

EAI/Springer Innovations in Communication and Computing

Bui Trong Hieu
Phan Thi Mai Ha
Ngo Ha Quang Thinh
Nguyen Thanh Hai *Editors*

3rd EAI International Conference on Renewable Energy and Sustainable Manufacturing

EAI ICRESM 2025

 **EAI**
RESEARCH MEETS INNOVATION

 Springer

EAI/Springer Innovations in Communication and Computing

Series Editor

Imrich Chlamtac, *European Alliance for Innovation, Ghent, Belgium*

The impact of information technologies is creating a new world yet not fully understood. The extent and speed of economic, life style and social changes already perceived in everyday life is hard to estimate without understanding the technological driving forces behind it. This series presents contributed volumes featuring the latest research and development in the various information engineering technologies that play a key role in this process. The range of topics, focusing primarily on communications and computing engineering include, but are not limited to, wireless networks; mobile communication; design and learning; gaming; interaction; e-health and pervasive healthcare; energy management; smart grids; internet of things; cognitive radio networks; computation; cloud computing; ubiquitous connectivity, and in mode general smart living, smart cities, Internet of Things and more. The series publishes a combination of expanded papers selected from hosted and sponsored European Alliance for Innovation (EAI) conferences that present cutting edge, global research as well as provide new perspectives on traditional related engineering fields. This content, complemented with open calls for contribution of book titles and individual chapters, together maintain Springer's and EAI's high standards of academic excellence. The audience for the books consists of researchers, industry professionals, advanced level students as well as practitioners in related fields of activity include information and communication specialists, security experts, economists, urban planners, doctors, and in general representatives in all those walks of life affected ad contributing to the information revolution.

Indexing: This series is indexed in Scopus, Ei Compendex, and zbMATH.

About EAI - EAI is a grassroots member organization initiated through cooperation between businesses, public, private and government organizations to address the global challenges of Europe's future competitiveness and link the European Research community with its counterparts around the globe. EAI reaches out to hundreds of thousands of individual subscribers on all continents and collaborates with an institutional member base including Fortune 500 companies, government organizations, and educational institutions, provide a free research and innovation platform. Through its open free membership model EAI promotes a new research and innovation culture based on collaboration, connectivity and recognition of excellence by community.

Bui Trong Hieu · Phan Thi Mai Ha ·
Ngo Ha Quang Thinh · Nguyen Thanh Hai
Editors

3rd EAI International Conference on Renewable Energy and Sustainable Manufacturing

EAI ICRESM 2025

 Springer

Editors

Bui Trong Hieu
VNU-HCM
Ho Chi Minh City University of Technology
Ho Chi Minh, Vietnam

Phan Thi Mai Ha
VNU-HCM
Ho Chi Minh City University of Technology
Ho Chi Minh, Vietnam

Ngo Ha Quang Thinh
VNU-HCM
Ho Chi Minh City University of Technology
Ho Chi Minh, Vietnam

Nguyen Thanh Hai
VNU-HCM
Ho Chi Minh City University of Technology
Ho Chi Minh, Vietnam

ISSN 2522-8595

ISSN 2522-8609 (electronic)

EAI/Springer Innovations in Communication and Computing

ISBN 978-3-032-21943-5

ISBN 978-3-032-21944-2 (eBook)

<https://doi.org/10.1007/978-3-032-21944-2>

© European Alliance for Innovation 2026

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 Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

If disposing of this product, please recycle the paper.

Preface

It is our great pleasure to welcome you to the 3rd EAI International Conference on Renewable Energy and Sustainable Manufacturing (EAI ICRESM 2025), held in Ho Chi Minh City, Vietnam, on 1–2 November 2025. The conference is organized under the auspices of the European Alliance for Innovation (EAI) and provides a distinguished international forum for researchers, practitioners, and industry experts to exchange and explore recent advances and developments in the broadly interdisciplinary areas of renewable energy, sustainable manufacturing, advanced materials, smart supply chains, and the intersection of energy, materials and manufacturing systems.

This year we received a total of 126 full-paper submissions. After a rigorous double-blind peer-review process, 68 papers were accepted for presentation and inclusion in the conference proceedings. These contributions cover a diverse range of technical tracks and sessions, reflecting the conference theme and the dynamic growth of research in sustainable manufacturing and energy-systems integration. We are honored to host four outstanding keynote speakers who bring visionary insights to our event:

Prof. Insu Jeon (School of Mechanical Engineering, Chonnam National University, South Korea) — “Phase-changing gels for sustainable thermal and electric energy harvesting”

Prof. Joo-Ho Lee (Department of Information Science and Engineering, Ritsumeikan University, Japan) — “From Pixels to Pose: Learning-Based Localization for Robots”

Prof. Wei-Cheng Wang (National Cheng Kung University, Taiwan) — “Air-Decarbonization: the Potential of eSAF (Sustainable Aviation Fuel)”

Prof. Jenn-Kun Kuo (National Sun Yat-sen University, Taiwan) — “Performance Analysis of Low Temperature Metal-Supported Solid Oxide Fuel Cells”

We are deeply grateful to these keynote speakers for sharing their expertise, to the authors for submitting their high-quality work, and to the members of the Technical Program Committee and reviewers for their dedicated service in ensuring the high standard of the conference contributions.

We would also like to express our sincere appreciation to the Organizing Committee, whose efforts have been crucial in bringing this conference to fruition. Key roles include:

Advisory Chairs: Assoc. Prof. Dr. Pham Tran Vu (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Huynh Thanh Cong (Vietnam National University-Ho Chi Minh City, VNU-HCM, Vietnam).

Organizing Chairs: Assoc. Prof. Dr. Bui Trong Hieu (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Tran Huu Nhan (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Nguyen Quoc Chi (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Le Tat Hien (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Pham Quang Trung (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Do Thanh Trung (Ho Chi Minh City University of

Technology and Education, HCMUTE, Vietnam), Assoc. Prof. Dr. Truong Nguyen Luan Vu (Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam), Assoc. Prof. Dr. Pham Son Minh (Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam), Dr. Pham Minh Tam (Vinh University of Technology Education, Vietnam).

General Chairs: Assoc. Prof. Dr. Nguyen Thanh Hai (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Phan Thi Mai Ha (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Ngo Ha Quang Thinh (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam).

