ISAS 2024
https://fas.hcmut.edu.vn/isas

The symposium program focuses on both fundamental and applied research in areas related to applied science. As a result, the ISAS 2024 will cover a wide range of topics in engineering physics and engineering mechanics and applied mathematics, computational physics, and innovative technologies.

VIET NAM NATIONAL UNIVERSITY HO CHI MINH CITY
BK TP.HCM
NATIONAL CHUNG HSING UNIVERSITY
SMARTer
智慧永續新農業研究發展中心

ISAS 2024
https://fas.hcmut.edu.vn/isas

INTERNATIONAL SYMPOSIUM ON APPLIED SCIENCE 202

HỘI NGHỊ QUỐC TẾ VỀ KHOA HỌC ỨNG DỤNG 2024

- BIOMEDICAL ENGINEERING
- ENGINEERING PHYSICS
- ENGINEERING MECHANICS
- COMPUTATIONAL PHYSICS
- APPLIED MATHEMATICS
- INNOVATION TECHNOLOGY

October 18th, 2024
Ho Chi Minh City University of Technology (HCMUT)
Ho Chi Minh City, Vietnam

Preface

The International Symposium on Applied Science (ISAS), formerly was International Symposium on Engineering Physics and Mechanics (ISEPM) has been held every two years since 2011, aims to bring together researchers from different countries and to promote a synergy collaborated research with the creation and exchange of ideas related to the applied science field.

The symposium program focuses on both fundamental and application research in areas related to the applied science field. ISAS 2024 will cover aspects not only the engineering physics and engineering mechanics field but also applied mathematics, computational physics, and innovation technologies. We will strive hard to create a platform of collaborations and meetings where all the scientists, academicians, lab experts, industry people and young researchers will meet at one place to share and gain knowledge through panel discussions, technical scientific sessions, workshops, and poster presentations.

Along with sharing and gaining knowledge, the symposium also provides space for interactions where everyone will be given freedom to interact and helps in making new international collaborations. The symposium will also provide the best opportunity for delegates and people from industry to make new contacts where they can develop their product. In this regard, on behalf of the Organizing Committee we warmly welcome all participants to join us and make the symposium a successful one. Please peruse this book for useful information. We are looking forward to developing with your in-depth collaborations.

The full-text accepted articles will be published on conference proceedings which is open-access publication from IOP Publishing: ***Journal of Physics: Conference Series*** *(SSN: 1742-6596) https://iopscience.iop.org/journal/1742-6596*

PROGRAM CHAIRS:
_ *Xuan Dai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Otto Theodor Iancu, University of Applied Sciences Karlsruhe, Germany*
_ *Congo Tak Shing CHING, National Chung Hsing University, Taiwan*
_ *Pásztory Zoltán, University of Sopron, Hungary*
_ *Trung Nghia TRAN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Tich Thien TRUONG, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Quang Linh HUYNH, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Thanh Nha NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Quoc Khai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Tan Thi PHAM, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Ngoc Son DO, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Thi Thu Hanh TRAN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Duy Khuong NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*

Proceedings Volume Editors:
_ *Thanh Nha NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Quoc Khai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*
_ *Nhat Tan LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam*

ORGANIZED BY

VIET NAM NATIONAL UNIVERSITY
HO CHI MINH CITY

HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY, VNU-HCM

FACULTY OF APPLIED SCIENCE, HCMUT

JOINT SESSION CO-ORGANIZED BY

SPONSORS

THE SCIENTIFIC COMMITTEE

Collaborative Research Member -
_ Koichi SHIMIZU, Xidian University, China
_ Hirofumi TANAKA, Kyushu Institute of Technology, Japan
_ Pham Trung Hieu NGUYEN, New Jersey Institute of Technology, USA
_ Congo Tak-Shing CHING, National Chung Hsing University, Taiwan
_ Chian-Hui LAI, National Chung Hsing University, Taiwan
_ Otto Theodor Iancu, University of Applied Sciences Karlsruhe, Germany
_ Pásztory Zoltán, University of Sopron, Hungary
_ Takeshi NAMITA, Kyoto University, Japan
_ Nobuki KUDO, Hokkaido University, Japan
_ Yuji KATO, Hokkaido University, Japan
_ Suchin TRIRONGJIMOAH, Ubon Ratchathani University, Thailand
_ Dinh Kien NGUYEN, Institute of Mechanics - VAST, Vietnam
_ Thi Phuong Quyen NGUYEN, Danang University, Vietnam
_ Bach Thang PHAN, Center for Innovative Materials and Architectures, VNHUCM, Vietnam

Ho Chi Minh City University of Technology Member -
_ Kieu Nhi NGO, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Van Hoang VO, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Tich Thien TRUONG, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Xuan Dai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Quang Linh HUYNH, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Trung Nghia TRAN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Tan Thi PHAM, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Ngoc Son DO, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Dinh Huy NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Thanh Nha NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Trung Kien PHAM, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Quoc Khai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Xuan Thanh Tram NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Duy Khuong NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam

THE ORGANIZING COMMITTEE

_ Xuan Dai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Bach Thang PHAN, Center for Innovative Materials and Architectures, VNHUCM, Vietnam
_ Otto Theodor Iancu, University of Applied Sciences Karlsruhe, Germany
_ Congo Tak-Shing CHING, National Chung Hsing University, Taiwan
_ Chian-Hui LAI, National Chung Hsing University, Taiwan
_ Pásztory ZOLTÁN, University of Sopron, Hungary
_ Tich Thien TRUONG, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Quang Linh HUYNH, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Thanh Nha NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Trung Nghia TRAN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Quoc Khai LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Dinh Huy NGUYEN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Tan Thi PHAM, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Ngoc Son DO, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_Thi Thu Hanh TRAN, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam
_ Duong Hung Anh LE, Ho Chi Minh City University of Technology – VNU-HCM, Vietnam

KEYNOTE SPEECHES

Title: "*The usefulness of analytical models in the design and analysis of structures*"

Professor Otto Theodor Iancu (University of Applied Sciences Karlsruhe, Germany)

Abstract: The design and analysis of structures subjected to different loads is very often made today by using expensive Finite element computations. However when plastic collapse is expected to occur the finite element solution is often non convergent and the results are difficult to interpret. In this case analytical models based on linear elastic - perfectly plastic material models provide very useful and stable solutions. The advantages of an analytical model are obvious: - they enable the designer to identify the important parameters and provide quick results in order to achieve an optimal structural design. However selecting a suitable calculational model requires in depth knowledge of mathematics, engineering mechanics, materials science and strength of materials theory. A precise observation of the failure behaviour of the structure provides additionally important information that contribute significantly to a successful mathematical modelling. Therefore is the connection between experiment- real behaviour- and theory – idealized behaviour- of great importance when selecting a suitable simulation model.

Title: "*Incredible impedance sensing technology for applications in many fields*"

Professor Congo Tak Shing Ching (National Chung Hsing University, Taiwan)

Abstract: The development of impedance sensing technology has brought revolutionary changes in many fields and solved many problems. Impedance sensing technology typically uses the relationship between current and voltage to measure specific properties of a material or system. This technology has wide applications in medical, environmental monitoring, food safety testing and other fields. In the medical field, impedance sensing technology is used for physiological monitoring, such as body composition analysis of fat and muscle tissue. Impedance sensors can also be used to monitor breathing and movement of body parts, helping diagnosis and treatment. In terms of environmental monitoring, impedance sensing technology can be used to monitor moisture content in soil, concentration of pollutants, and fluid flow in pipelines. This helps improve agricultural production efficiency and ensures efficient use of water resources and environmental protection. In terms of food safety testing, impedance sensing technology can be used to detect harmful substances in food, such as heavy metals, pesticide residues and additives, to ensure that food meets safety standards. In this talk, the speaker cites his own research experience applying impedance in many different fields.

Title: "*Applied science in building energy retrofits*"

Dr. Pásztory Zoltán (University of Sopron, Hungary)

Abstract: Energy consumption is one of the most crucial factors of sustainability. Our existing building stock is one of the biggest energy consumers in the world and that is why having to focus on the minimization their energy usage. More countries and the E. U. set the goal for carbon neutralization of building sector in the year 2050. The regulations for newly built require them to be buildings can be energy efϐicient. What should be done with the existing buildings? The paper aims at to look inside the REHOUSE renovation project supported by the European Union. The project offers eight innovative renovation packages which can be used during the renovation of old buildings. Some of these packages develop active energy saving proposals such as Multi-sourced heat pumps or Smart wall system and Intelligent window. Others offer a passive solution such as the Activated Cellulose insulation or Adaptable dynamic building envelopes and PanoRen facades. All these innovations based on applied science knowledge and use the ϐinite element modelling or other physical science tools. It is expected that the program of energy retroϐit renovation will provide more research interest.

INTERNATIONAL SYMPOSIUM ON APPLIED SCIENCE 2024

HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY (HCMUT), VNU-HCM

October, 18th, 2024, Ho Chi Minh City, Vietnam

ISAS 2024 - TECHNICAL PROGRAM

Time	OPENING CEREMONY Chairs: Prof. Dr.-Ing. Otto Theodor Iancu, Dr. Xuan Dai Le		Room: B4 Hall
7:00 – 8:00	Registration		
8:00 - 8:15	Dr. Xuan Dai Le – Dean of Faculty of Applied Science *OPENING SPEECH*		
8:15 - 8:30	Rector Board of HCMUT *GREETINGS FROM RECTOR BOARD*		
8:30 - 9:00	Keynote speech	Prof. Dr.-Ing. Otto Theodor Iancu (University of Applied Sciences Karlsruhe, Germany) *The usefulness of analytical models in the design and analysis of structures (6)*	
9:00 - 9:30	Keynote speech	Prof. Dr. Congo Tak Shing CHING (National Chung Hsing University, Taiwan) *Incredible impedance sensing technology for applications in many fields*	
9:30 - 10:00	Keynote speech	Prof. Dr. Pásztory Zoltán (University of Sopron, Hungary) *Applied science in building energy retrofit (188)*	
10:00 - 10:30	Teabreak - Poster session		

Session 1: APPLIED MATHEMATICS (chair: Dr. Xuan Dai Le)
Room: B4-306

Time	ID	Title	Author
10:30 - 12:00	14	Convergence of the solutions for weak vector quasi-equilibrium problems	Xuan Dai Le
	88	Evaluation of Nonlinear Wave Energy Dissipation over a Gyroid Triply Periodic Minimal Surface-based Porous Breakwater	Khanh Le Thanh Duy
	55	Privacy-Preserving Federated Optimization through Applied Mathematics	Le Trieu Phong
	200	Applying Structural Equation Modeling to Analyze Acceptance of a Transportation Policy in Ho Chi Minh City	Gia Tuan Kim
	60	Stability of approximate solutions of set-valued equilibrium problems	Linh Ha Manh

Session 2A: BIOMEDICAL ENGINEERING (Chairs: Prof. Dr. Congo Tak Shing CHING, Dr. Trung Nghia Tran) – Room B4-208

Time	ID	Title	Author
10:30 - 12:00	187	Teacher-Student Partnerships in Biomedical Education	Padraig Herbert
	50	A Study on Synthetic Data Generation for Electronic Health Records to Ensure Privacy Preservation	Tran Phuc Nhat Mai
	67	Influence of current injection and voltage acquisition on electrical impedance tomography image reconstruction: A simulation study	Minh Quan Cao Dinh
	148	Investigating Signal Changes in Impedance Cardiography through Varied Frequencies	Hai Anh Nguyen Thi
14:00 - 15:30	77	A comparative EEG analysis of classifying short sleep phases and waking states using Support Vector Machine and Random Forest	Nhi Yen Phan Xuan
	78	Positive Emotional State Recognition Using Nonlinear Dynamics Analysis and Machine Learning Algorithms with Electroencephalogram Signals	Quynh Nguyen Gia
	86	Visualizing brain signals in mental calculation by using Electroencephalography Topographic Map Animation with Independent component analysis perspectives	Nghiem Nguyen Ngoc
	90	Enhancing Diagnostic Accuracy for Knee Osteoarthritis Using a Deep Learning Approach	Aquib Raza

Session 2B: BIOMEDICAL ENGINEERING (Chairs: Prof. Dr. Quang Linh Huynh, Prof. Dr. Tran Thi Thu Hanh) – Room: B4-403

Time	ID	Title	Author
10:30 - 12:00	194	A Machine Learning Approach in EEG-Based Assessment of Cognitive Load by Mental Arithmetic Tasks	Nguyen Phuc Khang
	102	Effect of Training Frequency and Set Configuration on Upper Arm Muscle Properties via Ultrasound Image Gathering and Analysis	Minh Tu Anh Vo

	110	Positive and Negative Emotions Recognition using Multichannel EEG Analysis with Spectral Entropy and Machine Learning approaches	Bao Tran Trong Gia
	125	Effect of Rib Shapes on Droplet Generation in a T-junction Microchannel	Quoc Bao Duong
14:00 - 15:30	143	Statistical-based Feature Selection for Stroke Prediction: Performance Analysis of Multiple Classifiers	Khanh Yen Nguyen
	161	Data Augmentation in Seizure Detection	Nguyen Thi Minh Huong
	203	Prediction of punch force utilizing bag acceleration data during boxing training	Thuy Nguyen Nhu Son

Session 3: COMPUTATIONAL PHYSICS (Chair: Prof. Dr. Son Ngoc Do)
Room: B4-406

Time	ID	Title	Author
10:30 - 12:00	38	Glassy state of the flat 2D monatomic system with pentagonal structure	Nguyen To Nga
	61	Arc flash analysis using ETAP platform	Nguyen Ngoc Trieu
	3	Assessment of the lateral displacement of a single pile in the sloping ground based on finite element analysis program	Thanh Lam Danh
	4	Effect of Spacing and Penetration Length of Prefabricated Vertical Drain on the Consolidation Settlement of Soft Soil	Duc Huy Nguyen
14:00 - 15:30	205	Electronic properties of graphene/boron nitride heterostructures	Ngan Nguyen
	207	Research on the ability to generate electric current of the H/Pd(100) system in a fuel cell	Thai Pham
	106	Electromechanical properties of WS2 monolayer calculated via ab-initio principles	Dinh The Hung
	24	Tuning the Energy Band Structure and Effective Mass of PdS2 Monolayer by In-plane Strain	Tran The Quang
	26	Ab-initio calculations on mechanical, optoelectronics and piezoelectric properties of buckled honeycomb SnTe monolayer	Tran The Quang

Session 4A: ENGINEERING MECHANICS (Chairs: Prof. Dr.-Ing. Otto Theodor Iancu, Prof. Dr. Dinh Kien Nguyen) - Room: B4 Hall

Time	ID	Title	Author
10:30 - 12:00	73	Reflection on sustainability in civil engineering – investigation of the potential of numerical topology optimization	Daniela Masarczyk
	12	Studying the Large Span Multi-Cell Steel Box Girders – An Engineering Mechanics Look	Tham Hong Duong
	10	The use of PINN in analyzing two-dimensional elastoplastic problems	Le Nguyen Hoai Linh
	11	Static and free vibration analyses for Timoshenko micro-beam problems using finite element method	Hoang Nguyen Duy Thien
14:00 - 15:30	54	Modal Analysis of Laminated Composite Curved Shell Structures with Different Geometries by Using A Meshfree Method	Vay Siu Lo
	44	A comprehensive evaluation of various mean-free-path forms in hypersonic rarefied gas flows	Quach Huu Vinh
	103	Utilizing computational fluid dynamics (CFD) for simulating airflow and heat distribution to enhance thermal comfort in enclosed space	Kha Vy Vu Hoang
	22	The effect of damping in evaluating cable tension based on measuring frequency	An Huynh Thai
	101	Dynamic response analysis of PMSM motor in the case of using conventional gear transmission and CVT transmission	Le Thanh Quang

Session 4B: ENGINEERING MECHANICS (Chairs: Dr. Cong Ich Le, Dr. Thanh Nha Nguyen)
Room: B4-401

Time	ID	Title	Author
10:30 - 12:00	151	Size-dependent thermomechanical vibration of FGP microbeams using a higher-order shear deformable beam element	Cong Ich Le
	152	Nonlinear bending of FGP beams and frames based on a third-order shear deformation theory	Nam Vu Pham
	108	Numerical Analysis of Steel-Concrete Composite Slabs with Screw Stiffeners	Huong Thanh Khang

	137	Research on the effect of micro-voids distribution on dynamic crack behavior by extended consecutive-interpolation finite element method	Kim Bang Tran
14:00 - 16:00	121	Analysis of Behavior of the Soil-Pile System on the Seabed According to API RP 2A Standard by Finite Element Coding in MATLAB	Toan Nguyen
	104	Analysis and Simulation of Microwave Radiation on Human Skin Layers Model using The Finite Element Method	Duy Khanh Dinh Hoang
	150	Elastic Model for Polyethylene Terephthalate Fibre Reinforcement Structures: Application in Free Vibration Analysis of FG-TPMS Shell Panels (PET-FG-TPMS)	Thoi Duong Van
	39	Bond behavior of Reinforcing Steel and Geopolymer Concrete in Structure	Phan Duc Hung
	120	Dynamic analysis of plates resting on elastic foundation subjected to moving loads based on the first-order shear deformation theory	Thanh Trung Nguyen
	127	Physics informed neural network for for geometrically nonlinear analysis of truss structures	Si Do
	146	The development of mortar method for the non-conforming multi-patch elastic problems in isogeometric analysis	Quynh Vo-Manh

