organization staff and the dedicated members of the International Program Committees for their tireless efforts in making iM3F 2023 a success.

Pekan, Pahang, Malaysia

Wan Hasbullah Mohd Isa  
Ismail Mohd Khairuddin  
Mohd Azraai Mohd Razman  
Sarah 'Atifah Saruchi  
Sze-Hong Teh  
Pengcheng Liu

# Contents

<b>Diagnosis of COVID-19 on Chest X-ray (CXR) Images Using CNN with Transfer Learning and Integrated Stacking Ensemble Learning</b> .....	1
Wai Sing Low, Li Sze Chow, Mahmud Iwan Solihin, and Dini Oktarina Dwi Handayani	
<b>Sensor Fusion-Based Target Prediction System for Virtual Testing of Automated Driving System</b> .....	13
Ng Yuan Weun, Lee Kah Onn, Cheok Jun Hong, and Vimal Rau Aparow	
<b>Effect of Crack Length, Depth, and Location on Natural Frequencies of Railway Track</b> .....	31
Aidie Zeid Muhammad, Mohd Arif Mat Norman, Mazian Mohammad, and Azmale Amzah	
<b>Imputation Analysis of Time-Series Data Using a Random Forest Algorithm</b> .....	51
Nur Najmiyah Jaafar, Muhammad Nur Ajmal Rosdi, Khairur Rijal Jamaludin, Faizir Ramlie, and Habibah Abdul Talib	
<b>Harnessing Machine Learning, Blockchain, and Digital Twin Technology for Advanced Robotics in Manufacturing: Challenges and Future Directions</b> .....	61
Muhamad Ridzuan Radin Muhamad Amin, Abdul Nasir Abd. Ghafar, Norasilah Karumdin, Ahmad Noor Syukri Zainal Abidin, and Muhammad Nur Farhan Saniman	
<b>Humanizing Humanoids: An Extensive Review on the Potential of Prosthetic Robotic Arm with Integrated Monitoring System for Disabled People</b> .....	71
Mohd Hanafi Muhammad Sidik, Abdul Nasir Abd. Ghafar, Norasilah Karumdin, Nurul Najwa Ruzlan, and Waheb Abdul Jabbar	



<b>Intelligent Machining Systems for Robotic End-Effectors: State-of-the-Art and Toward Future Directions</b> .....	83
Abdul Nasir Abd. Ghafar, Devin Babu, Mohd Hanafi Muhammad Sidik, Muhammad Hisyam Rosle, and Nurul Najwa Ruzlan	
<b>Artificial Neural Network Analysis in Road Crash Data: A Review on Its Potential Application in Autonomous Vehicles</b> .....	95
Syukran Hakim Norazman, Mohd Amir Shahlan Mohd Aspar, Abdul Nasir Abd. Ghafar, Norasilah Karumdin, and Ahmad Noor Syukri Zainal Abidin	
<b>The Role and Impact of Robotics Integration in Precision Machining and Manufacturing: A Comprehensive Review</b> .....	105
Muhammad Nur Farhan Saniman, Muhamad Ridzuan Radin Muhamad Amin, Abdul Nasir Abd. Ghafar, Devin Babu, and Norasilah Karumdin	
<b>Nanomaterial in Robotics: Bridging the Gap Between Current Applications and Future Possibilities</b> .....	115
Mohd Amir Shahlan Mohd Aspar, Syukran Hakim Norazman, Abdul Nasir Abd. Ghafar, Norasilah Karumdin, and Azizi Miskon	
<b>Optimized-ELM Based on Geometric Mean Optimizer for Bearing Fault Diagnosis</b> .....	125
M. Firdaus Isham, M. S. R. Saufi, N. F. Waziralilah, M. H. Ab. Talib, M. D. A. Hasan, and W. A. A. Saad	
<b>Detection of Fault Features in Remanufacturing of Automotive Components Using Image Processing and Computer Vision Techniques</b> .....	141
Ibrahim Abdalla, Novita Sakundarini, Christina Chin May May, and Tissa Chandesa	
<b>The Significance of the Thoracic Spinal Multiple Segments During Different Pick-Object Approaches</b> .....	159
Wan Aliff Abdul Saad, Azuwan Mat Dzahir, Aizreena Azaman, Zair Asrar Ahmad, Mat Hussin Ab. Talib, Shaharil Mad Saad, Muhammad Danial Abu Hasan, Muhammad Firdaus Isham, Mohd Syahril Ramadhan Saufi, and Muhammad Asyraf Muhammad Rizal	
<b>Vibration Suppression of the Flexible Beam Structure Using PID Controller Tuned by Advanced Firefly Algorithm</b> .....	169
Mat Hussin Ab Talib, Muhammad Izzaz Syafiq Ismail, Hanim Mohd Yatim, Muhamad Sukri Hadi, Mohd Syahril Ramadhan Mohd Saufi, Wan Aliff Abdul Saad, Muhammad Danial Abu Hasan, and Muhammad Firdaus Isham	