Program Chair: Assoc. Prof. Dr. Phan Thi Mai Ha (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam).

Technical Program Chairs: Dr. Bui Thanh Binh (PetroVietnam University, Vietnam), Dr. Tran Hai Nam (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Ngo Quang Hieu (College of Engineering, Can Tho University, Vietnam), Dr. Nguyen Vang Phuc Nguyen (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Le Song Thanh Quynh (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Phung Tri Cong (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Nguyen Le Dung (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Nguyen Duy Anh (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Tran Hai (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Tran Duc (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Tran Dang Long (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Hong Duc Thong (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Assoc. Prof. Dr. Le Dinh Tuan (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Dao Thanh Phong (Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam), Dr. Tran Van Tron (Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam), Dr. Le Ngoc Huan (Eastern International University, EIU, Vietnam), Assoc. Prof. Dr. Luu Duc Binh (Da Nang University of Science and Technology, Vietnam), Assoc. Prof. Dr. Tao Quang Bang (Da Nang University of Science and Technology, Vietnam), Assoc. Prof. Dr. Nguyen Truong An (Military Technical Academy, Vietnam), Prof. Dr. Adam Voak, (Vietnam Aviation Academy, Vietnam), Dr. Nguyen Thi Cam Le (Vietnam Aviation Academy, Vietnam), Prof. Dr. Majo George (University of Economics and Finance, Vietnam), Dr. Nichapa Phraknoi (RMIT University, Vietnam), Assoc. Prof. Dr. Rajkishore Nayak (RMIT University, Vietnam).
Local Chair: Assoc. Prof. Dr. Phan Thi Mai Ha (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam).

Secretary Chairs: Dr. Truong Ngoc Cuong (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Dr. Vo Ngoc Anh Tuan (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam), Than Trong Khanh Dat (Ho Chi Minh City University of Technology, VNU-HCM, Vietnam).

And many other committee members whose contributions are sincerely acknowledged.

As the global imperatives of climate change mitigation, energy transition and circular manufacturing become ever more urgent, the themes addressed at EAI ICRESM 2025 are strikingly relevant. We believe that this conference will stimulate new collaborations,

inspire fresh ideas and foster the kind of innovation that will help shape sustainable industrial and energy systems of the future.

We hope that all participants will enjoy the technical programme, engage in fruitful discussions, establish new connections, and return to their home institutions invigorated by the rich exchange of knowledge and ideas.

We look forward to welcoming you in Ho Chi Minh City and wish you a successful and rewarding conference.

On behalf of the Organizing Committee

Nguyen Thanh Hai
Phan Thi Mai Ha
Ngo Ha Quang Thinh

Conference Organization

Advisory Chairs

Pham Tran Vu	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Huynh Thanh Cong	Vietnam National University-Ho Chi Minh City, VNU-HCM, Vietnam

Organizing Chairs

Bui Trong Hieu	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Tran Huu Nhan	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Nguyen Quoc Chi	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Le Tat Hien	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Pham Quang Trung	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Do Thanh Trung	Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam
Truong Nguyen Luan Vu	Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam
Pham Son Minh	Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam
Pham Minh Tam	Vinh University of Technology Education, Vietnam

General Chairs

Nguyen Thanh Hai	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Phan Thi Mai Ha	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Ngo Ha Quang Thinh	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam

Program Chairs

Phan Thi Mai Ha	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Ngo Ha Quang Thinh	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam

Secretary Chairs

Truong Ngoc Cuong	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Vo Ngoc Anh Tuan	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Than Trong Khanh Dat	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam

Technical Program Committee

Bui Thanh Binh	PetroVietnam University, Vietnam
Tran Hai Nam	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Ngo Quang Hieu	College of Engineering, Can Tho University, Vietnam
Nguyen Vang Phuc Nguyen	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Le Song Thanh Quynh	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Phung Tri Cong	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Nguyen Le Dung	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Nguyen Duy Anh	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Tran Hai	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Tran Duc	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Tran Dang Long	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Hong Duc Thong	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam

Le Dinh Tuan	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
Dao Thanh Phong	Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam
Tran Van Tron	Ho Chi Minh City University of Technology and Education, HCMUTE, Vietnam
Le Ngoc Huan	Eastern International University, EIU, Vietnam
Luu Duc Binh	Da Nang University of Science and Technology, Vietnam
Tao Quang Bang	Da Nang University of Science and Technology, Vietnam
Nguyen Truong An	Military Technical Academy, Vietnam
Adam Voak	Vietnam Aviation Academy, Vietnam
Nguyen Thi Cam Le	Vietnam Aviation Academy, Vietnam
Majo George	University of Economics and Finance, Vietnam
Nichapa Phraknoi	RMIT University, Vietnam
Rajkishore Nayak	RMIT University, Vietnam

Local Chair

Phan Thi Mai Ha	Ho Chi Minh City University of Technology, VNU-HCM, Vietnam
-----------------	--

Contents

Energy Transition

Energy Waste Detection in Smart Buildings Using Open Energy Data	3
<i>Pham Minh Thanh</i>	
Impact of Biodiesel-Diesel Blending Ratios on Injection Rate Characteristics at Simulated Diesel Engine Conditions	18
<i>Vo Tan Chau, Huynh Trung An, and Huynh Ba Vang</i>	
Impact of LPG Injection Length Ratios on Performance and Emission of LPG-Diesel Engines Using Split Injection Strategies in Dual-Fuel Combustion Mode	30
<i>Vo Tan Chau and Truong Thuan Phat</i>	

Low Carbon Technology

Application of Artificial Intelligence and IoT in Determining Growth Stages and Automatically Providing Fertilization for <i>Cucumis melo</i> L. in Greenhouses	47
<i>Minh-Dung Lam, Quoc-Bao Truong, Hong-Nhung Le Thi, and Tan-Kiet Nguyen Thanh</i>	
Enhancing Content-Based Image Retrieval via Query Expansion Using Weighted k -Nearest Neighbor Feature Aggregation	63
<i>Tran Van Khanh, Nguyen Ngoc Thuy, and Le Manh Thanh</i>	
ESG Disclosure and the Cost of Capital: Firm-Level Evidence from Vietnam's Energy Sector	81
<i>Hien Thu Mai and Thao Nguyen Nguyen</i>	
Researching, Calculating, and Designing Propulsion Systems for Autonomous Boats on Rivers and Seas	105
<i>Tran Nguyen Thien Son, Bui Trong Hieu, and Vu Trong Bach</i>	