Session 4C: ENGINEERING MECHANICS (Chairs: Prof. Dr. Hung Anh Ly, Dr. Duy Khuong Nguyen)
Room: B4-402

Time	ID	Title	Author
10:30 - 12:00	123	The effect of car types on head injuries of vietnamese pedestrians using dummy in crashes at center position	Hung Anh Ly
	160	A Study on the Kalman Filter Based PID Controller for Mecanum-Wheeled Mobile Robot	Thanh Long Le
	169	Investigation on multi-corners crash box structure subjected to axial crushing	Nguyen Tien An Hung
	170	Study on the assessment of absorbed energy of bulbous bow in ship collision	Tran Manh Quyen
14:00 - 16:30	198	Ride Comfort Analysis of an Electric Motorbike subjected under Random Road Profile by a Multi Body Dynamic Model	Pham Ngoc Dai
	172	Vibration analysis of in-line shaft generator driven from main engine	Tuan Le Dinh
	183	Coupled Finite Element Analysis and Multivariate Adaptive Regression Splines for predicting the bearing capacity of conical footings on slopes	Pham Gia Huy
	185	An Optimal Method for Calculating Suspension Spring Stiffness Based on Roll Angle and Roll Acceleration Values	Nguyen Tuan Anh
	177	Effects of Rotor Eccentricity on Interior Permanent Magnet Motor Performance in Electric Vehicle	Truc Hoang Ho
	179	Dynamic Performances Analysis of an Electric Motorbike in case of Transient Excitation by Multi Body Dynamic Model	Huu Nhan Tran
	116	Physics informed neural network for structural nonlinear analysis	Si Do

Session 5A: INNOVATION TECHNOLOGY (Chairs: Prof. Dr. Pásztory Zoltán, Dr. Duong Hung Anh Le)
Room: BKA Hall

Time	ID	Title	Author
10:30 - 12:00	193	Use of Paper- and Cardboard Based Foams Beyond the Packaging Industry	Pásztory Zoltán
	208	Identification of the most useful configurations and individual elements of a hybrid undergraduate engineering laboratory through a student survey	Michael Murphy
	8	Fabrication and Characteristics of Binderless Cellulosic Fiberboard for Building Insulated Applications	Duong Hung Anh Le
	40	Integrating Suspended Sludge and Fixed Film into a System to Remove Nitrogen Pollutants in Wastewater	Quang-Chi Bui
	52	Solution of using battery energy storage systems for power transmission congestion of Ninh Thuan - Binh Thuan power grid	Hoang Hai
14:00 - 16:30	17	Improve the surface roughness of resin 3D printed products using RSM Method	Huu Nghi Huynh
	192	Design of roller feeding assembly for 3D printer using powder materials	Bui Trong Hieu
	36	EXPLORING DIFFERENCE Bi-LSTM MODELS IN SOLAR POWER FORECASTING	Thi-Tinh-Minh LE
	41	EXPLORING THE EFFICIENCIES OF BI-LSTM MODELS IN SOLAR POWER FORECASTING IN VIETNAM	Ngo Tri Si
	51	Short-Term Traffic Flow Forecasting with XGBoost and Traffic Condition Classification	Nguyen Duy Anh

		via Gradient Boosting Machines	
	95	Short-Term Load Forecasting for Extended Holidays with Variable Breaks: A Case Study of the Lunar New Year in Vietnam	Phuc Diem Nguyen Ngoc
	174	Building a set of assessment tools for the student outcomes of the Engineering Mechanics and Engineering Physics fields	Le Cao Dang

Session 5B: INNOVATION TECHNOLOGY (Chairs: Prof. Dr. Daniel Jenkins, Dr. Sy Hieu Dau)
Room: B4-405

Time	ID	Title	Author
10:30 - 12:00	182	Automated delineation of coconut rhinoceros beetle with a distributed surveillance system and machine vision tools	Daniel Jenkins
	25	A system for detecting scratches on the surface of small-sized metal shafts after the grinding process using optical techniques combined with computer vision.	Sy Hieu Dau
	20	Arc flash analysis during short circuit failure on the power system	Trieu Nguyen Ngoc
	71	Academic and Mobility Behavior Analysis for Daily Stress recognition among Students	Hoang Khang Phan
14:00 - 16:00	79	Vessel system offsets survey using 3-D laser scanning system	Le Dinh Tuan
	191	Analysis of text-to-speech conversion techniques based on silence trimming and amplitude analysis	Linh Ta Thi Nha
	94	Which is better for Signature Forgery Detection: Contrastive or Triplet Loss?	Pham Hoang Minh Tram
	144	Influence of Powder Mixing Techniques on the Performance of TiN/420SS Composites Manufactured by Selective Laser Melting	Duc Tran
	196	Application of Drone in Detecting Drain Cover Damages on Road	Nguyen Dinh Hoang

Session 6: WAVE ENERGY – SIMULATION AND PROTOTYPE APPROACH (Chairs: Prof. Dr. Thien Tich Truong, Dr. Paul O Sullivan, MSc. Vay Siu Lo)
Room: B4-601

Time	ID	Title	Author
10:30 - 12:00	56	Numerical Analysis of Wells Turbine Performance with Optimized Chord Length for Enhanced Wave Energy Conversion	Huynh Tran Tuan Kha
	57	Analysis of the Efficiency of Wave Energy Exploitation by Various Devices in Vietnamese Coastal Waters	Binh Khanh Ngo
	58	Analysis of Wind-Wave Impact on Open Wave Channel Systems	Hung Thai Le
	97	Hydrodynamic Analysis of Point Absorber Wave Energy Converters Using ANSYS Aqwa	Phan Ngoc Quyen

Session 7: ONLINE (chair: Dr. Pham Thi Hai Mien)
Room: meet.google.com/eki-bkca-ufj

Time	ID	Title	Author
10:30 - 12:00	199	Application of Infrared Technique in Identifying White Spot Lesions	Pham Thi Hai Mien
	92	Fabrication of Reusable Electrochemical Platform based on the Host-Guest Interaction	Zhi Jia Chen
	195	Study on the critical state of axial compressor in gas turbine engine in exploitation of dusty invironment	Tran Quoc Toan
	175	The Effectiveness of Inhaling Illuminated Oxygen by Firefighters After Physical Activity or During Firefighting Operations	I-Hsaing Lin
	1	Determining areas for potential groundwater recharge in industry premises using GIS	Meghana Kashyap

Session 8: POSTERS (Chairs: Dr. Trung Hau Nguyen, Dr. Quoc Khai Le, Dr. Bao Toan Pham, Dr. Hong Duyen Trinh Tran, MSc. Trung Tin Tran, MSc. Nhat Tan Le)
Room: B4 Building

Time	ID	Title	Author
10:30 - 15:00	5	Application of optical imaging technique in diagnosing breast abnormality	Quy Tan Ha
	63	An Analysis of Medical Cost Dataset using Unsupervised Machine Learning Techniques	Tran Trung Nghia
	64	Feasibility Study of Electrical Impedance Tomography for Detecting Abnormal Structures Around Boreholes	Quoc Tuan Nguyen Diep
	68	Feasibility study for detecting buried landmines using electrical impedance tomography	Hoang Nhut Huynh
	69	Optimization of Electrode Shapes in Electrical Impedance Tomography	Huynh Thanh Ven

	111	Investigation of the difference between the absolute and the observed signal in electrical impedance tomography image reconstruction	Trinh Vo Dang Khoa
	126	Classification of Lumbar Spine Degeneration Using Vision Transformer with the RSNA Dataset	Dang Nguyen Ngoc An
	134	Integrating meta-information and imaging for breast cancer detection using RSNA screening mammography	Tran Anh Tu
	23	An Image Processing-based Method for Determining the Geometry Transmission Ratio of a Continuously Variable Transmission Gearbox	Tri Nhut Do
	91	Hybrid Feature Extractor for Enhanced Breast Tumor Discrimination on Ultrasound Images	Nguyen Thanh Hang
	131	Fitness Tracker Data Analysis for Sleep Quality Forecasting	Ngoc Xuyen Nguyen
	62	Evaluating minimum inhibition concentration of ampicillin and rifamycin encapsulated in different nanoparticles	Lac Tran-Ha
	75	Applying convolutional neural networks in identifying and classifying Acute Lymphocytic Leukemia and its subtypes using Matlab	Phan Nguyen Bao Huy
	82	Performance evaluation of a cross-polarized filter for otoscopic endoscopy	Phan Ngoc Khuong Cat
	96	An Image-Classifying-Based Diagnostic Method Applied to Electronic Fuel Injection System for Gasoline Engine	Lam Huynh Phat
	105	Design of 3D coated structures by topology optimization	Hoang Nguyen Vu
	113	Utilizing dermoscopy methods with machine learning and deep learning algorithms to diagnose skin lesions	Le Tuan Kiet
	156	Manufacturing mobile vaccine storage cabinets using Peltier electrothermal effect	Huu Xuan Mai
	165	Fabrication and Characterization of Flexible Piezoresistive Pressure Sensors Using Spinosum Structured PANI/PVA Hydrogel	Nguyen Xuan Thanh Tram
	166	The Modeling of Non-invasive Measurement of Fruit Sweetness using Near-Infrared (NIR) Spectroscopy Method	Hong Duyen Trinh Tran
	30	First-Principles Studies on the Work Function Changes of ZnO(2-1-10) Surfaces Induced by NO and NO_2 Adsorption for Gas Sensors	Po-Liang Liu
	136	A Comparative Analysis of YOLOv5 and YOLOv7 Object Detecting Models For Speed-Limit Traffic-Sign Recognition	Lam Nhat Phi
	138	Research on the ability to generate electric current of the H/Pd(100) system in a fuel cell	Pham Cong Thai
	140	IoT-based Smart Agriculture System: Design of Farming Diary	Nguyen Phuc Kha Ninh
	142	Research in Detection and Evaluation of Green Spaces Using UAV and Artificial Intelligence	Ta Dinh Khoa
	173	A study on laser plane interpolation for vision-based robot seam-tracking accelerated by GPU	Duong Huu Duyen Nguyen
	197	Application GIS and remote sensing in building a map of ecosystem services: A case study in the Thu Duc City, Ho Chi Minh City	Huong Dao Thi Viet
	176	Highspeed recognition of printed characters on packages with parallel computing and Machine Learning	Trung Hieu Vo
	178	Smart System for Monitoring and Controlling Dragon Fruit Quality in Cold Freight Trucks in Vietnam	Hoang-Tung Vu
	49	Analysis of head injuries of motorcyclist colliding with cars in traffic conditions in Vietnam	Du Ho Trong
	154	Evaluating Zirconia vs. Lithium Disilicate RBFDPs: An FEA Study on Load Conditions and Framework Designs	Cuong Nam Tran
	180	Optimization of Functional Rehabilitation Support Devices with 3D Printing Technology	Hoai Thuong Nguyen Thi
	181	Failure Through Crack Propagation in Photoelasticity Using Isogeometric Analysis of Phase-Field Models	Quoc Phan Minh Kien
	184	Impact of oxygenated Palm-biodiesel on combustion characteristics under various levels of EGR in simulated CI-engine condition	Vo Tan Chau
	84	Investigating the Impacts of Anhydrous Ethanol and Biodiesel as an Emulsifier on Macroscopic Spray Characteristics of Diesel-Ethanol and Tri-Fuel Blends in a Constant Volume Vessel	Vo Tan Chau
	117	Nonlinear Analysis of Stiffened Laminated Composite Plates Using SHELL181 Elements in ANSYS	Ho Tan Loc
	19	A Combined Segmentation and Classification Pipeline for Breast Tumors Analysis on Ultrasound Image	Nguyen Cong Thanh
	201	Analcime zeolite beads prepared from mineral clays for CO2 capture application	Hieu Le Tu

	204	Investigation of Bacterial Cellulose Production from Non-Hydrolyzed Orange Peel Extract Without Additional Nutrient Supplements	Pham Thi Tuyet
	15	Convergence of the solutions for weak vector quasi-equilibrium problems	Xuan Dai Le
	80	Fluorescence Turn-On Probe Based Detection of Orchid Viruses	Xuan-Yu Chen
	85	Cancer Theranostic Evaluation from the Intracellular Dark/Photo-toxicity Investigation of Benzothiazole Derivatives	Ryan Joshua Liou
	100	Enhanced Physiological Function and Improved Exercise Efficiency through Intelligent Oxygen	Chia-Feng Hsieh
	124	The Impact of Transcutaneous Vagus Nerve Stimulation on Depression in College Students	Ting-Yi Shen
	155	Estimation of Vital Signs Appropriate for the Vietnamese Population Using Photoplethysmography Signals: Methodology Study	Quang Linh Huynh
	158	Exercise stress test in detecting coronary heart disease with load control indoor cycle	Le Cao Dang
	167	Assessment of Muscle Fatigue via Surface Electromyography Signal Analysis using Higuchi Fractal Dimension with Tuning Parameter	Nguyen Hung Anh
	28	The molecular dynamics simulation of fullerene properties in water	Le Vu Phuc
	47	Comparison of water bamboo qualities and quantities harvested in different growth environments from Puli area in Taiwan	Yang Chih-Chi
	76	Ferrite Process for PVA Wastewater Treatment from 3D Printing: Efficiency Evaluation and Precipitate Characterization	Vincent K. S. Hsiao
	118	Preliminary Study: Ultrasonic/microwave-assisted extraction from orange pomace by-products: evaluation of their antioxidant and antibacterial ability	Yung-Kai LIN
	119	The establishment and optimization of the photoreactive culture system of Dunaliella salina	Yung Kai LIN
	130	Synthesis of Fe/chitosan-bentonite beads for H2S adsorptive removal	Hung Nguyen Manh
	149	Health protection equipment for motorbike drivers	Tuong Long Nguyen
	157	Investigation of bacterial cellulose production from orange peel extract	Pham Thi Tuyet
	162	Evaluate CO2 adsorption capacity of modified GIS zeolite through cation exchange with alkaline and alkaline earth metals	Bach Ngoc Nguyen Duy
	163	Proactive Drowsiness Alert System for Motobike Riders	Tuong Long Nguyen
	164	Innovation in Caring for and Protecting the Health of Motorbike Riders using CDSIO Tools	Tuong Long Nguyen
	186	Nonlinear bending of an agglomerated CNT-reinforced composite sandwich beam and frame structure	Dinh Kien Nguyen
	202	A Bi-Level Simulation for Assessing the Traffic Impact of Priority Bus Lanes in Mixed Traffic: A Case Study of Ho Chi Minh City	Hong Tan Van

Session 9: STUDENT FORUM (Chairs: Assist. Prof. Christina Garcia Alvarez, MSc. Nhat Tan Le)
Room: B4-602

Time	ID	Title	Author
10:30 – 11:00		From Curiosity to Innovation: Bridging Boundaries in Research and Collaboration	Assist. Prof. Christina Garcia Alvarez
11:00 – 12:00	W6	Mitigating UV-Induced Skin Damage: Design And Evaluation Of A UVB Detection Device	Nguyen Huu Tho
	W7	A study of the impact of relaxation music through electrocardiography	Bui Thien Thanh Tu
	W1	Polyvinyl alcohol/Chitosan/Gelatin hydrogel incorporated with betel leaves for enhanced wound care management	Tran Tam Nha
	W2	The effect of freeze-thaw treatment on the properties of gelatin/carbonate apatite membrane for nerve regeneDration scaffold	Dao Minh Khanh Tuyen
14:00 – 15:30	W9	Autism Spectrum Disorder Classification on EEG Signal: A Spectrogram and Deep Learning Approach	Nguyen Tu Nhat Khang
	W8	Leveraging Large Language Models for Medical Reporting from X-ray Images in a Chatbot	Nguyen Thi Mong Xuyen
	W3	Biomechanical Impact Analysis of Cage Positioning in Lumbar Interbody Fusion by the Finite Element Method	Le Thi Hoang Thuy
	W12	Research on applying synthesizer model on health record data	Vo Nguyen Phat
	W15	Geometry Optimization Models of Curcumin (Cur) and Beta-Cyclodextrin (β-CD) Molecules: A Computational Simulation Study	Nguyen Dac Quan
	W16	Interaction of curcumin with fullerene: a simulation method.	Nguyen Du Que Tram

Poster 10:30 – 15:00	W4	Buckling analysis of Reissner-Mindlin plates made of functionally graded material by using meshfree method	Hoang Ngoc Dang
	W5	Assess student spiritual life quality based on mobility and behavioural data	Hoang Khang Phan
	W14	Therapy support equipment - Infrared heat massage belt	Nguyen Dinh Hung
	W10	Design of wheelchair bed combined with phototherapy for stroke patient	Nguyen Minh Man
	W11	Spinal decompression belt with infrared light	Pham Duy Anh
	W13	Cervical Spine Traction Device Combined with Infrared Light Therapy	Le Thanh Vinh
	W17	Study of Bombyx mori fibroin in an acidic environment	Le Nhat Huy

Time	**BANQUET, CLOSING SESSION** **Chairs: Prof. Dr.-Ing. Otto Theodor Iancu, Dr. Xuan Dai Le** **Room: BKA Hall**
18:00 - 18:30	- *BEST PAPER AWARDS* - *CLOSING SPEECH*
18:30 – 21:00	**Banquet**

CONTENTS

SESSION 1: APPLIED MATHEMATICS

ID_14: Convergence of the solutions for weak vector quasi-equilibrium problems

Xuan Dai Le[1], Nguyen Van Hung[2], Hong Phuc Nguyen[1], Xuan My Nguyen[1]

[1]Ho Chi Minh City University of Technology, Vietnam National University, Ho Chi Minh City, Vietnam
[2]Posts and Telecommunications Institute of Technology
E-mail: ytkadai@hcmut.edu.vn

Abstract

In this paper, we first establish weak vector quasi-equilibrium problems in finite dimensional spaces. After that, we introduce the auxiliary solution sets and the concept of Rp+-quasi-convexity of the objective functions for weak vector quasi-equilibrium problems. Finally, based on the auxiliary solution sets and the concept of Rp+-quasi-convexity, we study the Painleve-Kuratowski lower convergence and convergence of the solution sets with a sequence of mappings converging continuously for these problems. Many examples are given for the illustration of our results. Our results in this paper are new and different some main results in the literature.