**Bearing Fault Diagnosis Based on Prominence Peak-Picking IMFs Selection and PSO-SSAE** ..... 181  
 Mohd Syahril Ramadhan Mohd Saufi, Mohd Salman Leong, Lim Meng Hee, Muhammad Firdaus Isham, Muhammad Danial Abu Hassan, Mat Hussin Ab Talib, Mohd Zarhamdy Md Zain, and Mohd Haffizzi Md Idris

**Investigation of Wheel Robot Grouser Width Parameter Effect on Robot Mobility in Soft Sand Terrain Using Sand Test Bed** ..... 199  
 Ikmanizardi Basri, Intan Nur Aqiella Che Aziz, Ahmad Najmuddin Ibrahim, and Yasuhiro Fukuoka

**Automated Harmonic Signal Removal-Based Image Feature Extraction Technique: A Comparative Study Using Online Databases** ..... 209  
 Muhammad Danial Abu Hasan, Syahril Ramadhan Saufi, M. Firdaus Isham, Shaharil Mad Saad, W. Aliff A. Saad, Zair Asrar Bin Ahmad, Mohd Salman Leong, Mat Hussin Ab Talib, Lim Meng Hee, and M. Haffizzi Md. Idris

**Human Mental Stage Interpretation Based on the Analysis of Electroencephalogram (EEG) Signals** ..... 225  
 Norizam Sulaiman, Mahfuzah Mustafa, Fahmi Samsuri, Siti Armiza Mohd Aris, and Nik Izzat Amirul Mohd Zailani

**Modeling Bearing Temperature of DC Machine in No-Load Condition Using Transfer Function** ..... 239  
 M. S. Mat Jahak and M. A. H. Rasid

**Evaluation of Transfer Learning Pipeline for ADHD Classification via fMRI Images** ..... 251  
 Nur Atiqah Kamal, Ahmad Fakhri Ab. Nasir, Anwar P. P. Abdul Majeed, M. Zulfahmi Toh, and Ismail Mohd Khairuddin

**Recent Studies of Human Limbs Rehabilitation Using Mechanomyography Signal: A Survey** ..... 263  
 Muhamad Aliff Imran Daud, Asmarani Ahmad Puzi, Shahrul Na'im Sidek, Salmah Anim Abu Hassan, Ahmad Anwar Zainuddin, Ismail Mohd Khairuddin, and Mohd Azri Abd Mutalib

**Ride Comfort Assessment of a Sitting Pregnant Women During Cornering: Autonomous Vehicle Simulation Maneuvering Analysis** .... 275  
 Nurul Afiqah Zainal, Muhammad Aizzat Zakaria, K. Baarath, Mohamad Heerwan Peeie, and M. Izhar Ishak

**3D LiDAR Vehicle Perception and Classification Using 3D Machine Learning Algorithm** ..... 291  
 Ericsson Yong, Muhammad Aizzat Zakaria, Mohamad Heerwan Peeie, and M. Izhar Ishak

**PID Controller Optimized by Bird Mating Optimizer for Vibration Control of Horizontal Flexible Plate** ..... 303  
 Muhamad Sukri Hadi, Ahmad Fikri Hakimi Mohd Lotpi, Hanim Mohd Yatim, Mat Hussin Ab. Talib, and Intan Zaurah Mat Darus

**Teaching Learning-Based Optimization for Solving CEC2014 Test Suite: A Comparative Study** ..... 315  
 Zulkifli Musa, Zuwairie Ibrahim, and Mohd Ibrahim Shapiai

**Design and Analysis of Vehicle Frontal Protection Mechanism** ..... 327  
 Jithin Menon Jyotheesh, Amar Ridzuan Abd Hamid, Cik Suhana Hassan, Eryana Eiyda Hussien, and Salihah Suroi

**Application of NBM and WERA Assessment Methods in Work Posture Analysis of Car Seat Assembly Operators in the Automotive Industry Final Line** ..... 339  
 N. Nelfiyanti and Nik Mohd Zuki Nik Mohamed

**Product Development of Electrical Appliance in Injection Molding Process with the Application of Computer-Aided Modeling (CAM) and Computer-Aided Engineering (CAE)** ..... 351  
 Wahaizad Safiei and Mohamad Farid Mohamad Sharif

**Experimental Analysis on Retention Forces of Cantilever Hook Snap-Fits** ..... 361  
 Siti Sarah Abdul Manan and Muhammed Nafis Osman Zahid

**The Prevalence of Musculoskeletal Disorders Symptoms and Ergonomics Risk Amongst Engineering, Science, and Technology Students** ..... 377  
 Fazilah Abdul Aziz and Nur Amirah Abdul Hafidz