Operational Research

A Comparison of Feature Selection and Predictive Algorithms for Predicting Plastic Film Breakage	117
<i>Ha-Ngoc-Huy Tran, Nguyen Nguyen-Vang-Phuc, and Yen-Nhi Nguyen</i>	

Enhancing the Efficiency of Online Order Fulfillment in Supermarkets
Through Order-Picking Optimization 134
*Thanh-Phat Nguyen, Trung Nguyen Quoc Pham,
Thao Huong Tran-Vo, and Dinh Tuan Tran*

Gamification and Sustainable Reverse Logistics: Enhancing Circular
Practices and Customer Repurchase in the Digital Age 153
*Ngoc-Hong Duong, Thu-Minh-Nu Tran, Thien-Trung Huynh,
Loc-Tan-Nguyen, Thinh-Truong-Tran Doan,
and My-Kieu-Khoa Nguyen*

A Study on Proposing Evaluation Criteria for the Development Potential
of High-Quality Logistics Human Resources in the Southeastern Region
of Vietnam 175
*Trinh Dinh Cuong, Nguyen Thanh Danh, Ho Thi Thu Hoa,
and Ho Thi Thu Hien*

Sustainable Supply Chains

Leveraging SMART FSMS for Carbon Neutral and Sustainable
Performance: A Mediation Study 195
*Majo George, Nguyen Truong An, An Duong Thi Binh,
Huy Truong Quang, and Minh Nguyen*

Effect of PET Content on the Crystallite and Morphology Formation
of PET/Sugar Bagasse-Derived Biochar 207
Bui Le Thanh Khiat, Nguyen Hong Quan, and Pham Trung Kien

Vietnamese Customers' Intention to Use and Willingness to Pay
for Household Solar Energy Products: A Study on Rooftop Solar Systems 214
Huynh Thi Minh Chau

Sustainable Logistics

Analysis of Transportation System Selection for an Agricultural
Supplies Manufacturing Company 231
Hoang-Oanh Dang, Quyen Ngoc Do, and Thao Huong Tran-Vo

Environmentally Conscious Vehicle Routing Model with Road
Roughness and CO₂ Emission Constraints 254
To-Dung Tran Hoang and Nguyen Nguyen-Vang Phuc

Smart Locker Adoption in Urban E-Commerce Logistics: Investigating Switching Intentions from Home Pickup Services 268
Ngoc-Hong Duong, Duyen-Lam-Mai Tran, Linh-Dieu-Thi Tran, Ngan-Thien-Ngoc Bui, Nghia-Gia Luu, and Thi-Anh-Nu-Ton Huyen

Eco-Innovation Technologies for Sustainable Tourism in Society 5.0: Integrating Human-Centric Digitalization and Green Transformation 286
Tuyen Tran

Sustainable Textile Industry

Curcumin Dispersions in Aloe Vera Mucilage: A Green Polymer-Based Approach 307
Uyen Nhi Ly and Nhan T. H. Le

Encapsulation of *Ocimum Sanctum* Essential Oil Using Solid Lipid Nanocarriers for Cosmetotextile Applications 323
Nhan T. H. Le and Pham Kim Khanh

Photochemical Effects on the Black Dyeing of My A Traditional Silk Fabric with *Diospyros Mollis* (Griff.) Fruit Extract 335
Thi Anh Dao Tran, Van Tri Huynh, Thi Ngoc Chau Pham, and Van Hung Nguyen

Optimizing Seam Performance - Investigating the Compatibility of Sewing Machine Specifications with Fabric Thickness in Seam Puckering 344
Nhu Ngoc Phan Ha and Song Thanh Quynh Le

Online Sustainability

Investigation on Exhaust Gas Emissions of a Diesel Engine Working with Dimethyl Ether 363
Simeon Iliev

How Does Hot Forging Influence the Wave Transmission and Microstructure of Ultrasonic Horns? 378
The Vinh Chung Tran, Hai Dang Nguyen, Duy Qui Dao, and Duy Khanh Bui

Synergistic Effects of Ultrasonic Assisted Vibration and Post Weld Heat Treatment on the Microstructure and Mechanical Properties of MIG Welded AISI 1020 Steel 391
Vo Thi Hong, Bui Duy Khanh, and Pham Quang Trung

Enhancing Rose Drying Efficiency with 20 kHz Ultrasonic Waves: Experimental Design, Performance Evaluation and Future Prospects	404
<i>Duy Qui Dao and Duy Khanh Bui</i>	
The Impact of Green Bonds on Firms' Financial Performance in Vietnam's Construction and Energy Sectors	413
<i>Hien Thu Mai, Tu Cam Luu, Hung Khanh Tran, Nhi Ngoc Vu, and Nga Hang Thi Doan</i>	
Kinematic Modeling and Simulation-Based Validation of ABB IRB 1520ID Welding Robot	439
<i>Hoai Tam Tran and Quang Hieu Ngo</i>	
Engineering Property of Calcium Silicate Hydrate (CSH) from Wasted PV Glass and Water Glass	458
<i>Nguyen Minh Phong, Tran Ngo Quan, Huynh Dung, Tran Van Khai, and Pham Trung Kien</i>	
Closed-Loop Speed Control of DC Motors Using PID: Simulation and Performance Evaluation	463
<i>Song Hung Nguyen, Duc Minh Phan, Phu Cuong Nguyen, and Thanh Truong Nguyen</i>	
Sustainable Manufacturing	
Effect of V-Grooving Technique on Springback Behavior of SS304 Sheet in V-Bending Process: An Experimental Study	481
<i>Anh-Chuong Le, Hoan Nguyen, Anh-Son Tran, Quoc-Nguyen Banh, and Minh-Tuan Ho</i>	
Simulation-Based Optimization of Injection Molding Parameters for Family Mold of Automotive Components	494
<i>Minh-Tuan Ho, Van-Keo Dong, Quoc-Dat Luong, Anh-Son Tran, and Quoc-Nguyen Banh</i>	
Development of a Predictive Model for Dimensional Accuracy of Rapid Prototyping Products Using DLP Technology: A Comparative Study with ANFIS and ANN	504
<i>Van Vu Le, Chiet Quan Han, Bui Van Tung, and Huu Nghi Huynh</i>	
Design and Fabrication of a 3D Printer Using Resin Based on DLP Technology	518
<i>Huu Nghi Huynh and Thanh Duy Phan</i>	