ID_88: Evaluation of Sinusoidal Wave Energy Dissipation over a Gyroid Triply Periodic Minimal Surface-based Porous Breakwater

Khanh Le Thanh Duy[1], Khuong D. Nguyen[1]

[1]Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam
E-mail: khanh.le100303@hcmut.edu.vn

Abstract

Breakwaters with porosity have been considered one of the most prospective keys to the wave's energy reduction issues in the shoreline engineering area. In this project, the specimen test would be a permeable porous breakwater designed based on the structural Triply Periodic Minimal Surface(TPMS) unit cells-Gyroid. The paper's primary purpose is to utilize the numerical method Finite Volume Method (FVM) to evaluate approximately the wave's dissipation before and after crashing against the structures. To be detailed, the experiment has two stages: validation and verification. For the first stage, to validate the accuracy of the mathematical sinusoidal wave model, a computational fluid dynamics software (CFD) Ansys Fluent was utilized to approximate the wave's characteristics and compared with the empirical experiment, which is generated by a plunger-type wavemaker controlled with three different radians per minute(RPM), separately 22(r/m), 44(r/m) and 66(r/m) in a wave flume without the breakwater. The wave's characteristics, such as period T, wave height H, and wavelength L, would be considered in this process. Next, those set-ups are reapplied for a numerical wave tank containing the Gyroid breakwater to evaluate the effective performance regarding the wave prevention proficiency, based on the transmission coefficient (Ct). In conclusion, the proposed wave model is validated, and there is substantial compatibility between the numerical and experimental results. Finally, the Gyroid breakwater has exhibited outstanding efficacy in wave transmission reduction.

ID_55: Privacy-Preserving Federated Optimization through Applied Mathematics

Trieu Phong Le[1], **Tran Thi Phuong**[1],

[1]National Institute of Information and Communications Technology (NICT)
E-mail: letrieu.letrieuphong@gmail.com

Abstract

In this paper, we first establish weak vector quasi-equilibrium problems in finite dimensional spaces. After that, we introduce the auxiliary solution sets and the concept of Rp+-quasi-convexity of the objective functions for weak vector quasi-equilibrium problems. Finally, based on the auxiliary solution sets and the concept of Rp+-quasi-convexity, we study the Painleve-Kuratowski lower convergence and convergence of the solution sets with a sequence of mappings converging continuously for these problems. Many examples are given for the illustration of our results. Our results in this paper are new and different some main results in the literature. In this presentation, we delve into the realm of federated optimization with a focus on privacy preservation, explored through the lens of applied mathematics. Federated optimization is a distributed learning paradigm that enables multiple entities to collaboratively train a shared model without exchanging their raw data. This feature is crucial in privacy-sensitive domains such as healthcare and finance, where safeguarding sensitive information is paramount. We begin by unpacking the foundational principles of federated optimization, including the concept of federated learning itself. Federated learning decentralizes the training process, allowing data to remain on local devices while only sharing model updates. This approach mitigates the risks associated with data breaches and unauthorized access. We will explore how this paradigm shift addresses key privacy concerns and promotes data security. Next, we move through various algorithms that power federated learning, analyzing their mathematical formulations. We will cover our recently proposed algorithms such as in [PPF2023, PPWO24], and other advanced algorithms, discussing their convergence properties, efficiency, and robustness in different scenarios. A major highlight of our discussion is the in-depth examination of privacy-preserving techniques within federated optimization. Techniques such as differential privacy and homomorphic encryption play a crucial role in enhancing the privacy of federated learning systems. We will explain how differential privacy introduces controlled noise to the model updates, ensuring that individual data points cannot be inferred. Homomorphic encryption further enhance privacy by enabling computations on encrypted data without revealing the raw data. Our presentation offers a thorough overview, incorporating the latest research in this dynamic field. Additionally, we will touch upon the challenges and future directions, including scalability issues, communication overhead, and the balance between privacy and model performance. By the end of this presentation, a comprehensive understanding of federated optimization, its mathematical foundations, and the cutting-edge privacy-preserving techniques shaping the future of secure distributed learning will be achieved. [PPF2023] Tran Thi Phuong, Le Trieu Phong, Kazuhide Fukushima: Distributed Stochastic Gradient Descent With Compressed and Skipped Communication. IEEE Access 11: 99836-99846 (2023) [PPWO24] Le Trieu Phong, Tran Thi Phuong, Lihua Wang, Seiichi Ozawa: Frameworks for Privacy-Preserving Federated Learning. IEICE Trans. Inf. Syst. 107(1): 2-12 (2024)

ID_200: Applying Structural Equation Modeling to Analyze Acceptance of a Transportation Policy in Ho Chi Minh City

Gia Tuan Kim[1] **and Hong Tan Van**[1*]

[1]Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam.
**E-mail: vhtan@hcmut.edu.vn*

Abstract

Abstract. Structural Equation Modeling is a powerful and versatile tool for studying policy acceptance, particularly when the subject involves complex, multivariate relationships. The key strengths of SEM lies in its ability to analyze both direct and indirect effects of multiple variables simultaneously, allowing researchers to assess how different factors - such as psychological perceptions or societal impacts - interact and contribute to policy support. The results in this applied study provide a comprehensive understanding of the factors influencing both participation in and support for cultural pedestrian streets in HCMC. We found that perceived traffic displacement and perceived effectiveness of organization emerge as key predictors of both participation and support, while accessibility primarily affects public agreement on implementation. These findings are consistent with other studies in urban planning, which emphasize the importance of effective management, traffic reduction, and accessible design in fostering successful pedestrian streets in HCMC.

ID_60: Stability of approximate solutions of set-valued equilibrium problems

Linh Ha Manh, Tam Tran Ngoc

E-mail: hmlinh.sdh231@hcmut.edu.vn

Abstract

Abstract. This article introduces a bi-level simulation approach for evaluating the impacts of implementing dedicated bus lanes. We illustrate this method with a case study of a specific route in Ho Chi Minh City, which involved using iterative simulations to make incremental adjustments to reflect any changes in bus service quality or other transport system modifications. By using this approach, it is possible to minimize negative impacts and implement appropriate mitigation measures, thereby increasing the chances of successfully implementing priority bus lanes particularly in mixed traffic condition. It is important to note that the priority bus lanes itself should be seen as a mitigation measure, as it not only offers additional capacity along the corridor but also provides a safer, more reliable, and possibly more comfortable alternative transport mode for students and employees in Ho Chi Minh City, all at a lower cost.

SESSION 2A: BIOMEDICAL ENGINEERING & ENGINEERING PHYSICS

ID_187: Teacher-Student Partnerships in Biomedical Engineering

Pádraig Herbert[1]

[1] *Department of Mechanical, Biomedical and Manufacturing Engineering, Munster Technological University, and PhD. Fellow at the Tyndall Institute, University College Cork, Ireland.*
** E-mail: padraig.herbert@mtu.ie*
Abstract

Project work undertaken by undergraduate and taught postgraduate students is a feature of many engineering degree programs where students are actively encouraged to take ownership of their project, hence engaging in active learning. Encouraging students to take ownership of their learning is a key component to the success of Problem Based Learning pedagogy (Lambert and Ashwin, 2021) . Due to the broad multifaceted skills required of a Biomedical Engineering student to conduct independent research, in particular in physiological measurement this project, proposes to structure and support students by recommending the use of a Biomedical Measurement development ecosystem within MTU. This research will not prescribe, but harvest knowledge from the experience of our learners when presented with the challenge of developing their projects using a proprietary hardware and software system (Schwartzman and Bouas Henry, 2009).

To further our efforts to promote a real and authentic learning environment, this project aims to collaborate with learners to develop level appropriate, learning resource for a Biomedical physiological measurement development system. The system consists of a hardware front-end, signal acquisition and transmission hardware as well as an online data capture and visualization platform. Learners who chose to develop final year projects and Masters Degree projects in physiological measurement will be given the opportunity to work with this equipment and also will be required to contribute to learning resources, either directly or by engaging with a focus group on completion of their project (Clegg, 2000).

This phenomenological study will use a focus group as the data capture tools (Bourne and Winstone, 2021) (Groenewald, 2004) , with thematic analysis of the transcribed audio . This project will produce a large range of diverse data, rather than a large quantity of data, which is more suited to qualitative thematic analysis. Published thematic frameworks will be adopted to aid in the analysis of the data captured from learners, building on the work of this author (Herbert, 2024) and others (Dounas-Frazer et al., 2016) . The research project is student-focused but will also benefit the academic and teaching staff within MTU and other higher education institutions, as insights gained into learners needs when presented with such technology, can inform the design of modules and teaching resources. Its anticipated the data captured at the focus group sessions could reveal a diverse range of issues experienced by learners; physiological measurement laboratory practice, biomedical data signal processing and data visualisation and modelling.

This research demonstrates the value and power of qualitative research, and even with limitations such as a small and homogenous sample size, valuable insights can be gained how we can further collaborate with and support learners during instances of active and self-directing learning experiences. Ultimately learners may be better prepared for the challenges of their careers, in industry or further academic p pursuits

---

ID_50: A Study On Synthesizing Electronic Health Record Data For Privacy Preservation

Tran Phuc Nhat Mai[1,3]**, Nguyen Phat Vo**[2,3] **and Nhat Tan Le**[1,3*]

[1]*Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 286 Ly Thuong Kiet Street, District 10, Ho Chi Minh City 70000, Vietnam*
[2]*Department of Computer Engineering and Computer Science, Ho Chi Minh City University of Technology (HCMUT), 286 Ly Thuong Kiet Street, District 10, Ho Chi Minh City 70000, Vietnam*
[3]*Vietnam National University Ho Chi Minh City, Quarter 6, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam*
**E-mail: lenhattan@hcmut.edu.vn*
Abstract

Predicting the risk of developing various diseases using machine learning models, deep learning, and neural networks trained on electronic health record (EHR) data has become crucial in today's healthcare landscape. However, safeguarding personal information remains a significant concern due to the potential for sensitive information leakage from EHR databases, which often contain personal information that, if revealed, can lead to identity theft, discrimination, and other types of harm. This study aims to apply synthetic data as a replacement for real databases to protect personal information while ensuring the responsible use of data for research, AI applications, and collaborative analysis. The research was conducted on two different EHR databases using a statistical model (Gaussian Copula Synthesizer) and a deep learning model (Conditional Generative Adversarial Network Synthesizer). Specifically, the study focused on forecasting diabetes risks in the next year and predicting Intensive Care Unit outcomes in EHRs. The quality of these synthetic datasets was evaluated using statistical metrics and machine learning efficiency. Moreover, data security efficiency was assessed using statistical-based privacy metrics, including k-Anonymity, l-Diversity, and ε– Identifiability values. The results demonstrate the significant quality and privacy of synthetic data generated by both models, highlighting the potential of the proposed pipeline of synthetic data-generating models in future healthcare applications.

ID_67: Influence of current injection and voltage acquisition on electrical impedance tomography image reconstruction: A simulation study

Quoc Tuan Nguyen Diep[1,2], Minh Quan Cao Dinh[1,2], Hoang Nhut Huynh[1,2], Hong Duyen Trinh Tran[1,2], Hau Tran Thien[1,2], Tran Anh Tu[1,2,*] and Trung Nghia Tran[1,2]

[1]*Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam*
**E-mail: tranatu@hcmut.edu.vn*

Abstract

In this study, a simulation was performed to evaluate the effects of combining current injection and voltage measurement methods on electrical impedance tomography image reconstruction. The current injection and voltage measurement methods considered included adjacent and opposite methods. The simulation was set up with 16 electrodes and alternating current with intensity i = 1 mA at frequency f = 50 kHz. A circular object with a conductivity of 0.9 units is placed in 5 different locations, 0.05 units apart. The results show that combining these methods has different advantages and disadvantages in terms of the contrast and position bias of the reconstructed images, providing the effectiveness and limitations of each method used for specific applications.

ID_148: Investigating Signal Changes in Impedance Cardiography through Varied Frequencies

Minh Quan Cao Dinh[1,2], Quoc Tuan Nguyen Diep[1,2], Hoang Nhut Huynh[1,2], Hai Anh Nguyen Thi[1,2], Tran Anh Tu[1,2,*] and Trung Nghia Tran[1,2]

[1]*Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam*
**E-mail: quan.caodinhminh@hcmut.edu.vn*

Abstract

Impedance Cardiography (ICG), a key component of Electrical Bioimpedance (EBI) technology, holds significant promise for cardiovascular health assessment. This study delves into the impact of varied frequencies on impedance cardiography, aiming to provide a nuanced understanding of cardiovascular dynamics. ICG offers crucial insights into cardiac function, including cardiac output, stroke volume, and vascular resistance by measuring electrical impedance in the thorax. Exploring different frequencies reveals a delicate balance between wavelength, tissue penetration, and sensitivity to physiological changes. Higher frequencies, such as 40kHz and 50kHz, present challenges in capturing deeper physiological alterations due to their shorter wavelengths, resulting in less stable waveforms. In contrast, the 30kHz frequency demonstrates optimal performance, striking a crucial balance with sufficient tissue penetration and sensitivity to dynamic cardiac-related changes, leading to precise and stable waveforms. Our findings underscore the importance of selecting an appropriate frequency for accurate and stable cardiovascular assessments in impedance cardiography. This conclusion reinforces the critical significance of ICG in optimizing patient care through tailored and precise diagnostic assessments.

ID_77: A comparative EEG analysis of classifying short sleep phases and waking states using support vector machine and random forest

Nhi Yen Phan Xuan[1,2*], Bao Minh Pham[1,2] and Khai Le Quoc[1,2], Quang Linh Huynh[1,2]

[1]Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: pxynhi.sdh231@hcmut.edu.vn*

Abstract

Multiple studies suggest that the various stages of sleep affect the effectiveness of taking a nap. For this reason, the purpose of this research is to create a model that may be used to categorize the first and second stages of short sleep or the awake state. We employ sleep recordings obtained from the openaccess dataset. In order to enhance the quality of the EEG signals, we implement a Notch Filter to reduce power line noise and a Bandpass (Butterworth) filter with a frequency range of 0.5–70 Hz to isolate the pertinent EEG signals. Two classifiers, Support Vector Machine (SVM) and Random Forest, are used to assess and compare the performance of classification. In addition, the mRmR (minimal Redundancy Maximum Relevance) feature selection approach is employed to improve the efficiency of the model. The results of our study indicate that both classifiers for each subject have an accuracy rate approaching 80%, differentiating between wakefulness and phases 1 and 2 of short sleep. This study emphasizes theefficacy of these strategies in offering essential instruments for comprehending and enhancing nap efficiency.

ID_78: Positive Emotional State Recognition Using Nonlinear Dynamics Analysis and Machine Learning Algorithms with Electroencephalogram Signals

Quynh Nguyen Gia[1,2], Quang Linh Huynh[1,2] and Quoc Khai Le[1,2*]

[1]Department of Biomedical Engineering Physics, Faculty of Applied Science, Ho Chi Minh city University of Technology, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: quockhai@hcmut.edu.vn*

Abstract

Electroencephalogram (EEG) signals processing has gathered increased interest from the scientific community for a long time, especially in the field of emotion recognition. The objective of this research is to propose a method that analyzes EEG signals from a publicly available dataset called SJTU Emotion EEG Dataset (SEED) to classify different emotional states, especially positive emotions. The dataset consists of EEG signals recorded from fifteen subjects while watching different film clips, each of which corresponds to a type of emotions. Initial analysis involves the extraction of features from the preprocessed data including time-domain analysis, frequency-domain analysis using Fast Fourier Transform (FFT) and nonlinear dynamics method. Machine learning algorithms are then applied as classifiers in order to determine the emotional states of each subject – categorized as positive, negative, or neutral – with the input is the extracted features. In this work, Support Vector Machine (SVM), Linear Discriminant Analysis (LDA) and Subspace Discriminant (SD) are used for training and testing the labeled data. The classification step achieved the highest accuracy level of 82.2% while the highest micro-F1 score value is 0.92 for positive emotions. The established methodology not only proposes an automated model for determining positive emotional states but also plays an important role at the beginning of the investigation further into emotion recognition by providing better visualization of how different emotional states are determined.