**Improving Machining Performance Through Cutting Tool Surface Modifications: A Specialized Review** ..... 389  
 Mohd Nizar Mhd Razali, Nurul Hasya Md Kamil, Nurul Nadia Nor Hamran, Amirul Hakim Sufian, and Teo Chong Yaw

**Exploring Composite Manufacturing Processes: Current Applications and Sustainability Improvement** ..... 399  
 Mohd Nizar Mhd Razali, Ainur Munira Rosli, Nurul Hasya Md Kamil, Amirul Hakim Sufian, and Mohamad Rusydi Mohamad Yasin

**Advancements and Challenges in 3D Printing for Medical Applications: A Focus Review on Polyethylene Composites and Parameter Optimization** ..... 409  
Ahmad Shahir Jamaludin, Ainur Munira Rosli,  
Nurul Nadia Nor Hamran, Mohd Zairulnizam bin Mohd Zawawi,  
and Mohd Amran Md Ali

**Solving Makespan and Energy Utilization in Hybrid Flow Shop Scheduling Problem Using Artificial Bee Colony (ABC)** ..... 419  
Muhammad Ammar Nik Mutasim, Alif Fakrurrazi Adham Farshid,  
and Mohd Fadzil Faisae Ab. Rashid

**Effective Knowledge Creation for Promoting Innovative Capacity in SME Malaysia Through University-SME-Collaboration (UEC): The Interaction Model** ..... 431  
Kartina Johan, Faiz Mohd Turan, and Sheikh Muhammad Hafiz Fahami

**Enhancing Shoe Rack Ergonomics: A Comprehensive Analysis** ..... 441  
Muhammed Nafis Osman Zahid and Nurul Hamidah Abd Aziz

**A Feature-Based Transfer Learning Method for Surface Defect Detection in Smart Manufacturing** ..... 455  
Muhammad Ateeq, Anwar P. P. Abdul Majeed, Hadyan Hafizh,  
Mohd Azraai Mohd Razman, Ismail Mohd Khairuddin,  
and Nurul Hazlina Noordin

**Simulation on Effect of Ultrasonic Shot Peening Velocity on VMS of Aluminum A380 Die-Casting Alloy** ..... 463  
Sean Ruben and Mohamad Rusydi Mohamad Yasin

**Economic Loss Risk-Based Reliability and Maintenance Assessment for High-Pressure Methanol Plant** ..... 473  
Mohd Aizad Ahmad and Zulkiffi Abdul Rashid

**Numerical Analysis of Rotating Zigzag Bed Separator in Cryogenic Condition for Removing Carbon Dioxide** ..... 485  
Deevikthiran Jeevaraj, Mohd Fadzil Ali Ahmad, and Asyiqin Imran

**Cooling Energy Harvesting from Liquefied Natural Gas Vaporizer Using Computational Fluid Dynamics (CFD) Technique** ..... 495  
R. N. Syafiq, Mohd Fadzil Ali Ahmad, and Hedzrul Bin Mohd Puad

**Numerical Simulation on the Effect of Blade Design Towards Pressure and Velocity in Pipeline** ..... 505  
Ibnu Kasir Ahmad Nadzri, Mohd Fadzil Ali Ahmad, and A. Asniza

**Improving Production Line Performance Through VSM and Simulation in Electronics Manufacturing Industry** ..... 517  
Chin Chun Yong and Noraini Mohd Razali

**Enhancing WEDM Efficiency by Teaching–Learning-Based Optimization for Machining Process Parameter Optimization** ..... 527  
J. B. Saedon, M. F. Othman, N. H. Mohamad Nor,  
M. S. Mohd Syawal, M. S. Meon, and Muhammad Razin Raghazli

**Development of Joining Process Ontology for Ensuring Data Consistency in Knowledge Management Systems** ..... 537  
Muhammad Alif Hafizan Bin Mohd Zaini and Munira Binti Mohd Ali

**Brain Lesion Image Segmentation Using Modified U-NET Architecture** ..... 549  
Xin Yin Lee, Mohd Jamil Mohamed Mokhtarudin, and Ramli Junid

**Tuning of FOPID Controller for Robotic Manipulator Using Genetic and Multiple-Objective Genetic Algorithms** ..... 557  
Nurul Faqihah Hambali, Nor Mohd Haziq Norsahperi,  
Mas Athirah Mohd Hisban, Mohd Khair Hassan,  
Wan Zuha Wan Hasan, Luthffi Idzhar Ismail, and Hafiz Rashidi Ramli

**Steering Torque Estimation for Distributive Steering System in Electric Vehicle Steer by Wire System** ..... 575  
S. M. H. Fahami, Faiz Mohd Turan, and M. A. Zakaria

**Classification of Distracted Male Driver Based on Driving Performance Indicator (DPI)** ..... 587  
Shatiskumar Ganasan and Norazlianie Sazali

**Detection of Potholes Using Image Processing Method** ..... 597  
Muhammad Zulkifli Bin Abdullah Norhairi and Norazlianie Sazali