Advanced Material Processing

An Experimental Study on the Influence of the Thickness of Stainless Steel Sheet SUS 304 by Multi-Stage Single Point Incremental Forming (MSPIF) Technology	537
<i>Tran Trung Le, Le Khanh Dien, Pham Minh Tuan, Nguyen Thanh Nam, Nguyen Thai Duong, and Vo Tan Kiet</i>	
Reducing Defects and Enhancing Quality in Rapid Investment Casting by Controlling Mold Temperature	554
<i>Thanh Tan Nguyen, Minh Tri Ho, Hieu Giang Le, Van-Thuc Nguyen, Hoai Nam Nguyen, Phi Long-Nguyen Nhut, Ngoc-Thien Tran, and Van Tron Tran</i>	
Evaluation of the Formability of AA5083 Aluminum Alloy by the Constrained Groove Pressing Technique Using Numerical Simulation	573
<i>Manh Hung Le, Manh Tien Nguyen, Truong An Nguyen, and Tam Ho</i>	
Developing Stiff, Strong, and Tough Alginate-Based Hydrogels Via a Drying and Rehydration Process	586
<i>Tuan Thanh Quach, Xuan Tung Nguyen, Huu Phuc Phan, Linh Tran, Thai Khanh Nguyen, Hoai Nam Nguyen, and Van Tron Tran</i>	
Automotive Sustainability	
A Parametric Modeling Approach for Marine Propellers: Case Study for Wageningen B-Screw Series	601
<i>Doan Minh Thien, Trinh Duc Minh, Nguyen Thi Ngoc Hoa, and Tat-Hien Le</i>	
A Push-Pull Mechanism Applied to Steering Feel Simulation Control for Automotive Steer-by-Wire Systems	615
<i>Khanh Truong Nam, Long Nguyen Thanh, Lam Tran Quang, Dai Pham Ngoc, and Long Tran Dang</i>	
Investigating the Energy Balance in Longitudinal Motion of an Electric Vehicle Using MATLAB/SIMSCAPE	627
<i>Khoi-Do Minh, Minh-Ka Nguyen Nhat, Dat-Phan Nguyen Thanh, and Duc Tran</i>	
Experimental and Numerical Investigation on Quasi-Static Axial Crushing of Thin Double-Walled Multi-corner Double-Hat Columns	645
<i>Bao-Tang Gia, Thai-Tran Quoc, and Hai Tran</i>	

The Effect of Impulse Response Function on Impact Force Reconstruction Using Wavelet Deconvolution Technique	666
<i>Loi Le-Tan, Hai Tran, and Tuan Le-Dinh</i>	
Design and Optimization of Outlet Line Systems of Automated Sludge Suction in Catfish Farming Ponds: A CFD-Based Study	688
<i>Thien-Phuong Ton, Thien-Phuc Tran, and Manh-Dien Huynh</i>	
Ground Effect on X-Wing Aerial Vehicle Using Lattice Boltzmann Method	701
<i>Nhi Nguyen Ngoc, Do Tran Tuan Minh, Tran Thi Phuong Thao, Nguyen Huy Hoang, Son Nguyen Dang Thai, Sang Nguyen Van, and Dung Duong Viet</i>	
Investigation of the Effect of Deadrise Angle on Resistance and Free-Surface Flow Characteristics of Planing Hull	713
<i>Tran Dinh Tu and Huynh Van-Vu</i>	
Sustainable Transportation	
Influence Analysis of the Load Distribution on the Tractor-Semi-Trailer Dynamic Stability in the Case of Turning	727
<i>Tri Tam Pham Cong and Cong Tri Tam Pham</i>	
Investigation of a Mechanical Starting Mechanism for a Two-Stroke Free-Piston Engine	747
<i>Nguyen Huynh Thi, Nguyen Van Trang, Huynh Thanh Cong, Dao Huu Huy, Huynh Van Loc, and Truong Hoa Hiep</i>	
Finite Element Modeling and Evaluation of a Motorcycle Half Helmet for Enhanced Impact Protection	761
<i>Ho Trong Du, Ly Hung Anh, and Nguyen Van Trang</i>	
Influence Analysis of the Semitrailer's Steering Angles on the Tractor – Semitrailer Dynamic Stability in the Case of Turning	780
<i>Trung Thanh Do and Huu Nhan Tran</i>	
Impact of Finite Element Mesh Shape on the Accuracy of Tube Hydroforming Simulations	801
<i>Chung Nguyen, Minh Tam Pham, and Thanh Binh Nguyen</i>	
Dynamic Response Analysis of a Crane Vessel During Heavy-Load Lifting Operations	810
<i>Tran Van Tao, Trinh Duc Minh, and Tat-Hien Le</i>	

Effects of Butanol and Pentanol Addition on the Sooting Tendency
of Diesel Diffusion Flames 825
Long H. Duong, Hoang My Nguyen, and Vinh Dat Ly

Experimental Investigation of the Effects of Palm Biodiesel on Smoke
Point and Soot Volume in Diesel Fuel Blends 838
Long H. Duong, Tan Chau Vo, and Khanh Duy Do

Robotics and Mechatronics

Interval Linear Quadratic Regulator for Robust DC Motor Speed
Control Under Parametric Uncertainties 853
*Duc Minh Phan, Song Hung Nguyen, Thi Lan Nguyen,
Duc Binh Luu, and Thanh Truong Nguyen*

Integrated MCDM Approach for Industrial Robot Selection:
An Entropy-Based Evaluation with TOPSIS, ARAS, and MOORA 871
Thanh-Lam Bui, Dinh-Hieu Phan, and Tien-Dat Hoang

Study on Bearing Failures Classification Using Wallet Visualized
Scalograms and Deep Learning of Vibration Signals 881
Tri Dung Nguyen and Hai Lam Dam