ID_86: Visualizing brain signals in mental calculation by using Electroencephalography Topographic Map Animation with Independent component analysis perspectives

Nghiem Nguyen Ngoc[1], Khai Le Quoc[1] , Cong Danh Nguyen[1] , Toan Vo Duc[1]

[1]Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology, 268 Ly Thuong Kiet, Ho Chi Minh City, Vietnam
E-mail: nghiem.nguyenhiarorashi@hcmut.edu.vn

Abstract

Cognitive Neuroscience is a scientific study area that examines biology processes and features that underlie cognition, focusing particularly on brain neural connections involved in mental processes. This research field discovers how the brain works when we perform a specific cognitive task such as doing school tests or brain games, from which experts can analyze and evaluate how they affect our brain. EEG signals are an essential tool in the mental process for detecting and monitoring the variations and patterns in the brain's electrical activity. In this study, we aim to try to observe electrical activity through brain mapping animation of the brain using EEG signals recorded from participants while they performed mental calculations. The data involved thirty-six participants divided into good performers and poor performers based on their number of mental arithmetic tasks . We hypothesized that there would be changes in the distribution of EEG activity before and during performing cognitive activity in good and poor performers. The data were preprocessed, segmented into 2-second epochs, and decomposed into independent components (ICs) using ICA (independent component analysis). We used K-means clustering to obtain nine notable original brain signal based on clusters containing ICs from more than half of the subjects criteria. We applied spectral power to detect the change in theta (4-8Hz), alpha (8-12Hz), low beta (12-20Hz), high beta (20-30Hz) and Gamma (30-45Hz) in rest and task condition. event-related spectral perturbation, or ERSP, (Makeig, 1993) (event-related shifts in the spectral power) was employed to divide two groups. Topographic map animations were created from the 2-second epochs to visualize the changes in brain activity over time. We expect this approach will allow us to observe the evolution of electrical brain activity during mental calculation through saturation of color bar, particularly in regions associated with cognitive and numerical processing. We also anticipate observing differences in brain dynamics between individuals with varying arithmetic abilities. This study has the potential to provide a novel tool for investigating brain dynamics during mental arithmetic and may have applications in assessing and improving effectiveness of cognitive activity.

ID_90: Enhancing Diagnostic Accuracy for Knee Osteoarthritis Using a Deep Learning Approach

Aquib Raza[1,2,#], Congo Tak Shing Ching[3,4,5,6,#], Peng-Ta Liu[3,7], Thien-Luan Phan[3,8,#], Ngoc-Luan Tran[3], Ha Anh T. Nguyen[3], Mohammad Rameez[9], HungChung Li[10], Dao Nguyen Phuong Linh[11], Nguyen Van Hieu[8],*, Trung Nghia Tran[12,13*]

[1]*Taiwan International Graduate Program On Artificial Intelligence Of Things (Phd Program), National Taiwan University, 10673, Taipei City, Taiwan.*
[2]*Research Center for Information Technology, Academia Sinica, 11529, Taipei City, Taiwan.*
[3]*Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taichung 402, Taiwan*
[4]*Department of Electrical Engineering, National Chi Nan University, Nantou County, Taiwan*
[5]*Advanced Plant and Food Crop Biotechnology Center, National Chung Hsing University, Taichung 402, Taiwan*
[6]*International Doctoral Program in Agriculture, National Chung Hsing University, Taichung 402, Taiwan*
[7]*Fall Prevention Center and Department of Physical Medicine & Rehabilitation, Changhua Christian Hospital, Changhua 500, Taiwan*
[8]*Department of Physics and Electronic Engineering, University of Science, Vietnam National University - Ho Chi Minh City, Ho Chi Minh City 70000, Vietnam*
[9]*Department of Computer Science, University of York, Heslington, York YO10 5DD, United Kingdom.*
[10]*Undergraduate Program of Intellectual Creativity Engineering, National Chung Hsing University, Taichung 402, Taiwan.*
[11]*Independant Research Medical Doctor*
[12]*Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City 72409, Vietnam*
13 HCMUT, Vietnam National University Ho Chi Minh City, Thu Duc, Ho Chi Minh City 71308, Vietnam
 # These authors contributed equally
**E-mail: nvhieu@hcmus.edu.vn, ttnghia@hcmut.edu.vn*

Abstract

This study presents a deep learning framework that combines convolutional neural networks (CNNs) with autoencoders to enhance the diagnostic accuracy of knee osteoarthritis. Using a publicly available dataset from the Mendeley data repository, knee joint images were pre-processed using Contrast Limited Adaptive Histogram Equalization (CLAHE) to improve contrastand ensure uniform sizing. An autoencoder was first employed to learn compressed data representations in an unsupervised manner, which were then used to train a CNN for the classification of knee images into 'healthy' and 'osteoarthritic' categories. The model was trained with an 80:20 train-test split, utilizing early stopping and data augmentation techniques to mitigate overfitting and improve model generalization. Performance evaluation metrics, including accuracy, precision, recall, and ROC-AUC, demonstrated a high test accuracy of98.95%. Furthermore, high precision and recall rates confirmed the model's robustness in diagnosing knee osteoarthritis. To provide interpretability, Gradient-weighted Class Activation Mapping (Grad-CAM) was applied, revealing critical image regions influencing the model's decisions. Additionally, tDistributed Stochastic Neighbor Embedding (t-SNE) was used to visualize high dimensional encoded features in a two-dimensional space, offering deeper insights into how the model discriminates between different classes. The promising results of this deep learning approach indicate its potential for broader application in medical imaging diagnostics, providing healthcare professionals with a tool that enhances diagnostic accuracy and operational efficiency. This framework lays a foundation for developing scalable AI-driven diagnostic systems for a variety of complex medical conditions.

SESSION 2B: BIOMEDICAL ENGINEERING & ENGINEERING PHYSICS

ID_194: A Machine Learning Approach in EEG-Based Assessment of Cognitive Load by Mental Arithmetic Tasks

Phuc Khang Nguyen[1,2], Quang Linh Huynh[1,2] and Quoc Khai Le[1,2*]

[1]Department of Biomedical Engineering Physics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
** E-mail: quockhai@hcmut.edu.vn*

Abstract

In this study, we investigate the characteristics of electroencephalogram (EEG) signals during mental arithmetic tasks. The publicly available dataset used in this study includes EEG recordings from 36 healthy volunteers performing serial subtraction tasks, with data collected using a 23-channel Neurocom EEG system. The study aims to explore the changes in brain activity during cognitive workload by analyzing the power spectral density, entropy, and statistical features of the EEG signals. Key features such as band power in delta, theta, alpha, beta, and gamma frequency bands, entropy, mean power, standard deviation, kurtosis, skewness, autocorrelation, and RMS energy were extracted from each channel. The subjects were categorized into good and bad counters based on their arithmetic performance. The extracted features were then used to train machine learning models, including Linear Discriminant Analysis (LDA), k-Nearest Neighbors (KNN), and Support Vector Machine (SVM), to classify the cognitive workload levels. The KNN model demonstrated the highest overall performance with an F1 score of 0.857. This research highlights the potential of using EEG features to assess cognitive workload and provides a foundation for future studies on brain-computer interfaces and cognitive neuroscience.

ID_102: Effect of Training Frequency and Set Configuration on Upper Arm Muscle Properties via Ultrasound Image Gathering and Analysis

Minh Tu Anh Vo[1,2], Ngoc Minh Tam Nguyen[1,2], Hong Huong Huynh[1,2], Huu Xuan Mai[1,2], Nhat Tan Le[1,2*]

[1]Department of Biomedical Engineering Physics, Faculty of Applied Sciences, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, ward 14, District 10, Ho Chi Minh City, Vietnam.
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
** E-mail: lenhattan@hcmut.edu.vn*

Abstract

Ultrasound imaging offers a non-invasive method to evaluate muscle architecture and adaptations following resistance training. This study aimed to assess changes in upper arm muscle thickness and quality in response to an 8-week structured resistance training program using ultrasound measurements. The study also examines how training frequency—both in terms of total sessions and specific muscle group sessions—affects these adaptations. A cohort of healthy adults participated, receiving preliminary training in exercise techniques and ultrasound usage. Participants were divided into two groups: Group CS (Cluster Set) performed exercises with clustered sets and short rest intervals, while Group RS (Regular Set) performed traditional sets with longer rests. Both groups trained three times weekly. Results indicated significant increases in muscle thickness, primarily attributed to reductions in intramuscular fat content. The study highlights the influence of training frequency and set structure on muscle adaptations. Further research should incorporate electromyography (EMG) to evaluate muscle activation during training sessions, providing deeper insights into the neuromuscular adaptations and the effectiveness of varied exercise programs.

ID_110: Positive and Negative Emotions Recognition using Multichannel EEG Analysis with Spectral Entropy and Machine Learning approaches

Bao Tran Trong Gia[1,2*], Hao Vu1,2, Khai Le Quoc[1,2]

[1]Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: bao.trantronggia@hcmut.edu.vn*

Abstract

Emotion recognition is a critical component of human-computer interaction, facilitating more natural and effective communication between users and machines. This study explores the recognition of positive and negative emotions using a multichannel Electroencephalogram (EEG) analysis approach, incorporating spectral entropy and machine learning techniques. Spectral entropy, which quantifies the complexity and irregularity of EEG signals, is employed to extract relevant features from the raw EEG data. These features are then fed into various machine learning models to classify emotions accurately. The research leverages a comprehensive dataset of EEG recordings from participants exposed to emotion-inducing stimuli, ensuring a robust analysis of both positive and negative emotional states. Preprocessing steps, including noise reduction and artifact removal, are meticulously applied to ensure the quality and reliability ofthe EEG signals. Spectral entropy features are extracted from multiple frequency bands, capturing the nuanced variations in brain activity associated with different emotional states. Several machine learning algorithms, including Random Forest (RF), Support Vector Machine (SVM), k-Nearest Neighbor (kNN), Decision Tree (DT), and Neural Network (NN), are evaluated for their performance in classifyingthe emotions. The study also examines the impact of feature selection and dimensionality reduction techniques on the accuracy and efficiency of the classifiers. Cross-validation and other statistical methods are employed to validate the models and prevent overfitting. The preliminary results from the integration of spectral entropy features with advanced machine learning approaches demonstrate an accuracy of 73.7% and f1-scores of approximately 0.6583 to 0.7347 when differentiating between negative, positive and neutral emotional states. The findings suggest that multichannel EEG analysis, when combined with sophisticated feature extraction and classification techniques, holds great promisefor developing more intuitive and responsive human-computer interfaces. Future research directions include the application of deep learning models to further improve the robustness and scalability of emotion recognition systems.

ID_125: Effect of rib shapes on droplet generation in a T-junction microchannel

Quoc-Bao Duong[1], Song-Thanh-Thao Nguyen[1*]

[1]Department of Aerospace Engineering, Faculty of Transport Engineering, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam
**E-mail: nguyensongthanhthao@hcmut.edu.vn*

Abstract

Microfluidic technology is attracting attention from researchers and now it is applied in many fields such as biology, pharmaceuticals and chemistry. This technology is considered to have many advantages than traditional methods, which includes time saving, reduced sample volume and effective cost. The goal of this study is to investigate the effects of rib shapes on droplet generation in a Tjunction microchannel. By using three-dimensional (3D) laminar model with the Volume Of Fluid (VOF) base on ANSYS FLUENT software (Student version), the numerical models of modified T-junction is proposed to predict fluid phenomena at microscale. This study showed that the droplet size could be controlled by changing the flow rate of continuous phase (Oil) and flow rate of dispersed phase (Water). In addition, the rib shapes in T-junction significantly impacted the droplet size. From these results, it was found that a rib shape was optimal in droplet generation. These types of small rib shapes can still be manufactured by using photolithography technique. Next, these results will make significant contributions to the manufacture microfluidic devices with high precision. The ability to control droplet size through modified T-junction with rib shapes not only improves the efficiency and reliability of microfluidic systems but also extends applications in multiple scientific fields. This research lays the groundwork for further exploration into the optimization of microfluidic devices, potentially leading to innovations that enhance their performance. In conclusion, the application of microfluidic technology, as demonstrated through the use of advanced simulation tool like ANSYS FLUENT, showcases the potential for significant advancements in various scientific fields. This study not only highlights the advantages of this technology but also sets the stage for future innovations of microfluidic devices. This study's insights into the relationship between rib shapes and droplet generation are important contributions to the design and manufacture of next-generation microfluidic devices.

ID_143: Statistical-based Feature Selection for Stroke Prediction: Performance Analysis of Multiple Classifiers

Yen Khanh Nguyen[1,2*], Dan Lin Lieu[1,2], Duyen Thuy Pham[1,2], Truc Thi Thanh Nguyen[1,2], and Khai Quoc Le[1,2]

[1]Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: yen.nguyenkhanh@hcmut.edu.vn*

Abstract

Stroke is known to be a global burden. This medical condition was a worldwide leading cause of disability in 2022. As stroke is a fatal condition, it is necessary to develop techniques for early prediction. Recently, machine learning has been extensively applied in medicine and healthcare. With powerful predictive models, machine learning is a suitable choice for developing a stroke prediction model. This study focuses on comparing various classifiers employed for predicting strokes. Initially, the research involves a literature review of existing papers pertaining to stroke prediction, examining various scholarly papers to gather insights into stroke's risk factors. A publicly available dataset of 5110 participants is used as the training and testing data. From the original ten features, by employing statistical computations and evaluations, key features are identified and served as inputs for the predictive models. Following the features selection phase, several machine learning models are deployed to forecast the likelihood of strokes. The F1 score is used to evaluate each model's performance. The classifier demonstrating the highest F1 score is considered the most efficient model. This research aims to not only ascertain the most effective classifier for stroke prediction but also to pinpoint the critical features that play crucial roles in enhancing the predictive accuracy of the models employed. In conclusion, our paper provides a comparative view of the performances of different classifiers instroke predictions and determines which model can further be implemented. The results generated by the applied models can be used to suggest whether an individual has a high chance of experiencing stroke and whether one should make changes in their lifestyle to lower the risk. However, in order for the predictions to become practical, the employed model should be able to make its estimation in a specific duration of time. Further research should be done with more detailed dataset to achieve this goal.

ID_161: Data Augmentation in Seizure Detection

Nguyen Thi Minh Huong[1], Trung-Hau Nguyen[1], Quang Linh Huynh[1]

[1]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: yen.nguyenkhanh@hcmut.edu.vn*

Abstract

Seizure detection is a challenging duty for doctors because Electroencephalogram (EEG) signals are the most complicated biological waves. So, supporting doctors to interpret EEG signals is a vital role for researchers in recent years. Thanks to the rapid development of technology, machine learning facilitates seizure detection by its effective models. However, imbalanced data is still a barrier to many trials. In this work, we propose an approach to increase features of the ictal state to create a large ictal database. Firstly, features in many domains like time domain (TD), frequency domain (FD), time-frequency domain (TFD), and nonlinear (NL) aspect, are extracted. Then, the image-like matrix is formed and augmented in two ways, a generative adversarial network and the arrangement of features. Finally, a two-dimensional convolutional neural network is applied to detect ictal from interictal. The results of the attempt are 98,47% accuracy, 98.52 % sensitivity, and 98,25 specificity, slightly lower than our previous work, but it opens a new approach for patient-independent seizure detection.

ID_203: Prediction of punch forceutilizing bag acceleration data during boxing training

Son-Thuy Nguyen Nhu[1], An-Khang Bui[1], Minh-Triet Do Nguyen[1], Cao-Dang Le[1], Huu-Xuan Mai[1], Quang-Linh Huynh[1] and Trung-Hau Nguyen[1]

[1]Department of Biomedical Engineering, Ho Chi Minh City University of Technology, Ho Chi Minh City, Vietnam
E-mail: haunguyen85@hcmut.edu.vn

Abstract

The demand for physical fitness and mental health has led to the substantial popularity of martial arts and combat sports. Research on training tracking devices has also been increasingly interested due to the challenges of boxing, such as the risks of injuries and the need for correct training techniques. The aim of this research is to design a device to monitor boxing training to support athletes and coaches. The proposed device is integrated with an accelerometer and a gyroscope and is attached to the punching bag. The linear and angular accelerations due to the punches are measured by the device and are sent to a computer for further analysis. Another circuitry is designed with a load cell to measure the true punching force. An artificial neural network (ANN) model is developed to learn the true punching force from the punch-induced bag accelerations. As a result, a high correlation of 0.99 of the punching force between the true and the predicted values indicates the feasibility of the proposed device for estimating the punching force based on the punching bag accelerations. Furthermore, a multi-function user interface is designed to allow athletes and coaches to monitor and assess their training activities both in real-time and in history.

SESSION 3: COMPUTATIONAL PHYSICS

ID_38: Glassy state of the flat 2D monatomic system with pentagonal structure

Nga Nguyen[1]

[1]Vietnam National University Ho Chi Minh City
E-mail: jacqueline.nga.nguyen@gmail.com

Abstract

Formation of a glassy state of two-dimensional (2D) simple monatomic system with a pentagonal structure is studied by cooling from the melt via molecular dynamics (MD) simulations. We use the so-called Lennard-Jones-Gauss (LJG) interatomic potential proposed by M. Angel and H.R. Trebin (M. Engel, H.R. Trebin, Phys. Rev. Lett. 98 (2007) 225505) with the pentagonal structure forming ability. We find that although a relatively low cooling rate is used, crystallization does not occur in the system. Instead, glass-like phase transition occurs in the system while temperature dependence of total energy per atom in the system is rather smooth (i.e. glassy-like transition) and fivefold rings dominate in the system during the whole cooling process. At around the glass transition temperature fraction of pentagons steeply increases toward the stable high value of solid glassy state. Moreover, diffraction pattern of the final state at low temperature exhibits a glassy-like behavior of the atomic configuration which contains diffusive rings. Glass formation is analyzed based on the occurrence/growth of solid-like atoms.