Application of Computer Vision in Quantitative Control and Quality
Inspection of Caps in Medical Test Tube Manufacturing 893
Le Xuan Thuyen, Nguyen Duc Phat, and Tran Ngoc Huy

Design and Fabrication of a Tomato Sorting Robot Prototype Integrating
Image Processing Technology and Artificial Intelligence 905
Tien-Dat Hoang, Dinh-Hieu Phan, and Thanh-Lam Bui

Study on the Design and Finite Element Analysis of a Twin Autonomous
Underwater Vehicle 920
*Hoang-Phuong Vu, Thanh-Long Le, Nguyen Thanh Truong,
and Nhat-Anh Ngo*

Diagnose the Automatic Transmission Failures Using Support Vector
Machine Model 933
Anh Tuan Pham, Ngoc Tuan Vu, Van Tra Nguyen, and Van Tu Nguyen

Research on Developing an Algorithm to Determine the Welding Path
for a T-Joint Welding Using a 2D Laser Sensor 947
Minh Tuan Pham, Pham Hai Duong Tran, and Tri Cong Phung

Low-Cost Fabrication of Microfluidic Paper-Based Analytical Devices Using an Inexpensive 3D-DLP Printer	961
<i>Dat Nguyen-Tien, Nam Le-Nhat, Son Tran-Anh, Nguyen Le Dung, Trung-Nghia Tran, and Tuan Ngoc Anh Vo</i>	
Stress-Strain Distribution and Fatigue Life Analysis of ECAP Dies for M1 Copper Plate Processing	978
<i>Ta Dinh Xuan, Nguyen Dinh Phuong, Phan Cong Quang Truong, Doan Tat Khoa, and Van-Canh Nguyen</i>	
Prediction and Optimization of Surface Roughness and MRR in Ti-6Al-4V Turning Using a Deep Neural Network Regressor	985
<i>Van-Canh Nguyen, Nguyen Anh Thang, and Thuy-Duong Nguyen</i>	
Design Sliding Mode Controller for Automotive Electric Power Steering Based on Simulation-in-the-Loop	999
<i>Hoang Quan Vo, Long Giang Nguyen Van, Thanh Trung Do, Trung Kien Nguyen, and Duc Thien Tran</i>	
Integrated Simulation and Validation Approach for Defect-Free Sand Casting of Centrifugal Pump Casings	1013
<i>Nguyen Hai Dang and Pham Quang Trung</i>	
Investigation of Initial Temperature Control in Rotary Friction Welding Using Induction Heating Assistance	1022
<i>Huynh Vinh Loi, Truong Quoc Viet, and Nguyen Hai Dang</i>	
Author Index	1035

Energy Transition



Energy Waste Detection in Smart Buildings Using Open Energy Data

Pham Minh Thanh^(✉)

Vietnamese-German University, Ho Chi Minh City, Vietnam
thanh.phaminh@gmail.com

Abstract. This research addresses the critical challenge of identifying energy waste in buildings, which account for approximately 40% of global energy consumption. Leveraging the Building Data Genome Project 2 dataset - an open repository containing hourly energy consumption data from 1,636 non-residential buildings - this study employs data mining techniques to detect inefficiencies and support Lean Six Sigma's waste reduction goals [1]. The methodology combines cluster analysis to identify abnormal energy patterns with correlation mining between occupancy data and HVAC usage. Implementation used Python with Matplotlib for visualization and Scipy for statistical analysis. Results revealed distinct energy consumption patterns across buildings, with clustering identifying specific consumption profiles and potential anomalies. Building_5 demonstrated significantly higher consumption peaks (exceeding 110 kWh) compared to other buildings, while correlation analysis between occupancy and HVAC usage showed a weak positive correlation ($r = 0.218$, $p = 0.307$), indicating potential inefficiencies in HVAC operation relative to actual occupancy. These findings directly connect to Lean's "7 Wastes" framework by highlighting overproduction of energy during low-occupancy periods and waiting waste from systems running unnecessarily. The research provides building managers with actionable insights for targeting energy waste reduction through data-driven decision making. This study distinguishes itself from prior works using the same dataset through: (1) a novel integration of K-means clustering with Lean Six Sigma waste framework for interpretability, (2) explicit temporal pattern analysis across working vs. non-working hours to identify occupancy-energy misalignments, and (3) a systematic anomaly detection approach linking statistical outliers to actionable waste categories. Unlike existing studies that focus on prediction or benchmarking, this work emphasizes waste detection for operational improvement.

Keywords: Energy Efficiency · Smart Buildings · Waste Detection · Cluster Analysis · Building Data Genome Project · Lean Six Sigma

1 Introduction

Buildings are responsible for a substantial portion of global energy consumption, accounting for approximately 40% of energy usage worldwide and 36% of CO₂ emissions [2]. With increasing concerns about resource conservation and environmental sustainability, identifying energy waste in buildings has become a critical challenge. Traditional approaches to energy management often rely on rule-based systems or manual inspection, which can miss subtle patterns of inefficiency or waste.

The advent of smart building technologies and the proliferation of energy meters have created opportunities for more sophisticated data-driven approaches to energy waste detection. Open energy datasets, such as the Building Data Genome Project, provide researchers with unprecedented access to detailed energy consumption data across diverse building types [1]. These datasets enable the application of advanced data mining techniques to identify patterns, anomalies, and inefficiencies that may not be apparent through conventional analysis.

This research addresses the need for systematic approaches to energy waste detection using open data sources. The study focuses on identifying abnormal energy consumption patterns through cluster analysis and exploring the relationship between occupancy and HVAC usage through correlation mining. By applying these techniques to the Building Data Genome Project 2 dataset, which contains hourly energy consumption data from 1,636 non-residential buildings, this research aims to provide actionable insights for energy waste reduction.

Research Contribution and Novelty.

While prior studies have applied clustering and data mining to building energy datasets, this research provides three key contributions that distinguish it from existing work:

1. **Integrated Framework:** This study uniquely combines unsupervised clustering with the established Lean Six Sigma waste taxonomy, providing an interpretable framework that bridges data science techniques with operational management concepts familiar to facilities professionals.
2. **Temporal Waste Pattern Analysis:** Unlike previous works that focus primarily on prediction or benchmarking, this research explicitly analyzes the temporal relationship between occupancy and energy use across different time periods (working vs. non-working hours) to identify specific types of operational waste.
3. **Actionable Anomaly Detection:** The methodology translates statistical anomalies (e.g., off-hours consumption, morning ramp-up spikes) into specific waste categories (Overproduction, Waiting, Defects), enabling building managers to prioritize interventions based on established continuous improvement frameworks.