ID_61: Arc flash analysis using ETAP platform

Nam Nguyen Nhat[1*], **Trieu Nguyen Ngoc**[1,2]

[1] Power Systems Department, Faculty of Electrical & Electronics Engineering, Ho Chi Minh city University of Technology, VNU-HCM, Vietnam.
[2] Electrical Engineer, Energy and Industrial, Aurecon GDC, Ho Chi Minh City, Vietnam.
**E-mail: nnnam@hcmut.edu.vn*

Abstract

The demand for physical fitness and mental health has led to the substantial popularity of martial arts and combat sports. Research on training tracking devices has also been increasingly interested due to the challenges of boxing, such as the risks of injuries and the need for correct training techniques. The aim of this research is to design a device to monitor boxing training to support athletes and coaches. Theproposed device is integrated with an accelerometer and a gyroscope and is attached to the punching bag. The linear and angular accelerations due to the punches are measured by the device and are sent to a computer for further analysis. Another circuitry is designed with a load cell to measure the true punching force. An artificial neural network (ANN) model is developed to learn the true punching force from the punch-induced bag accelerations. As a result, a high correlation of 0.99 of the punching force between the true and the predicted values indicates the feasibility of the proposed device for estimating the punching force based on the punching bag accelerations. Furthermore, a multi-function user interface is designed to allow athletes and coaches to monitor and assess their training activities both in real-time and in history.

ID_3: Assessment of the lateral displacement of a single pile in the sloping ground based on finite element analysis program

Phuong Khanh Chau[1,2], Anh Tuan Le[1,2], Ngoc Tran Duong[3], Thanh lam Danh[4], and Tan Hung Nguyen[4*]

[1]*Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam;*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam;*
[3]*Faculty of Architectural, Civil and Environmental Engineering, Nam Can Tho University, Can Tho City, Vietnam;*
[4]*Faculty of Civil Engineering, Can Tho University of Technology, Can Tho City, Vietnam;*
**E-mail: nthung@ctuet.edu.vn*

Abstract

The current study observed the effect of embankment height, pile diameter, and pile embedment length on the lateral displacement of the reinforced concrete pile installed in the sloping ground using the finite element analysis program Plaxis 2D. While the embankment height in the study was 1.5, 3.0, and 4.5 m, the pile diameter was 0.25, 0.5, and 1.0 meters. The pile length was chosen as 10, 15, and 20 m for the analysis. Based on the results and discussions, this study figured that the embankment height affected significantly the lateral displacement of the pile. As the height of the embankment increased, the lateral displacement of the pile increased. Results of the lateral displacement of the pile in the case of difference in pile diameter were similar. It could be seen that the pile diameter did not affect the lateral displacement of the pile in the sloping ground. Finally, the study for the effect of pile embedment length showed that for the pile head, a pile with a longer embedment length resulted in a smaller lateral displacement. However, for the pile toe, piles with different embedment lengths produced similar lateral displacements. It is noted that the current study only evaluated the effect of embankment height, pile diameter, and pile length on the lateral displacement of the pile based on the finite element analysis program Plaxis 2D. Further studies on the effects of these factors based on experimental evaluation should be carried out.

ID_4: Effect of Spacing and Penetration Length of Prefabricated Vertical Drain on Consolidation Settlement of Soft Soil

Van Cong Bang Dang[1,3], Anh Tuan Le[1,3], Tan Phuc Tran[2,3], Thien Hoa Nguyen[4], Duc Huy Nguyen[5], Dang Khoa Do[5] and Tan Hung Nguyen[5,*]

[1]*Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam;*
[2]*Bach Khoa Dormitory Service Center, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam;*
[3]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam;*
[4] *Faculty of Architectural, Civil and Environmental Engineering, Nam Can Tho University, Can Tho City, Vietnam;*
[5] *Faculty of Civil Engineering, Can Tho University of Technology, Can Tho City, Vietnam;*
**E-mail: nthung@ctuet.edu.vn*

Abstract

Surcharge load with prefabricated vertical drain (PVD) is a special soft soil improvement technique. The utilization of this technique leads the soft soil to reach the ultimate consolidation settlement effectively since it can save the time and cost for embankment construction. The effectiveness of using surcharge load with PVD to enhance the ultimate consolidation settlement of the soft soil is strongly dependent on the soil properties, surcharge load, the configuration of PVD such as spacing and penetration length. The current study investigates the effect of PVD spacing and penetration length on the consolidation settlement of the improved soft soil via finite element analysis program, Plaxis 2D 2017. The results showed that the soft soil with PVD different spacings as 1.0 m, 1.5 m and 2.0 m produced similar results for the ultimate consolidation settlement and the excess pore water pressure. In addition, this study also figured that PVD penetration lengths seemed to not affect remarkably the consolidation process of the improved soft soil when the PVD penetration length was 50%, 75% and 100%. It is noted that the results of the current study were based on a finite element analysis program. In the future, further laboratory and field tests should be carried out to better understand the consolidation settlement of the soft soil that subjected to surcharge load and improved by PVD as the vertical drains.

ID_205: Electronic properties of graphene/boron nitride heterostructures

Nguyen Luu Thanh Ngan[1,2], and Do Ngoc Son[1,2*]

[1]*Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet, District 10, Ho Chi Minh City, Vietnam.*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Ho Chi Minh City, Vietnam.*
**E-mail: dnson@hcmut.edu.vn*

Abstract

Nanomaterials have attracted much attention in semiconductors due to their small size, large surface area, and quantum effects. However, there are many challenges in developing optoelectronic devices based on semiconductors and other materials, including issues with integration, performance limitations, and scalability. The advent of simple yet revolutionary experimental techniques that facilitate the combination of graphene with other atomically thin van der Waals (vdW) crystals, consequently creating heterostructures, has marked a significant milestone in the dynamic and ever-evolving 6ield of material science. These so-called vdW heterostructures, especially those that ingeniously combine the unique properties of graphene [1] with hexagonal boron nitride (h-BN) [2], have not only unlocked previously inaccessible realms of physics [3] but have also introduced an array of novel and exciting properties [4] that have proven to be of immense value in the manufacturing of devices [5]. The study of graphene and h-BN heterostructures using density functional theory has been a topic of significant interest in recent years. Graphene, a single atomic layer of carbon atoms arranged in a two-dimensional honeycomb lattice, is known for its remarkable electrical conductivity and mechanical strength. On the other hand, h-BN, often called "white graphene", is an insulator with a similar honeycomb structure. The combination of these two materials into a heterostructure - a system composed of layers of two or more materials - has the potential to exhibit unique properties that differ significantly from their individual components [6]. Previous research, particularly focusing on monolayer graphene [7] and bilayer graphene [8], has revealed that the intentional introduction of impurities into an intrinsic semiconductor can modify its electrical, optical, and structural properties in a controlled manner, opening a plethora of possibilities. However, despite the comprehensive research conducted on graphene and h-BN individually, there remains a significant gap in the scientific literature. This gap pertains to the lack of comprehensive research that thoroughly investigates the impact of doping on the properties of these heterostructures. This area, despite its potential implications for the field and its potential to revolutionize our understanding, remains largely unexplored. Therefore, we wil address this issue. In this conference, we will report: (1) a review of the literature about graphene, h-BN, and their 2D hybrids, including their structural, and physical properties. (2) our results on the properties of graphene and h-BN heterostructures using 6irst-principles calculations. (3) the systems' structural stability and electronic properties, providing insights that could pave the way for new applications in electronics and photonics, contributing to the growing body of knowledge in this area and potential future technological applications.

ID_207: Research on the ability to generate electric current of the H/Pd(100) system in a fuel cell

Pham Cong Thai[1,2], Tran Thi Thu Hanh[1,2*]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam.*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam.*
**E-mail: thuhanhsp@hcmut.edu.vn*

Abstract

In the search of emerging sustainable energy, hydrogen fuel cells are one of the most effective solutions for producing electricity. To investigate the electric current intensity generated in the fuel cell, the adsorption of hydrogen on the Pd(100) surface is simulated based on density functional theory (DFT) with a vacuum environment. In this work, we study the convergence of the initial k-point selection for the palladium (Pd) system both in the presence and absence of hydrogen atoms. The chemical bond stability states in the model are specifically examined through the hydrogen adsorption sites. By the simulation results of the hydrogen adsorption on Pd slab, we show that the endothermic reaction of hydrogen atoms onto the top site of the Pd surface is the primary factor contributing to its designation as the least favourable site in comparison to the hollow site and bridge site.

ID_106: Electromechanical properties of WS2 monolayer calculated via ab-initio principles

Dinh The Hung[1], Nguyen Hoang Linh[2], Tran The Quang[3], Do Van Truong[2]

[1]Phenikaa Group
[2]Hanoi University of Science and Technology
[3]Thai Binh University
**E-mail: hung.dinhthe@phenikaa-uni.edu.vn*

Abstract

In this study, we investigate the electromechanical properties of the WS2 monolayer using ab-initio calculations. Firstly, we confirmed the stability of the WS2 monolayer structure through dynamic stability analysis using phonon dispersion spectra and static stability criteria based on elastic constants. Our findings show that the WS2 monolayer has fracture strains up to 20% under the uniaxial strain along the x-axis and 26% along the y-axis, respectively. The critical stresses corresponding to these strain values are 11.64 N/m and 16.53 N/m, respectively. Specifically, as the charge varies from -0.04 to 0.04 e/atom, there is a decrease in the failure strain along the x-axis, from 22% at equilibrium to 20%. At equilibrium, the WS2 monolayer is identified as an indirect semiconductor with an energy band gap of 1.82 eV. Despite the presence of charge doping, the WS2 monolayer retains its indirect semiconductor properties at various charge-doped states. However, at a charge-doped value of 0.04 e/atom, the energy band gap of the WS2 monolayer decreased by 16.34%, resulting in a value of 1.52 eV. Our results are highly beneficial for research on the WS2 monolayer in practice applications, as well as for understanding mechanisms to control its electromechanical properties in other fields.

ID_24: Tuning the Energy Band Structure and Effective Mass of PdS2 Monolayer by In-plane Strain

Tran The Quang[1]

[1]Thai Binh University
**E-mail: tranthequang12@gmail.com*

Abstract

In this study, we have explored mechanical and electronic properties, as well as the effective mass, of the PdS2 monolayer material by Density Functional Theory (DFT). To confirm the high stability of the PdS2 monolayer, we performed two tests with phonon dispersions and elastic constants. Besides, the obtained results indicate that the PdS2 monolayer exhibits substantial durability, with an ultimate stress of up to 6.54 N/m and an isotropic failure strain (ε_{iso}) of 0.14. At equilibrium state, the PdS2 monolayer is identified as an indirect semiconductor with an energy bandgap of 1.24 eV. Under the influence of iso strain, significant changes are observed in the energy band structure, with the energy bandgap decreasing progressively as the strain increases. These alterations in the energy band structure also positively affect the effective mass of charge carriers, enhancing their mobility within an electric field. Consequently, these findings suggest that the PdS2 monolayer is a promising candidate for future applications in electronics and optoelectronics.

ID_26: Ab-initio calculations on mechanical, optoelectronics and piezoelectric properties of buckled honeycomb SnTe monolayer

Tran The Quang[1], Nguyen Hoang Linh[2], Do Van Truong[2], Dinh The Hung[3]

[1]*Thai Binh University*
[2]*Hanoi University of Science and Technology*
[3]*Phenikaa Group*
**E-mail: tranthequang12@gmail.com*

Abstract

In this paper, we investigate the mechanical, optoelectronics, and piezoelectric properties of a buckled honeycomb monolayer using ab-initio principles. Our study reveals several remarkable characteristics of the SnTe monolayer. Firstly, we confirm the stability of the SnTe monolayer through phonon dispersion analysis and the evaluation of elastic constants. Our findings indicate that the SnTe monolayer exhibits flexible mechanical properties with low elastic constants, indicating its durability under strain with the maximum facture strain up to 20%. We then explore the optoelectronic properties of the SnTe monolayer, discovering that it is a promising candidate for advanced devices due to its excellent absorption coefficients. Additionally, we observe surprising piezoelectric effects in this monolayer. The fitting process results reveal that the SnTe monolayer possesses high in-plane piezoelectric coefficients, with d11 ~ 11 pm/V. Our calculations provide a deeper understanding of the characteristics and mechanisms underlying the performance of this two-dimensional material, contributing valuable insights for future applications.

SESSION 4A: ENGINEERING MECHANICS

ID_73: Reflection on sustainability in civil engineering investigation of the potential of numerical topology optimization

Daniela Masarczyk[1], Valentin Z¨opf[2], Tizian Arold[3], Detlef Kuhl[1]

[1]*Chair of Mechanics and Dynamics, University of Kassel, Germany*
[2]*Independent Researcher, Kassel, Germany*
[3]*Institute of Materials Engineering, University of Kassel, Germany*

Abstract

The transformation of the building sector towards sustainability is one of the key engineering challenges of this century. Bridge design is a typical task in civil engineering, the high material usage in combination with the considerable construction effort makes their longevity a strongly desirable property. A mechanically efficient design contributes to optimum load distribution within the structure. Numerical topology optimization is a valuable tool that can be applied for form finding of load-appropriate structural layouts within a predefined design-space. This study takes the design of a mechanically efficient bridge into focus, that can be manufactured on a model scale using the resource-saving methods from additive manufacturing (am). The considerations on mechanical optimality, that are included in the layout of the bridge and its components, are presented to demonstrate a perspective for sustainable design in civil engineering.

ID_12: Studying the Large Span Multi-Cell Steel Box Girder An Engineering Mechanics Look

Tham Hong Duong[1*]

[1]*Faculty of Civil Engineering, Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam*
**E-mail: tham.dh@ou.edu.vn*

Abstract

Thin-walled closed steel structures are now applied widely in urban regions, especially in metropolitan or megacities. Several large span overheads, fly-overs, overpasses, and city sky bridges are built; some are horizontally curved structures for aesthetic, economic, and effective purposes. The working conditions for such structures require careful analysis, not only in the structural analysis but in the science of materials with different levels of knowledge. Stress-strain relationships in static and dynamic aspects, relating to stiffness, local and overall buckling, etc., are primary issues in engineering mechanics. Firstly, it is necessary to review the response of the thin-walled structures subjected to torsion, including equations of internal forces and moments, both flexural and torsional moments for horizontally curved structures. Secondly, it focuses on studying the behavior of the thin-walled structures subjected to flexion and torsion. Finally, some in-depth investigations about warping effects are tentatively conducted. Some comparisons between the analytical and numerical solutions are made, and some suggestions are recommended to engineers and practitioners in real construction works to understand better this special structure and unusual secondary effect _ 'warping'. The article will only focus on the superstructures in the hope of clarifying the working conditions and responses of the HCB in a general look at engineering mechanics; any analysis of the infrastructure is limited.

ID_10: The use of PINN in analyzing two-dimensional elastoplastic problems

Hoai Linh Le Nguyen[1,2], Nha Thanh Nguyen[1,2*]

[1]*Department of Engineering Mechanics, Faculty of Applied Sciences (FAS), Ho Chi Minh University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City (VNU-HCM), Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*
**E-mail: nhanguyen@hcmut.edu.vn*

Abstract

By utilizing characteristics of neural networks, the Physics-Informed Neural Network (PINN) is truly an innovative method in dealing with differential equations. Despite being proposed and developed recently, it still brings an outstanding way to deal with traditional mechanics problems. Regarding PINN as a differential equation solver, the governing equation of a mechanics system can be directly handled using deep learning techniques. As a variation of PINN, the deep energy method (DEM) exhibits some superior properties compared to the traditional PINN, such as the requirement in the order of the derivative field for calculation is less, the implementation is easier, and the convergence rate is higher, etc. In order to examine the applicability of DEM in nonlinear systems, this study applies the DEM model to deal with elastoplastic problems, which possess material-kind nonlinearity. Through the study, problems with the assumption of a bilinear material model are handled and analyzed. The results are validated by the reference results obtained from previous studies. The findings show that DEM is extremely effective in solving nonlinear systems. Also, in comparison to other traditional approaches such as the Finite Element Method (FEM), meshless, etc., PINN is indeed a promising approach in the next stage of research in the computational mechanics field.

ID_11: Static and free vibration analyses for Timoshenko microbeam problems using finite element method

Duy Thien Hoang Nguyen[1,2] and Nha Thanh Nguyen[1,2*]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*
**E-mail: nhanguyen@hcmut.edu.vn*

Abstract

The study aims to introduce a beam finite element for analyzing the static and dynamic behavior of micro beams, with a specific focus on sizedependent effects. The proposed model is based on the Modified Couple Stress Theory (MCST) and follows a Timoshenko beam formulation. The key aspect of the new element is its ability to account for size effects by incorporating a length scale parameter in the element matrices. When the parameter is set to zero, the element reduces to the classical Timoshenko beam element. To validate the accuracy of the model, static and free vibration analyses are conducted under various cases of boundary condition. The comparison demonstrates the good agreement between newly developed element beam in this study and reference literatures, confirming the reliability of the proposed model. Simultaneously, a case study is presented, focusing on a micro-structure composed of interconnected micro-beams, emphasizing the significance of considering size-dependent behavior in the design and analysis of micro-scale structures. Additionally, the MATLAB algorithm programmed in this paper simplifies the ability to cyclically compute the matrices or four types of beam element: Classical Euler-Bernoulli, micro Euler-Bernoulli, classical Timoshenko, and micro Timoshenko beam, by incorporating theoretical conversion parameter. As a result, the relationships between these beam types are clarified and applied flexibly in beam analysis.

ID_54: Modal Analysis of Laminated Composite Curved Shell Structures with Different Geometries by Using A Meshfree Method

Vay Siu Lo[1,2], Nha Thanh Nguyen[1,2], Andrzej Katunin[3] and Thien Tich Truong[1,2*]

[1]Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
[3]Department of Fundamentals of Machinery Design, Faculty of Mechanical Engineering, Silesian University of Technology, Konarskiego 18A, 44-100 Gliwice, Poland
**E-mail: tttruong@hcmut.edu.vn*

Abstract

This paper investigates the free vibration of curved shell structures composed of laminated composites with various geometries and boundary conditions using a meshfree method. The study employs the radial point interpolation method (RPIM) for its meshfree approach. The RPIM shape function, chosen for its Kronecker delta property, enables the direct imposition of essential boundary conditions. Both the field variables and the geometry of the curved shell are interpolated through the RPIM shape function. The formulation of the curved shell is based on the first-order shear deformation theory (FSDT), which incorporates transverse shear strain effects. A convected coordinate system, tied to the curved surface, is utilized to map an arbitrary curved shell from 3D space into 2D space for computational purposes. Numerical solutions are initially obtained in this convected coordinate system and then mapped back to the global coordinate system. Numerous numerical examples demonstrate the accuracy and capability of the meshfree method, with the natural frequencies of laminated curved shells of different geometries and boundary conditions showing good agreement with reference solutions.

ID_44: A comprehensive evaluation of various mean-free-path forms in hypersonic rarefied gas flows

Vinh Huu Quach[1,3*], Tram T. H. Tran[2,3] and Nha Thanh Nguyen[1,3]

[1]Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[3]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: qhvinh.sdh232@hcmut.edu.vn*

Abstract

Simulations of the hypersonic rarefied gas flows are important when designing high-speed vehicles such as re-entry vehicles. Computational Fluid Dynamics (CFD) and Direct Simulation Monte Carlo (DSMC) are two typical approaches to simulate these flows. The latter has a higher computational cost than the CFD, which solves the Navier Stokes-Fourier (NSF) equations. Appropriately treating the slip and jump conditions is critical for comparing the DSMC data and the CFD results. The accuracy of the NSF simulations is typically determined by the slip and jump boundary conditions used to predict the surface properties, such as the slip velocity and the surface gas temperature. The mean free path of gas molecules is vital in the slip-and-jump boundary conditions to generate precise simulation results. The current work comprehensively evaluates two forms of the mean free path, the Hard-Sphere (HS) and Variable-Hard-Sphere (VHS), to determine the appropriate one for use in hypersonic rarefied gas flow simulations to predict the surface properties. The basic aerodynamic configurations, such as the sharp leading edge flat plate, wedge, and cylinder in cross flow, are adopted to validate two mean free path forms. The Mach numbers of the cases range from 6 to 10, and argon and nitrogen are the working gases. The simulation results show that the VHS mean free path form gives better results than the HS one compared to the DSMC data.

ID_103: Utilizing computational fluid dynamics (CFD) for simulating airflow and heat distribution to enhance thermal comfort in enclosed space

Kha Vy Vu Hoang[1,2], Thai Quoc Hoang[1,2], My Hien Nguyen Thi[3] and Nha Thanh Nguyen[1,2*]

[1]Department of Engineering Mechanics, Faculty of Applied Sciences (FAS), Ho Chi Minh University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City (VNU-HCM), Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
[3]Institute of Transport and Environment Research, Ho Chi Minh City University of Transport, 2 Vo Oanh Street, Ward 25, Binh Thanh District, Ho Chi Minh City, Vietnam
**E-mail: nhanguyen@hcmut.edu.vn*

Abstract

Computational fluid dynamics has emerged as a powerful tool in the design and analysis of heating, ventilation, and air conditioning (HVAC) systems. This study applies computational fluid dynamics to simulate airflow distribution and thermal parameters, such as temperature and velocity, in enclosed spaces to evaluate and enhance thermal comfort. Thermal comfort is assessed using two key indices: Predicted Mean Vote (PMV) and Predicted Percentage of Dissatisfaction (PPD). By integrating CFD results with parameters such as clothing value, metabolic rate, relative humidity, and Mean Radiation Temperature, the study provides an accurate calculation of PMV and PPD parameters. Furthermore, the obtained results are verified with those from the previous study and introduces a new approach focused on using computational fluid dynamics to simulate airflow and heat distribution, aiming to improve thermal comfort in enclosed spaces. Based on the obtained values, the thermal comfort of each manikin will be assessed using PMV and PPD indices, with evaluations and calculations based on the ASHRAE 55 standards. Despite some limitations, this research serves as a valuable reference for researchers, scientists, and engineers seeking to advance the application of CFD in HVAC systems. This research was conducted using the student version of ANSYS Fluent, a powerful CFD tool that enables the simulation and analysis of fluid dynamics.

ID_22: The effect of damping in evaluating cable tension based on easuring frequency

An Huynh-Thai[1,2], Toan Pham-Bao[1,2*] ,Luan Vuong-Cong[1,2], Hung NguyenQuoc[1,2]

[1]Laboratory of Applied Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City 700000, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City 700000, Vietnam
**E-mail: baotoanbk@hcmut.edu.vn*

Abstract

The cable vibration regularly appears in operating structures and harms the performance and service life of the structure. Therefore, it is necessary to develop solutions to control and predict the condition of structures, especially cable structures such as cable-stayed bridges, suspension bridges, bridges with post-tensioned cables, signal towers, etc. In inspecting cable structures, estimating the tension acting on the cable based on vibration plays a significant role, owing to the damping of cables. The vibration measurement through accelerometers is more commonly used in construction buildings, because of its flexible implementation at low cost, and good accuracy while still ensuring construction safety standards, so practical formulas are proposed and improved accuracy for the problem of determining cable tension for different cable structures without considering damping. In this study, the continuous cables have been mathematically modeled to evaluate the tension of the cable considering damping.

ID_101: Dynamic response analysis of PMSM motor in the case of using conventional gear transmission and CVT transmission

Le Thanh Quang[1], Ly Vinh Dat[1], Thanh Phuc Le[1]

[1]*Ho Chi Minh City University of Technology and Education*
quanglt@hcmute.edu.vn

Abstract

This paper presents the results of an analysis and evaluation of the efficiency, advantages and disadvantages of the transmission system on electric vehicles using CVT and conventional gear transmission. The study uses the finite element method based on Ansys software to simulate the mechanical behavior of the CVT transmission system and the conventional chain-driven gear transmission system. The input is the power signal of a three-phase PMSM motor with a regenerative braking system, which is modeled using MATLAB Simulink. The finite element model is built from 3D laser scanning data of the engine of a 2009 Toyota Prius. The efficiency, advantages, and disadvantages of the two transmission designs are evaluated based on the output torque-revving-power characteristics graph of the PMSM motor.

SESSION 4B: ENGINEERING MECHANICS

ID_151: Size-dependent thermomechanical vibration of FGP microbeams using a higher-order shear deformable beam element

Ngoc Duyen Dang[1,2], Ngoc Anh T. Le[3] and Cong Ich Le[4*]

[1]*Faculty of Mechanical Engineering, Thuyloi University, 175 Tay Son, Dong Da, Hanoi, Vietnam*
[2]*Graduate University of Science and Technology, VAST, 18 Hoang Quoc Viet, Hanoi, Vietnam*
[3]*Institute of Applied Mechanics and Informatics, VAST, 291 Dien Bien Phu, Ho Chi Minh City, Vietnam*
[4]*Faculty of Mechanical Engineering, Le Quy Don Technical University, 236 Hoang Quoc Viet, Hanoi, Vietnam*
**E-mail: lecongich79@lqdtu.edu.vn*

Abstract

In this work, the size-dependent thermomechanical vibration of functionally graded porous (FGP) microbeams is investigated using a higher-order shear deformable beam element. The porosities are assumed to be symmetrically distributed in the thickness direction, while the elastic moduli are temperature dependent. Based on the higher-order shear deformation beam theory, a size dependent beam element, in which the modified couple stress theory (MCST) is employed to capture the microstructural size effect, is derived and used to construct the discretized equation of motion. The natural frequencies are predicted for FGP microbeams with various boundary conditions. Numerical investigations are presented to show the accuracy and efficiency of the derived beam element. The influence of the material length scale parameter, the porosity coefficient as well as the boundary conditions on the frequencies of the FMG microbeams. The effects of the temperature rise on the vibration of the FGP microbeams are also examined and highlighted.

ID_152: Nonlinear bending of FGP beams and frames based on a third-order shear deformation theory

Vu Nam Pham[1] and Cong Ich Le[2*]

[1]*Faculty of Mechanical Engineering, Thuyloi University, 175 Tay Son, Dong Da, Hanoi, Vietnam*
[2]*Faculty of Mechanical Engineering, Le Quy Don Technical University, 236 Hoang Quoc Viet, Bac Tu Liem, Hanoi, Vietnam*
**E-mail: lecongich79@lqdtu.edu.vn*

Abstract

Nonlinear bending analysis of functionally graded porous (FGP) beams and frames under mechanical loading is presented in the framework of a thirdorder shear deformation theory. The beams and frames consist of two isotropic faces on the top and bottom layers and a porous core in the middle layer with symmetric distributions of porosities in the thickness direction. Based on the von Ka rma n nonlinear relationship, a nonlinear beam element formulation is derived and employed to establish the nonlinear equilibrium equation. Different from the existed third-order shear deformation elements, the present element is derived by using the transverse shear rotation, not the sectional rotation, as an independent variable. Explicit expressions for the internal force vector and tangent stiffness matrix are given. The nonlinear response of various FGP beams and frames to mechanical loading is predicted using the Newton–Raphson iterative method, and effects of the porosities on the nonlinear behavior are examined. Numerical results show that the proposed beam element is efficient, and it is capable of furnishing accurate results with just several elements. The effects of the porosity coefficient on the nonlinear behavior of the FGP beams and frames are studied in detail and highlighted.

ID_108: Numerical Analysis of Steel-Concrete Composite Slabs with Screw Stiffeners

Khang Thanh Huong[1], Linh Van Hong Bui[2,3], Phuoc Trong Nguyen[4*]

[1]*Ph.D Student, Faculty of Civil Engineering, Ho Chi Minh City Open University, 97 Vo Van Tan Street, Vo Thi Sau Ward, District 3, Ho Chi Minh City, Vietnam*
[2]*Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[3]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam*
[4]*Faculty of Civil Engineering, Ho Chi Minh City Open University, 97 Vo Van Tan Street, Vo Thi Sau Ward, District 3, Ho Chi Minh City, Vietnam*
**E-mail: phuoc.nguyen@ou.edu.vn*

Abstract

This paper numerically analyzes the behavior of steel-concrete composite slabs reinforced with screw stiffeners. These slabs are modeled as simply supported one-way slabs subjected to a concentrated load, with screws distributed according to predefined conditions, using the finite element method (FEM). The FEM models are implemented using ANSYS LS-DYNA software, employing constant stress hexahedron SOLID, BEAM, and SHELL elements to simulate concrete, screws, and steel decking, respectively. The results obtained from the numerical simulation of the composite slabs include bending moment, displacement, strain in steel decking and concrete, and failure mode. The results are compared with experimental data to demonstrate the accuracy and reliability of the proposed numerical approach. The comparison indicates that the numerical FEM models could reliably predict the structural behavior of steel-concrete composite slabs Additionally, through an extended parametric investigation, the use of screw stiffeners in the composite slabs enhances load-carrying capacity and prevents adverse failure modes. This finding highlights the practical benefits of the shear anchoring technique using screws.

ID_137: Research on the effect of micro-voids distribution on dynamic crack behavior by extended consecutive-interpolation finite element method

Kim Bang Tran[1,2] and Tich Thien Truong[1,2]

[1]*Department of Engineering Mechanics, Faculty of Applied Sciences, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Viet Nam National University, Ho Chi Minh City, Vietnam*
**E-mail: tkbang@hcmut.edu.vn*

Abstract

For structures containing cracks, the distribution of micro-voids around the crack will affect the stress field adjacent to the crack tip and the crack growth prediction. The problem becomes more complicated if the structure is subjected to dynamic loads. Then, the stress intensity factor will vary over time and the distribution of micro-voids will affect the dynamic behavior of the crack tip. So analyzing the effect of micro-voids distribution on dynamic crack behavior is necessary. During the simulation process, the mesh in areas where micro-voids distributed around the crack will be very complicated and affects the stress field and dynamic stress intensity factor results. The extended consecutive interpolation finite element method (XCFEM) is an efficient numerical method to solve this problem. The complexity of the meshing process will be significantly reduced when in XCFEM, the enrichment idea of extended finite element method is used, and the stress 6ield results will be improved due to the approximation shape functions constructed based on the consecutive interpolation procedure involve both nodal values and averaged nodal gradients as interpolation conditions. Therefore, analyzing the effects of micro-voids distribution on the dynamic crack behavior will become more convenient due to the simpler mesh and the improvement of the dynamic stress intensity factor results. In this article, the XCFEM with Matlab programming language will be used to study the effect of micro-void distribution on dynamic crack behavior. The results obtained from XCFEM will be compared with the published results from prestigious international scientific articles.

ID_121: Analysis of Behavior of the Soil-Pile System on the Seabed According to API RP 2A Standard by Finite Element Coding in MATLAB

Toan Nguyen[1], Song-Thanh-Thao Nguyen[2]

[1]*Ho Chi Minh City University of Technology*
[2]*Vietnam National University Ho Chi Minh City*
**E-mail: ntt160402@gmail.com*

Abstract

Piles are essential for supporting large structures across various fields, making analysis of their behavior important. Traditionally, this analysis employs three main methodologies: the Winkler foundation models, the elastic continuum methods, and the numerical methods. Each method has advantages but also limitations, especially regarding non-linear soil behavior and computational costs. To achieve a realistic representation of the soil properties in the soil-pile interaction model, this study incorporated non-linear soil behavior by springs having the non-linear stiffness defined by the American Petroleum Institute's API RP 2A, which has been used widely in the design of offshore fixed steel structures. Depend on the soil layers properties and pile geometry, the load-displacement characteristics curves t-z, Q-z, and p-y, which express the nonlinearity of soil and how the soil supports loads along the pile, were defined. These curves, adhering to API guidelines, allow to compute soil stiffness. A finite element model for a 3D soil-pile system using beam elements for pile and non-linear springs for soil was developed by coding in MATLAB to investigate the behavior of piles subjected to axial and lateral loads in marine environments. The various closed-end pile geometries and loading scenarios were explored, providing valuable insights into soil-pile interactions and provide a valuable reference for developing jacket models. The results in pile displacement of the study found good agreement with established commercial software, confirming the model's reliability and accuracy. Regarding the effect of lateral load on the pile's behavior, it was observed that the upper sections are most susceptible to movement, likely due to the soil characteristics at shallower depths. Additionally, the study examined the consequences of subjecting the pile to an axial load surpassing the limit in specific soil layers. In such cases, the soil's capacity to resist additional load without significant displacement was exceeded, leading to increased pile movement. The study provided engineering insights where pile geometry could be optimized to balance material use with structural resilience and safety under loading conditions. These results enhanced the understanding of axial and lateral pile behaviors, contributing to the improved design and installation of pile foundations in offshore environments.

ID_104: Analysis and simulation of microwave radiation on human skin layers model using the finite element method

Duy Khanh Dinh Hoang[1,2], Trung Nghia Tran[1,2], Thien Tich Truong[1,2] and Nha Thanh Nguyen[1,2*]

[1]*Faculty of Applied Sciences (FAS), Ho Chi Minh University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City (VNU-HCM), Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*
** E-mail: nhanguyen@hcmut.edu.vn*

Abstract

Human skin serves as the external covering of the body and is the largest organ of the integumentary system. It plays a crucial immunological role in protecting the body against pathogens and preventing excessive water loss. Other functions of the skin include insulation, temperature regulation, sensation, synthesis of vitamin D, and protection of vitamin B folate. In modern technological life, electronic devices emit infrared wavelengths, which can adversely affect skin cells with prolonged exposure. In this research, we conduct a simulation of infrared radiation on human skin, specifically through the three major layers: the epidermis, dermis, and hypodermis. The material properties of human skin are referenced from recent studies, with experiments conducted in the radiation range of 1.5-3.0 GHz. Additionally, designing a microwave cavity is an indispensable step to create the electromagnetic field environment required for the simulation. This study employs the Finite Element Method (FEM) using ANSYS High Frequency Structure Simulator (HFSS) software. The simulation analysis results demonstrate the impact of microwave radiation on human skin across different layers and its associated heat transmission. This aids in the development and evaluation of safety limits for microwave radiation frequency above 3.0 GHz. However, there is limited data on the thermal effects of radiation on thicker skin layers. This is crucial for the research team to further develop the model and obtain specific parameters to mitigate the adverse effects of microwave radiation on the human body.