These contributions address a gap in the literature where energy data analysis often remains disconnected from operational decision-making frameworks, limiting practical implementation in building management practice.

The significance of this research extends beyond energy conservation to connect with established frameworks for operational efficiency. Specifically, the findings are interpreted within the context of Lean Six Sigma's "7 Wastes" framework, which identifies seven types of waste in operational processes: Transport, Inventory, Motion, Waiting,

Overproduction, Over-processing, and Defects [5, 6]. In the context of building energy management, these wastes can manifest as inefficient HVAC operation (Overproduction), energy consumption during unoccupied periods (Waiting), and suboptimal equipment performance (Defects).

By linking energy waste detection to the Lean Six Sigma framework, this research provides building managers and energy professionals with a familiar conceptual structure for understanding and addressing energy inefficiencies. The ultimate goal is to support data-driven decision-making for energy conservation in smart buildings, leading to cost savings and reduced environmental impact.

2 Literature Review

2.1 Energy Consumption in Buildings

Buildings play a crucial role in global energy consumption, with the building sector accounting for approximately 40% of European energy consumption and 36% of CO₂ emissions [2]. Residential buildings alone contribute to about 27% of energy usage in the EU, highlighting the significant impact that buildings have on overall energy consumption [2]. The substantial energy footprint of buildings underscores the importance of identifying and addressing energy waste in this sector.

2.2 Open Energy Datasets

The availability of open energy datasets has significantly advanced research on building energy efficiency. The Building Data Genome Project, initiated as an international consortium of academics and practitioners in the field of building energy, aims to create large, open datasets to enhance understanding of building behavior and energy use. The first phase of this project, released in 2017, included one year of hourly data from over 500 buildings.

The Building Data Genome Project 2, which serves as the primary data source for this study, expanded on the initial dataset to include 3,053 energy meters from 1,636 non-residential buildings, with hourly data spanning two full years (2016–2017) [1]. This dataset encompasses various types of meters, including electricity, chilled water, steam, hot water, gas, water, irrigation, and solar. The hourly frequency provides sufficient resolution for analyzing daily, weekly, monthly, seasonal, and annual patterns of energy use.

More recently, efforts have been made to consolidate existing open datasets through initiatives like the Building Data Genome Directory, which serves as a one-stop shop for data necessary for building energy research. This directory covers meter, building-level, and community-level data at various spatial and temporal scales, facilitating access to diverse datasets for energy analysis.

2.3 Clustering Approaches for Energy Data Analysis

Clustering techniques have been widely applied in the analysis of building energy data to identify patterns and similarities in consumption profiles. Various methods, including

Support Vector Machine (SVM), Neural Networks, K-Means, Gaussian Process, Principal Component Analysis (PCA), and others, have been employed to find consumers with similar behaviors [3, 4, 9]. K-Means, in particular, has been recognized for its efficiency in clustering daily customer energy consumption data.

A comparative study revealed that hierarchical algorithms provide better results for daily energy load data, though they are less efficient than K-means approaches with few clusters in terms of execution time. To address the increasing volume of energy data, researchers have proposed multi-layered approaches that derive local profiles from small, specific areas (e.g., apartments or buildings) and global profiles based on the findings from the local level. This approach reduces computational complexity while maintaining analytical accuracy.

2.4 Correlation Between Occupancy and Energy Usage

The relationship between building occupancy and energy consumption has been a focus of numerous studies, particularly in the context of office buildings. Research has shown that occupant behavior significantly impacts energy use, with studies highlighting the importance of accurately modeling occupant behavior in building energy performance simulations [7, 8].

2.5 Lean Six Sigma's Waste Reduction Framework

Lean Six Sigma is a methodology that combines Lean's focus on eliminating waste with Six Sigma's emphasis on reducing variation and improving quality [5, 6]. The "7 Wastes" framework, a core component of Lean thinking, identifies seven types of waste in operational processes [5]:

- Transport: Unnecessary movement of materials or information
- Inventory: Excess storage of materials or information
- Motion: Unnecessary movement of people or equipment
- Waiting: Delays or idle time
- Overproduction: Producing more than needed or before it is needed
- Over-processing: Doing more work than required
- Defects: Errors or quality issues requiring rework

While traditionally applied in manufacturing and service industries, the 7 Wastes framework can be adapted to the context of building energy management. For instance, energy consumption during unoccupied periods can be viewed as "Waiting" waste, while over-cooling or over-heating spaces represents "Overproduction" waste. By linking energy inefficiencies to this established framework, building managers can leverage familiar concepts to address energy waste systematically.

3 Methodology

3.1 Data Source

This study utilizes the Building Data Genome Project 2 (BDG2) dataset, an open data repository containing hourly energy consumption data from 1,636 non-residential buildings across North America and Europe [1]. The dataset includes 3,053 energy meters with

measurements spanning two full years (2016–2017), resulting in approximately 53.6 million data points. The meters measure various energy types, including whole-building electrical, heating and cooling water, steam, and solar energy.

For this analysis, a subset of the dataset focusing on electrical energy consumption was selected to ensure consistency in the type of energy being analyzed. The data includes hourly measurements across different buildings, allowing for detailed temporal pattern analysis and the identification of potential energy waste.

Building Selection Rationale.

Five buildings (Building_1 through Building_5) were selected from the BDG2 dataset based on the following criteria: (1) Complete data availability across the two-year period with minimal missing values (<5%), (2) Diversity in consumption patterns identified through preliminary exploratory analysis, (3) Availability of both electricity and occupancy schedule metadata, and (4) Representation of different consumption scales to demonstrate the methodology’s applicability across varied building profiles.

While this focused subset limits the generalizability of specific numerical findings, it provides sufficient diversity to demonstrate the methodology and identify distinct waste patterns. The five buildings exhibited consumption ranges from 12 kWh to 110 kWh, baseline variations from 30–60 kWh, and different temporal patterns, making them representative of the heterogeneity in the larger dataset. Future work should expand this analysis to larger building samples to validate the patterns observed and enhance statistical robustness.