ID_150: Elastic Model for Polyethylene Terephthalate Fibre Reinforcement Structures: Application in Free Vibration Analysis of FG-TPMS Shell Panels in Concrete (PET-FG-TPMS)

Thoi V. Duong[1*], Khuong D. Nguyen[1]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
**E-mail: thoiduongvan133@gmail.com*

Abstract

This paper investigates new frameworks for Polyethylene Terephthalate fiber-reinforced functionally graded triply periodic minimal surface shells (PET-FGTPMS) with concrete material. We propose one functional classification framework focused on controlling mass density, elastic modulus, and shear modulus, with an average porosity of 0.35. The study examines three plate-based TPMS structures: Primitive, Gyroid, and I Wrapped Package-graph. Free vibration analyses of the plates and shell are performed using a theoretical model with three-dimensional isogeometric analysis (3D IGA). Critical parameters like porosity coefficient, TPMS type, inclusion types, and volumes of the two material phases are thoroughly explored. Their effects on the plate response are presented for different thicknesses. The mass density framework is particularly promising for comparing different TPMS structures, with the TPMS compensating for the stiffness deficit of PET reinforcement, as assessed through fundamental vibration frequencies. Each type of TPMS has its advantages with different PET reinforcement ratios. This study aims to advance the development of concrete PET-FG-TPMS plates and shells, highlight the impact of various functional classification frameworks, and guide the design of lightweight, mechanically efficient structures.

ID_39: Bond behavior of Reinforcing Steel and Geopolymer Concrete in Structure

Phan Duc Hung[1], Thành T. Nguyễn[2], Tran Cao Thanh Ngoc[3], Anh Tuan Le[3]

[1]*Ho Chi Minh City University of Technology and Education*
[2]*Vietnam National University Ho Chi Minh City*
[3]*International University*
**E-mail: hungpd@hcmute.edu.vn*

Abstract

In addition to meeting the forecasted high demand for energy, there is considerable pressure on thermal power plants to provide energy and handle carbon dioxide (CO2) emissions. Therefore, energy issues and impacts on the environment need to be assessed and considered to ensure the reduction of CO2emissions in accordance with international commitments. The potential to utilize by-products from thermal power plants (fly ash) in the production of geopolymer concrete with similar properties to traditional cement concrete helps to limit or replace the use of cement as well as releasing a large amount of fly ash emissions. This is also the main solution to reduce environmental impacts and CO2 emissions in implementing national policies on protecting the natural environment, ensuring sustainable environmental development, and in line with the trend of minimizing the harmful effects of climate change. Sustainable building materials and circular economy have been widely used in the construction of various infrastructures around the world, aiming to utilize and recycle by-products from industries. Understanding the bond behavior between reinforcing steel and geopolymer concrete is becoming an urgent issue that needs to be studied to apply this eco-friendly concrete to structures. This paper uses a pull-out test to deal with the shear bond strength of steel-encased reinforced concrete members. This comparative test can be carried out on a series of samples through changes in concrete strength, steel diameter, and steel type (surface of steel bar: smooth and ribbed/deformed bars). In this paper, the bond strength was investigated by conducting pull-out tests on smooth and ribbed bars with a nominal diameter of 14 mm. Geopolymer concrete (GPC) has strength corresponding to ordinary Portland cement concrete (OPC) with durability levels of B20, B30, B35, and B40 was used in the experiments with the main purpose of determining the material interactions between the steel rebar and geopolymer concrete compared to traditional cement concrete.

ID_120: Dynamic analysis of plates resting on elastic foundation subjected to moving loads based on the first-order shear deformation theory

Thanh Trung Nguyen[1,2], Vay Siu Lo[1,2] and Thien Tich Truong[1,2*]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam.*
**E-mail: tttruong@hcmut.edu.vn*

Abstract

This paper investigates the dynamic behavior of plates resting on a Pasternak elastic foundation under moving loads, utilizing the first-order shear deformation theory (FSDT). FSDT simplifies the plate theory by considering only first-order shear deformation, enhancing formulation simplicity. Additionally, employing plate theory reduces computational complexity, as 2D models entail fewer degrees of freedom compared to their 3D counterparts. The Newmark direct integration method was used to solve the dynamic responses of the plate resting on an elastic foundation. Next, the finite element method with an 8-node quadrilateral element is employed for computational analysis, implemented using MATLAB. First, a comparison is made with an analytical solution to show the accuracy and reliability of the research. Numerical examples are then presented of the influence of the effects of thickness variation, foundation parameters, moving loads, velocities, and boundary conditions on the response of the plate. The results show that the method converges very fast and reliably when compared to other research findings. The results can be applied to many different engineering applications related to plates resting on elastic foundations.

ID_127: Physics informed neural network for for geometrically nonlinear analysis of truss structures

Si Do[1], Mai DucDai[1], Hau T. Mai[2]

[1]*Ho Chi Minh City University of Technology and Education*
[2]*Industrial University of Ho Chi Minh City*
**E-mail: dotiensi000@gmail.com*

Abstract

In this study, a Physis-Informed Neural Network (PINN) is presented to solve the geometrically nonlinear analysis of truss structures. Accordingly, a loss function is designed to guide the learning process based on the total potential energy. Instead of solving nonlinear equations, the structural responses are determined by minimizing the loss function. In our computational framework, the parameters including weights and biases of the network are treated as design variables. In addition, nodal unknown displacements are taken into account of output, while spatial coordinates of nodes are considered as input data. When the training phase ends, the structural behaviors are indicated by our model without using any structural analyses. Several numerical examples are investigated to evaluate the efficiency of the proposed framework. The obtained results reveal that the present approach is simple and effective for nonlinear analysis.

ID_146: The development of mortar method for the non-conforming multi-patch elastic problems in isogeometric analysis

Quynh Vo Manh[1,2], Cong Huu Hoang[2] and Khuong Duy Nguyen[1,2*]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam 2 Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*
**E-mail: ndkhuong@hcmut.edu.vn*

Abstract

Isogeometric Analysis (IGA) leverages Non-Uniform Rational B-Splines (NURBS) for complex geometries, offering an attractive alternative to traditional Finite Element Analysis (FEA). However, connecting NURBS patches in IGA often requires non-conforming interfaces. The Mortar method addresses this challenge by efficiently coupling such interfaces in solving Partial Differential Equations (PDEs). This work presents a novel development of the Mortar method tailored explicitly for non-conforming multi-patch elastic problems in IGA. We introduce a novel formulation for the coupling coefficient within the Mortar method, ensuring accurate solution transfer across nonmatching interfaces. The efficient implementation of this method in the IGA framework is also presented. The effectiveness of the proposed method is demonstrated through numerical examples, showcasing its ability to handle complex geometries with significant computational speedup compared to conforming patches. Validation is performed using established benchmark problems in linear elasticity. Finally, we discuss the advantages and limitations of the proposed Mortar method, highlighting its potential for practical engineering applications. We also identify promising avenues for future research in this area. This work contributes significantly to developing robust IGA techniques for complex engineering problems involving multi-patch domains. It provides a valuable resource for researchers and practitioners seeking efficient solutions for elastic analysis using IGA.

SESSION 4C: ENGINEERING MECHANICS

ID_123: The effect of car types on head injuries of Vietnamese pedestrians using dummy in crashes

Ly Hung Anh[1,2]

[1]Department of Aerospace Engineering, Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Viet Nam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: lyhunganh@hcmut.edu.vn*

Abstract

Simulation for crashworthiness has been widely applied recently because of its feasibility and cost-saving. Pedestrian is always the most vulnerable road user. Reducing the number of traffic accidents and also fatalities involving pedestrians is always a concern of the government in Vietnam. This research employed numerical simulation with the use of a dummy finite element model to study the head injury risk of a Vietnamese pedestrian involved in a frontal impact at center position with a variety of car types (Sedan, SUV and Pick-up). The finite element dummy model used is V-dummy which is scaled from the Hybrid III dummy model to suit Vietnamese anthropometry. Impact speeds are set 20, 30, 40, 50, 60 km/h. Impact angles are varied from 0º, 45º, and 90º. A total of forty-five simulation cases are conducted to investigate the head injury by using HIC (Head Injury Criterion). The findings show that the HIC increases with respect to velocity and varies with the impact angle. When V-dummy is struck by a car, the head will hit on windshield or bonnet of the car first (named phase of car impact) and then fly in the air later before hitting to the ground (named phase of ground impact). This research is limited to phase of car impact. The position of head impact on the car strongly depends on type of vehicle and the impact angle. When a pedestrian is hit by a car at angle 90º, the shoulder strike on the car bonnet before the head, it causes HIC in impact angle 90º lower than 0º and 45º. The HIC value will increase with the impact speed.

ID_160: A Study on the Kalman Filter Based PID Controller for Mecanum-Wheeled Mobile Robot

Thanh-Long Le[1,3*]**, Nghiem Gia Khang**[1,3]**, Vuong Dinh Thien**[2,3]

[1]Faculty of Mechanical Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2] Faculty of Electrical and Electronics Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[3] Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam
**E-mail: ltlong@hcmut.edu.vn*

Abstract

Recently, the mecanum-wheeled mobile robot (MWMR) has been widely adopted in many industries because of its enhanced mobility and the ability of the mecanum wheel (sometimes called the Swedish wheel). However, this implementation will increase the complexity of the robot, resulting in the phenomena of slip or vibration. On the other hand, the Kalman filter has remained a cornerstone in system state estimation and is an effective tool in the noise-reducing process. Therefore, this study aims to design a PID controller, which is used popularly in the industrial landscape, with the integration of the Kalman filter to reduce the noise within the operation of the robot system. This approach has rarely been explored in academic literature, to address this gap, this research will build a mechanical model and implement it into the Matlab/Simulink environment for simulation. At its core, the study aims to harness the predictive capabilities of the Kalman filter, integrating it with the PID controller to minimize MWMR errors during operation. Through this integrated methodology, the paper has proved the value of the Kalman filter when integrating with PID by comparing the results with the non-Kalman filter cases.

ID_169: Investigation on multi-corners crash-box structure subjected to axial crushing

Hung Nguyen[1], Dat Nguyen[1], Hai Tran[2,*] , and Tao Tran-van[2]

[1]*Department of Automotive Engineering, Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam.*
[2]*Department of Naval Architecture & Marine Engineering, Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam.*
**E-mail: haitran@hcmut.edu.vn*

Abstract

This paper investigated the crushing behavior of multi-corner crash-box subjected to quasi-static axial impact loading via FEM numerical simulation and experiments. The effects of the number of welded lines on the welded area and the heat-affected zone, which influence the crushing force, folding process, and energy absorption capacities of multi-corners, are studied. The numerical simulations reveal that adjusting these parameters can significantly influence the crushing behavior and energy absorption characteristics of the multi-corner crash-box. The FEM results also show that using a higher strain-rate material model increases peak and mean force when compared to a low strain-rate material model. In this work, three experiments were conducted to verify FEM model. The experimental results showed great agreement with numerical results in all models of folding collapse in symmetric modes, the crushing force, folding displacement, total energy absorption - EA, specific energy absorption-SEA and the crushing force efficiency -CFE. In conclusion, using the multi-corner crash-box can improve the crashworthiness parameters under axial crushing.

ID_170: Study on the assessment of absorbed energy of bulbous bow in ship collision

Quyen Tran-manh[1], Hai Tran[1]*, Tao Tran-van[1]

[1]*Naval Architecture & Marine Engineering Department, Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT) VNU-HCM, Ho Chi Minh City, Vietnam.*
**E-mail: haitran@hcmut.edu.vn*

Abstract

The evaluation of energy absorption characteristics of the bulbous bow structure in ship collisions or grounding accidents is a crucial research area. Predicting dynamic reactions or determining the collision energy absorption capability of the bulbous bow structure during impacts is essential in the design process. This paper investigates the collision behavior of the bulbous bow structure impacting a rigid wall using numerical simulations conducted with the commercial finite element code LS-DYNA. Namely, impact force histories on the bulbous bow structure, crushing depths/displacements, and collision energy absorption of the ship structure during impact are numerically determined under, consideration of different collision velocities, ship masses, impact angles and impact positions. The FEM results will be compared to results obtained from AASHTO. The results indicate that collision forces, deformations of the bulbous bow structure, and absorbed collision energies can be effectively predicted using current numerical simulation. The maximum collision force and energy absorption are directly influenced by the collision velocity and mass of the impacting ship. Notably, variations in collision positions (H) and impact angles (α) result in differences in collision forces and deformations at the bulbous bow structure. Therefore, careful consideration of parameters (H) and (α) is crucial to predict structural damage effectively. In addition, the pre-and post-collision motion behavior of the ship is also evaluated using a 6-degree-of-freedom (6DOF) system.

ID_198: Ride Comfort Analysis of an Electric Motorbike subjected under Random Road Profile by a Multi Body Dynamic Model

Ngoc Dai Pham[1], Huu Nhan Tran[1], Duc Tran[1], Dinh Hung Nguyen[1]

[1]Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT)– Vietnam National University Ho Chi Minh City, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
E-mail: phamngocdai@hcmut.edu.vn

Abstract

An electric motorbike is designed with full technical specifications regarding size and weight distributed on the front and rear axles of the vehicle. The wheel is connected to the vehicle body frame through a suspension system including linkage, spring, and shock absorber elements. The designed suspension system specifications play a very important role in ensuring the vehicle's ride comfort, safety and road holding ability. To ensure technical requirements, the suspension system is designed with the spring stiffness parameters and the damping coefficient of the shock absorber selected in the common value range of the vehicle's suspension system. The ride comfort greatly affects the quality of the vehicle's design and the health safety of people using the vehicle. This paper focuses on the ride comfort of an electric motorbike. The evaluation of ride comfort is analyzed by a Multi-Body Dynamic (MBD) model with 4 degrees of freedom (4DOF) subjected under the random excitation, according to ISO 8608 standard. The simulation is performed with three random types of road profile, class A, class B, class C. The velocity is in the range of from 10 ÷ 80 (km/h), at each value of velocity the Root Mean Square (RMS) index of the acceleration in the time domain is determined. The acceleration index includes to frequency weighting according to ISO 2631:1-1997 standard is used to evaluate the ride comfort. The MBD model in 3-dimensional (3D), including wheels in contact with the road surface, linkage bars and suspension systems linked to the vehicle frame through linkage joints, is employed. The obtained results show that, with the same v value, when the vehicle moves on road surface A class, the ride comfort is always smaller than road surface B class and C class. Considering the same type of road surface, as v increases, the rid comfort index increases, leading to a decrease in comfort and an increase in suspension working space requirement.

ID_172: Vibration analysis of in-line shaft generator driven from main engine

Tuan Le-Dinh[1,2*], Hai Tran[1,2]

[1]Department of Naval Architecture and Marine Engineering, Ho Chi Minh City University of Technology (HCMUT), Vietnam
[2]Viet Nam National University – Ho Chi Minh City (VNU-HCM), Ho Chi Minh City, Vietnam
**E-mail: tuan-ledinh@hcmut.edu.vn*

Abstract

In recent years, offshore service vessels have increasingly used hybrid propulsion systems with generators mounted coaxially with the main engine. These latest state-of-the-art in-line shaft generators enable ship operators and builders to benefit from efficiency, performance, and reliability. By reducing a ship's CO2 emissions, it also helps ships meet the International Maritime Organization's (IMO) EEDI (Energy Efficiency Design Index) measure targeting new ship designs and construction to ensure energy-efficient standards and EEXI (Existing Ship Energy Efficiency Index) measure addressing existing ships and promotes retrofits and optimizations. The paper presents the vibration analysis of Power Take Off generators (PTO) driven by engine-driven reduction gear. This analysis relates measurements of vibration carried out at 90% and 100% rated generator speed with unloaded generator and ship service speed under steady state operation. First, the study introduced experimental measurement on the same type of PTO generator installed on different ships with the same or different main engines. Second, based on this experimental measurement, the vibration analyses are evaluated and compared to relevant criteria and standards. The research results of the vibration analysis and the comparison with the criteria required on these in-shaft generators driven from the main engine were used as results of the quality assessment of the installation of hybrid propulsion systems for recent new building ships in Vietnam. This was verified by the results of vibration measurement, analysis and evaluation on in-line shaft generators installed on three recent new-building ships.

ID_183: Coupled Finite Element Analysis and Multivariate Adaptive Regression Splines for predicting the bearing capacity of conical footings on slopes

Gia Huy Pham[1,2], Nhat Tan Duong[1,2] and Van Qui Lai[1,2*]

[1]*Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Viet Nam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
**E-mail: lvqui@hcmut.edu.vn*

Abstract

Exploring the behavior of conical footings is a significant aspect of geotechnical engineering, particularly in supporting wind turbine towers on mountain slopes. This study employs Finite Element Analysis (FEA) within Plaxis 3D to investigate the behavior of conical footings. The Mohr-Coulomb material is assumed, and the research focuses on two pivotal parameters of soil shear strength: c (cohesion) and φ (internal friction angle). The study aims to assess the impacts of geometry parameters, consisting of the cone apex angle (α), the setback ratio (b/B), and the slope angle (β) on the failure mechanisms of conical footing. Furthermore, with the FEA dataset, Multivariate Adaptive Regression Splines (MARS) are implemented to propose a predictive formula of the UBC (ultimate bearing capacity) factor, indicating the relationship between these five input parameters and the outcome UBC. The sensitivity analysis is also conducted, revealing the contribution of each variable to the UBC of conical footings on slopes.