3.2 Data Preprocessing

Before applying clustering and correlation analysis, several preprocessing steps were performed to ensure data quality and compatibility with the analytical methods:

- **Missing value handling:** Any gaps in the time series data were identified and addressed through interpolation where appropriate.
- **Outlier detection:** Extreme values that could potentially skew the analysis were identified using statistical methods and either corrected or excluded from the analysis.
- **Temporal aggregation:** While the original data has hourly resolution, some analyses were performed on daily or weekly aggregations to identify broader patterns.
- **Normalization:** Energy consumption values were normalized by building area where applicable to enable fair comparisons across buildings of different sizes.
- **Feature extraction:** Additional features such as day of week, weekend/weekday indicators, and seasonal markers were derived from the timestamp information to enrich the analysis.

The preprocessing steps were implemented in Python using standard libraries such as Pandas for data manipulation and NumPy for numerical operations.

3.3 Clustering Analysis

To identify patterns and anomalies in energy consumption, K-means clustering was applied to the processed data. K-means is an unsupervised learning algorithm that partitions observations into k clusters, where each observation belongs to the cluster with

the nearest mean. This method is particularly suitable for energy data analysis due to its efficiency and interpretability.

Clustering Feature Selection.

The K-means clustering analysis utilized the following input features to capture comprehensive consumption patterns:

1. Hourly consumption values (kWh): Raw energy measurements at hourly intervals
2. Normalized consumption: Energy values normalized by maximum building consumption to enable cross-building comparison
3. Temporal indicators: Hour of day (0–23), day of week (0–6), weekend/weekday binary flag
4. Statistical features: Rolling mean (24-h window), standard deviation (24-h window), and rate of change between consecutive hours
5. Seasonal indicators: Month indicator (1–12) and season categorical variable (Winter, Spring, Summer, Fall)

These features were selected to capture both magnitude and temporal patterns of consumption, enabling the algorithm to identify buildings with similar operational characteristics.

The clustering analysis was performed at two levels:

- Building-level clustering: Buildings were clustered based on their overall energy consumption patterns to identify groups with similar characteristics. This helps in understanding the typical behavior of different building types and identifying outliers that deviate from expected patterns.
- Temporal pattern clustering: Energy consumption patterns were clustered across different time periods (e.g., days, weeks) to identify recurring patterns and anomalies. This approach helps in detecting unusual consumption events that might indicate energy waste.

Elbow Method and Cluster Selection.

The optimal number of clusters was determined using the elbow method, which involves plotting the sum of squared distances between data points and their cluster centroid against the number of clusters. Figure 1 presents the elbow curve showing the within-cluster sum of squares (WCSS) as a function of cluster number k . The curve exhibits a clear “elbow” at $k = 2$, where the rate of WCSS decrease diminishes significantly. While $k = 3$ and $k = 4$ show incremental improvements, $k = 2$ was selected because: (1) it provides the most distinct separation between normal and anomalous consumption patterns, (2) it balances model simplicity with explanatory power, and (3) the marginal improvement beyond $k = 2$ was less than 15%, suggesting diminishing returns.

Occupancy Data Limitations.

An important methodological limitation is that occupancy data in the BDG2 dataset represents scheduled occupancy (typical operating hours) rather than real-time measured occupancy. This means the correlation analysis reflects alignment between energy use

ability to reproduce temperature distribution within materials, build predictive models, and optimize processes is a notable advantage, contributing to time and cost savings in experimentation, while minimizing defects. Induction heating is an effective method for rapid and localized heating of the workpiece, especially when utilizing a high-frequency heating system. Ferromagnetic materials like C45 steel exhibit high heating efficiency due to their excellent ability to absorb magnetic field energy. This enables precise control of the initial temperature, creating favorable conditions for the welding process.

The integrated high-frequency induction heating and rotary friction welding system was successfully designed and fabricated, leveraging the advantages of induction heating and RFW to ensure durable, uniform, and low-defect weld quality. The combination of preliminary high-frequency heating improved the bondability of dissimilar materials, reduced the necessary friction force, and minimized deformation during welding. Components such as the ZVS 3000W high-frequency heating circuit, MMA 200PRO welding machine, HTK AR33 square linear slide, and the 2-rod pneumatic cylinder were appropriately selected, ensuring the precision, stability, and high performance of the entire system. Despite minor discrepancies between simulation and experimental results, the overall agreement indicates the model's reliability, while providing valuable insights into effective temperature control. This system is suitable for various high-tech industries, including automotive, aerospace, and precision engineering, particularly for joining dissimilar materials (steel-aluminum, stainless steel-copper) with stringent technical requirements. Precise temperature control facilitates the creation of high-quality joints, extending product lifespan and reducing operational costs.

To further enhance the system's efficiency and applicability, the study recommends several improvements. For the heating system, it is suggested to use induction coils with fewer turns to optimize localized heating, and U-shaped coils to ensure rapid operational space for the rotary friction welding process. Optimization of the induction coil design is needed to increase heating efficiency for non-ferromagnetic materials such as aluminum or brass. Additionally, employing more advanced temperature sensors (e.g., thermal cameras) would enable real-time monitoring and adjustment of heat distribution, ensuring uniform temperature across the heated zone. Further research into and application of high-frequency induction heating for pipe end sealing is also a promising direction.

Acknowledgments. We acknowledge Ho Chi Minh City University of Technology (HCMUT), VNU-HCM for supporting this study.

References

1. Simpson, P.G.: Induction Heating: Coil and System Design. McGraw-Hill, New York (1960)
2. Maalekian, M.: Thermal modeling of friction welding. *ISIJ Int.* **48**(10), 1429–1433 (2008). <https://doi.org/10.2355/isijinternational.48.1429>
3. Istardi, D., Triwinarko, A.: Induction heating process design using COMSOL® multi-physics software. *TELKOMNIKA (Telecommun. Comput. Electron. Control)* **9**(2), 327–334 (Aug.2011). <https://doi.org/10.12928/telkomnika.v9i2.704>

4. Dawood, A.B., et al.: A thermal model of rotary friction welding for similar and dissimilar metals. *Metals* 7(6), 224 (2017). <https://doi.org/10.3390/met7060224>
5. Rudnev, V., Loveless, D., Cook, R.L.: *Handbook of Induction Heating*, 2nd ed. CRC Press, New York (2017). <https://doi.org/10.1201/9781315117485>

Author Index

A

An, Huynh Trung 18
An, Nguyen Truong 195
Anh, Ly Hung 761

B

Bach, Vu Trong 105
Banh, Quoc-Nguyen 481, 494
Binh, An Duong Thi 195
Bui, Duy Khanh 378, 404
Bui, Ngan-Thien-Ngoc 268
Bui, Thanh-Lam 871, 905

C

Chau, Huynh Thi Minh 214
Chau, Vo Tan 18, 30
Chung Tran, The Vinh 378
Cong, Huynh Thanh 747
Cong, Tri Tam Pham 727
Cuong, Trinh Dinh 175

D

Dam, Hai Lam 881
Dang, Hoang-Oanh 231
Dang, Long Tran 615
Dang, Nguyen Hai 1013, 1022
Danh, Nguyen Thanh 175
Dao, Duy Qui 378, 404
Dien, Le Khanh 537
Do, Khanh Duy 838
Do, Quyen Ngoc 231
Do, Thanh Trung 999
Do, Trung Thanh 780
Doan, Nga Hang Thi 413
Doan, Thinh-Truong-Tran 153
Dong, Van-Keo 494
Du, Ho Trong 761
Dung, Huynh 458
Duong, Long H. 825, 838
Duong, Ngoc-Hong 153, 268
Duong, Nguyen Thai 537

G

George, Majo 195
Gia, Bao-Tang 645

H

Ha, Nhu Ngoc Phan 344
Han, Chiet Quan 504
Hien, Ho Thi Thu 175
Hiep, Truong Hoa 747
Hieu, Bui Trong 105
Ho, Minh Tri 554
Ho, Minh-Tuan 481, 494
Ho, Tam 573
Hoa, Ho Thi Thu 175
Hoa, Nguyen Thi Ngoc 601
Hoang, Nguyen Huy 701
Hoang, Tien-Dat 871, 905
Hoang, To-Dung Tran 254
Hong, Vo Thi 391
Huy, Dao Huu 747
Huy, Tran Ngoc 893
Huyen, Thi-Anh-Nu-Ton 268
Huynh, Huu Nghi 504, 518
Huynh, Manh-Dien 688
Huynh, Thien-Trung 153
Huynh, Van Tri 335

I

Iliev, Simeon 363

K

Khanh, Bui Duy 391
Khanh, Pham Kim 323
Khoa, Doan Tat 978
Kien, Pham Trung 207, 458
Kiet, Vo Tan 537

L

Lam, Minh-Dung 47
Le Dung, Nguyen 961
Le Thanh Khiet, Bui 207
Le Thi, Hong-Nhung 47

Le, Anh-Chuong 481
 Le, Hieu Giang 554
 Le, Manh Hung 573
 Le, Nhan T. H. 307, 323
 Le, Song Thanh Quynh 344
 Le, Tat-Hien 601, 810
 Le, Thanh-Long 920
 Le, Tran Trung 537
 Le, Van Vu 504
 Le-Dinh, Tuan 666
 Le-Nhat, Nam 961
 Le-Tan, Loi 666
 Loc-Tan-Nguyen, 153
 Loi, Huynh Vinh 1022
 Luong, Quoc-Dat 494
 Luu, Duc Binh 853
 Luu, Nghia-Gia 268
 Luu, Tu Cam 413
 Ly, Uyen Nhi 307
 Ly, Vinh Dat 825

M

Mai, Hien Thu 81, 413
 Minh, Do Tran Tuan 701
 Minh, Khoi-Do 627
 Minh, Trinh Duc 601, 810

N

Nam, Khanh Truong 615
 Nam, Nguyen Thanh 537
 Ngo, Nhat-Anh 920
 Ngo, Quang Hieu 439
 Ngoc, Dai Pham 615
 Ngoc, Nhi Nguyen 701
 Nguyen, Chung 801
 Nguyen, Hai Dang 378
 Nguyen, Hoai Nam 554, 586
 Nguyen, Hoan 481
 Nguyen, Hoang My 825
 Nguyen, Manh Tien 573
 Nguyen, Minh 195
 Nguyen, My-Kieu-Khoa 153
 Nguyen, Phu Cuong 463
 Nguyen, Song Hung 463, 853
 Nguyen, Thai Khanh 586
 Nguyen, Thanh Binh 801
 Nguyen, Thanh Tan 554
 Nguyen, Thanh Truong 463, 853
 Nguyen, Thanh-Phat 134

Nguyen, Thao Nguyen 81
 Nguyen, Thi Lan 853
 Nguyen, Thuy-Duong 985
 Nguyen, Tri Dung 881
 Nguyen, Trung Kien 999
 Nguyen, Truong An 573
 Nguyen, Van Hung 335
 Nguyen, Van Tra 933
 Nguyen, Van Tu 933
 Nguyen, Van-Canh 978, 985
 Nguyen, Van-Thuc 554
 Nguyen, Xuan Tung 586
 Nguyen-Tien, Dat 961
 Nguyen-Vang-Phuc, Nguyen 117
 Nhat, Minh-Ka Nguyen 627
 Nguyen, Yen-Nhi 117
 Nhut, Phi Long-Nguyen 554

P

Pham, Anh Tuan 933
 Pham, Cong Tri Tam 727
 Pham, Minh Tam 801
 Pham, Minh Tuan 947
 Pham, Thi Ngoc Chau 335
 Pham, Trung Nguyen Quoc 134
 Phan, Dinh-Hieu 871, 905
 Phan, Duc Minh 463, 853
 Phan, Huu Phuc 586
 Phan, Thanh Duy 518
 Phat, Nguyen Duc 893
 Phat, Truong Thuan 30
 Phong, Nguyen Minh 458
 Phuc, Nguyen Nguyen-Vang 254
 Phung, Tri Cong 947
 Phuong, Nguyen Dinh 978

Q

Quach, Tuan Thanh 586
 Quan, Nguyen Hong 207
 Quan, Tran Ngo 458
 Quang, Huy Truong 195
 Quang, Lam Tran 615
 Quoc, Thai-Tran 645

S

Son, Tran Nguyen Thien 105