ID_185: An Optimal Method for Calculating Suspension Spring Stiffness Based on Roll Angle and Roll Acceleration Values

Ngoc Tram Nguyen[1], Duc Ngoc Nguyen[1], Huu Dong Pham[1], Manh Long Nguyen[2], and Tuan Anh Nguyen[1*]

[1]*Automotive Engineering Division, Thuyloi University, Hanoi, Vietnam*
[2]*Faculty of Vehicle and Energy Engineering, Phenikaa University, Hanoi, Vietnam*
**E-mail: anhngtu@tlu.edu.vn*

Abstract

The stiffness of the suspension spring plays a vital role in maintaining the vehicle's ride comfort during vibration. An optimal calculation method is proposed in this paper to find the ideal stiffness value of the suspension spring. Firstly, a half-dynamic model is established to describe the vehicle's vibration. Then, an optimal calculation method is formulated, which consists of two steps: running the loop to find the Root Mean Square (RMS) values of the vibration and determining the ideal stiffness value based on finding the minimum values of roll angle and roll acceleration. According to the study's findings, the ideal stiffness of the suspension spring is 36900 N/m, obtained in the first case. Even when the excitation amplitude increases (in the second case), the ideal stiffness value is still 36900 N/m, achieved using the proposed method. This helps to demonstrate the correctness of the optimal method established in this paper. Finally, the vehicle vibration is investigated using the optimal stiffness value above.

ID_177: Effects of Rotor Eccentricity on Interior Permanent Magnet Motor Performance in Electric Vehicles

Truc Hoang Ho[1*], Nattapon Chayopitak[2], Ruchao Pupadubsin[2], Nattawoot Depaiwaand[1], and Takushi Saito[3]

[1]*School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand*
[2]*National Electronics and Computer Technology Center, Pathum Thani 12120, Thailand*
[3]*School of Engineering, Tokyo Institute of Technology, Tokyo 152-8550, Japan*
**E-mail: 66016125@kmitl.ac.th*

Abstract

Interior Permanent Magnet (IPM) motors represent one of the most popular choices for an electric vehicle (EV) powertrain because of their high efficiency, compact size, and high controllability. However, rotor eccentricity is very problematic since it leads to the development of unbalanced magnetic forces, increases vibrations, noise emanation, and even premature failure. The followingpaper investigates how static and dynamic eccentricity can affect performance in IPM motors by using advanced approaches in simulation. The motor model is constructed within the Altair Flux framework, with simulations conducted for eccentricity levels between 0.0025 m and 0.0050 m. The simulation data is processed and synthesized in MATLAB for magnetic flux density analysis. The frequency analysis pertaining to the radial force density on the stator surface is executed utilizing discrete Fourier transform, while the unbalanced magnetic forces exerted on the rotor centre are determined by integrating the radial force density across the rotor surface. The results contribute to the understanding of how eccentricity affects the performance of IPM motors and bring some important insights into improving the motor design. Moreover, this can also support the development of a digital twin or an artificial intelligence model for fault detection and predictive maintenance.

ID_179: Dynamic Performances Analysis of an Electric Motorbike in case of Transient Excitation by Multi Body Dynamic Model

Huu Nhan Tran[1], Ngoc Dai Pham[1], Quang Lam Tran[1]

[1]*Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT)– Vietnam National University Ho Chi Minh City, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
**E-mail: thnhan@hcmut.edu.vn*

Abstract

The dynamic performances of an electric motorbike subjected under transient road profile is analyzed by a MultiBody Dynamics (MBD) 4 degrees of freedom (4DOF) model. The dynamic characteristics between suspension elements connected to the vehicle frame are determined by a MBD model. The electric motorbike specifications are selected based on the designed vehicle model, including size parameters and loading distributed in the front and rear axles of the vehicle. Suspension system parameters include the stiffness of the spring and the damping coefficient of the shock absorber, which is selected in the common value range of the vehicle's suspension system, corresponding to the natural frequency and damping ratio. The transient road profile according to the IRC 99 - 1988 standard, has the length in range of 1.5÷3.7 (m), and examined velocity range of 10÷80 (km/h). The evaluation indexes of the dynamic performances are analyzed including human body stability GAtr (%), safety working space of the suspension system GRtr (%) and the tire road holding ability GLtr (%). In which, the GAtr, GRtr, GLtr are respectively the ratios of the human vertical acceleration to the gravity acceleration, the dynamic suspension relative displacement to the suspension working deflection capacity, and the tire dynamic load to the tire static load. The obtained results show that with only one rider, the obtained GAtr was greater than 1 under excitation range of [d1 ≥ 2 (m), v>40 (km/h)], [d1 = 1.5 (m), v>13 (km/h)]. With two riders, d1 = 3.7 (m), the obtained GAtr was less than 1 in the entire examined velocity domain. Both front and rear suspension systems ensured GRftr<60% in all the investigated cases. In the front suspension system, with the same v and d1, with two riders, the GRftr was always greater compared to the one rider case. The obtained GLtr was greater than the critical value of 1 with d1 = 3.7 m, v>36 (km/h). The lower d1, the smaller critical velocity, causing the GLtr>1 is obtained.

ID_116: Physics informed neural network for structural nonlinear analysis

Si Do[1], Mai Duc Dai[1], Hau T. Mai[2]

[1]Ho Chi Minh City University of Technology and Education
[2]Industrial University of Ho Chi Minh City
**E-mail: dotiensi000@gmail.com*

Abstract

The dynamic performances of an electric motorbike subjected under transient road profile is analyzed by a MultiBody Dynamics (MBD) 4 degrees of freedom (4DOF) model. The dynamic characteristics between suspension elements connected to the vehicle frame are determined by a MBD model. The electric motorbike specifications are selected based on the designed vehicle model, including size parameters and loading distributed in the front and rear axles of the vehicle. Suspension system parameters include the stiffness of the spring and the damping coefficient of the shock absorber, which is selected in the common value range of the vehicle's suspension system, corresponding to the natural frequency and damping ratio. The transient road profile according to the IRC 99 - 1988 standard, has the length in range of 1.5÷3.7 (m), and examined velocity range of 10÷80 (km/h). The evaluation indexes of the dynamic performances are analyzed including human body stability GAtr (%), safety working space of the suspension system GRtr (%) and the tire road holding ability GLtr (%). In which, the GAtr, GRtr, GLtr are respectively the ratios of the human vertical acceleration to the gravity acceleration, the dynamic suspension relative displacement to the suspension working deflection capacity, and the tire dynamic load to the tire static load. The obtained results show that with only one rider, the obtained GAtr was greater than 1 under excitation range of [d1 ≥ 2 (m), v>40 (km/h)], [d1 = 1.5 (m), v>13 (km/h)]. With two riders, d1 = 3.7 (m), the obtained GAtr was less than 1 in the entire examined velocity domain. Both front and rear suspension systems ensured GRftr<60% in all the investigated cases. In the front suspension system, with the same v and d1, with two riders, the GRftr was always greater compared to the one rider case. The obtained GLtr was greater than the critical value of 1 with d1 = 3.7 m, v>36 (km/h). The lower d1, the smaller critical velocity, causing the GLtr>1 is obtained.

SESSION 5A: INOVATION TECHNOLOGY

ID_193: Use of Paper- and Cardboard Based Foams Beyond the Packaging Industry

Z Kóczán[1*] and Z Pásztory[1]

[1]*Faculty of Wood Engineering and Creative Industry, University of Sopron, 4 Bajcsy Zs., Sopron, Hungary*
**E-mail: koczan.zsofia@uni-sopron.hu*

Abstract

Paper and cardboard are used as raw materials in many areas of industry, due to their favorable properties. As a renewable raw material, it is an environmentally friendly product. That is a raw material which can be included in the model of the circular economy, since it can be recycled, and at the end of its life cycle, it biodegrades. Paper and cardboard-based products are alternative raw materials in the field of architecture that contribute and promote sustainability, since the amount of waste generated in the construction industry is very significant, it is essential to use raw materials from renewable sources. In this research, foaming technology was used to investigate how the paper or cardboard waste can be reused or recycled as thermal insulation boards in the construction industry. The present study showed that the thermal conductivity of the samples was similar to that of materials currently on the market, however the density was too high. The water resistance of the samples could be increased by the application of additives or coatings. This raw material is favorable, as it is recycled the production of the insulating material does not require as much energy as if it were made from primary raw material. Also, no environmentally harmful binders were used during production. The most important result of the research is that the insulation material samples were made of recycled, natural-based material so the product also meets the requirements of the circular economy and sustainability.

ID_208: Identification of the most useful configurations and individual elements of a hybrid undergraduate engineering laboratory through a student survey

Michael D. Murphy[1*], Tom O'Mahony[2], Guilherme Carrilho da Graça[3], Padraig Herbert[4]

[1]*Department of Process, Energy and Transport Engineering, Munster Technological University, Bishopstown, Cork, Ireland*
[2]*Department of Electrical and Electronic Engineering, Munster Technological University, Bishopstown, Cork, Ireland*
[3]*Instituto Dom Luiz (IDL), Faculdade de Ciências, Universidade de Lisboa, Campo Grande, 1749–016, Lisboa, Portugal*
[4]*Department of Mechanical, Biomedical and Manufacturing Engineering, Munster Technological University, Bishopstown, Cork, Ireland*
**E-mail: michaeld.murphy@mtu.ie*

Abstract

The adoption and utilisation of remote, asynchronous and virtual laboratories (VLs) for undergraduate education has substantially increased post COVID-19. These methods can be integrated with traditional synchronous physical laboratories (PLs) to form hybrid laboratories (HLs). HLs have been compared to other laboratory environments in previous research studies. However, no study has explored, from the students' perspective, how useful different configurations and individual elements of a HL are for learning. Therefore, this study posed questions to determine the most useful individual elements and configurations of an undergraduate engineering HL. To answer these questions a research methodology was designed. A group of undergraduate engineering students (n = 21) in the Munster Technological University were surveyed to determine their perspectives on the individual elements and configurations of a HL they recently completed in energy modelling. The questionnaire employed multi-item psychometric scales that enabled quantitative analysis. The results showed that 85.7% of students preferred HLs, while 9.5% preferred VLs only and 4.8% preferred PLs only. 95.2% of students found VLs and their asynchronous operation useful, with screencasts of modelling found to be the most useful VL element.76.2% and 90.5% of students found it useful to interact with their peers and teacher in the PLs, respectively. 85.7% of students thought the VLs helped them in developing an understanding of how energy models work.

ID_8: Fabrication and Characteristics of Binderless Cellulosic Fiberboard for Building Insulated Applications

Duong Hung Anh Le[1,2*]

[1]Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Vietnam.
Email: leduonghunganh@hcmut.edu.vn

Abstract

In recent years, the advancement of bio-based products from renewable resources has proved a great potential in building and construction applications in the context of globally sustainable development. The outstanding features of building insulation materials from plants or agricultural residues are low-cost productivity, high-specific strength, and a good thermal resistant capacity. However, the primary issue of these petrochemical inorganic products is the emission of volatile compounds when recycling leading to environmental impacts and human health concerns. From this viewpoint, this study presents the fabrication process of fiberboards from sugarcane bagasse without the addition of binder or syntetic resins. The wet-forming method and drying process were employed for producing low-density fiberboards. After manufacturing, the characteristics of the morphological properties and microstructure were observed and analysed using the high-advanced techniques including SEM and FTIR to observe the main aspects influencing the performance of samples. Additionally, the potential use in buildings was also examined throughout the thermal resistant value regarding standard EN 12667:2002 and ISO 8301. According to the results, binderless cellulosic fiberboard can be a promising material for building insulation applications.

ID_40: Integrating Suspended Sludge and Fixed Film into a System to Remove Nitrogen Pollutants in Wastewater

Quang-Chi Bui[1], **Nguyen Nguyet-Minh Phan**[1], **Trung-Viet Nguyen**[2*], **Chih-Chi Yang**[1], **Ku-Fan Chen**[1], **Yung-Pin Tsai**[1*]

[1]Dept. of Civil Engineering, National Chi Nan University, 1, University Rd., Puli, Nantou 545, Taiwan
[2]Faculty of Environment, School of Engineering and Technology, Van Lang University, 69/68 Dang Thuy Tram, Ward 13, Binh Thanh District, Ho Chi Minh City, Vietnam
**E-mail: Y.P.T: yptsai@ncnu.edu.tw; T.V.N: tvtvhv763@gmail.com.*

Abstract

Currently, mankind is faced with a multitude of environmental challenges as a result of unsustainable development. The world is becoming more conscious of sustainable alternatives, particularly in developing nations. The rapid trend of urbanization in these countries has been having a major impact on the environmental situation. Implementing the vertical urban concept efficiently tackled challenges related to scarce land resources, maximized energy efficiency, and aligned development with the present circumstances. The quantity of tall structures in urban areas is growing rapidly, resulting in a progressively higher concentration. This method has successfully met urban dwellers' living and working space needs. Nevertheless, the growing population density in urban regions has resulted in the release of substantial quantities of wastewater and solid waste, leading to significant environmental strain. Currently, climate change is getting increasingly intricate as rising sea levels expedite the occurrence of saltwater intrusion, which greatly impacts water sources. Consequently, the influence of wastewater on water sources is garnering considerable attention. Hence, efficient wastewater treatment also aids in the establishment of urban sustainability. The properties of domestic wastewater differ depending on the particular human activities that produce it. Wastewater from office buildings contains a higher nitrogen concentration than wastewater from residential areas. Therefore, removing nitrogen from wastewater in office buildings with limited land resources requires a solution. The experiment employed Integrated Fixed Film Activated Sludge (IFAS) technology to remove nitrogen from domestic wastewater. The case study was conducted at the wastewater treatment plant of an office building situated in Ho Chi Minh City, Vietnam. Hydraulic retention time (HRT), alkali dosage, and Dissolved Oxygen (DO) are crucial parameters for optimal operational conditions. Furthermore, the study examined the potential influence of operational variables on eliminating nitrogen from wastewater. The research results have improved the efficiency of management of domestic wastewater treatment works in office buildings by determining the correct amount of chemicals to add, providing the necessary amount of oxygen, and optimizing hydraulic retention time. Besides, integrating two biological treatment processes in one reactor has helped save land funds and investment costs, thereby promoting sustainable urban development.

ID_52: Solution of using battery energy storage systems for power transmission congestion of Ninh Thuan – Binh Thuan power grid

Nhat Nam Nguyen[1*], Hai Hoang[1,2], Duc Quang Vu[1,2], Canh Toan Truong[1,2], Xuan Tra Thai[2] and Phan Tu Vu[1]

[1]*Power Systems Department, Faculty of Electrical & Electronics Engineering, Ho Chi Minh City University of Technology – Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
[2]*Training, Research and Development Centre, Power Engineering Consulting Joint Stock Company 2, Ho Chi Minh City, Vietnam*
**E-mail: nnnam@hcmut.edu.vn*

Abstract

Currently, in order to reduce CO2 emissions to combat climate change as committed at the COP 26-27-28 conferences, many countries around the world, including Vietnam, are strongly transitioning from traditional energies to renewable ones. The development of renewable energy (RE) sources such as wind and solar power contributes not only to supplement and diversify the electricity sources but also to enhance the national energy supply security. However, the rapid and concentrated development of RE sources in some areas causes many disadvantages in the operation of Vietnam power system. Especially, this overdevelopment puts more pressures on the weak interconnected transmission infrastructure of the system. As a result, many RE power plants are forced to reduce their outputs, and hence they cannot feed the full capacity into the power grid. Ninh Thuan - Binh Thuan is a particularly notable area where the local electricity demand is very low while many RE sources have been putting into operation in recent years. As the power system in this region is expected to develop with a high proportion of RE in the future, the negative impact of RE on the transmission is inevitable. To handle this unexpected situation, this paper focuses on studying the impact of RE on the power system in Ninh Thuan – Binh Thuan region by 2025. In this research, the power flow analysis over the time is carried on to identify the overloading locations on the power grid. The solution of using battery energy storage systems (BESS) for Ninh Thuan - Binh Thuan power system is then validated on the analysis platform of ETAP 22.5. The obtained results show that the use of BESSs with reasonable powers, capacities and locations can ensure the stable, safe and reliable operation of the power grid.

ID_17: Improve the surface roughness of resin 3D printed products using RSM Method

Huu Nghi Huynh[1,2], Quoc Thi Huynh [1,2], Trong Hieu Bui[1,2*]

[1]*Faculty Of Mechanical Engineering, Ho Chi Minh City University Of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Vietnam.*
**E-mail: hieubt@hcmut.edu.vn*

Abstract

Additive Manufacturing has been widely applied in many different industries and 6ields, especially in 3D printing technology using liquid plastic materials—a technology that creates products with superior structural complexity, detail, and surface roughness. In developing countries, research into the use of desktop and open-source devices to create products that can be used in important 6ields such as industry, healthcare, and jewelry is of great interest due to advantages in equipment costs, materials, etc. However, nowadays, products created on these lines are of unsatisfactory quality for application in production. The main reason is that users do not have the optimal process parameter sets for each speci6ic application goal, and research on this issue is not receiving adequate attention. Therefore, the authors researched to analyze and learn about the in6luence of important process parameters on product surface quality, determining the optimal set of parameters suitable for the product. The study uses the Response Surface Methodology (RSM) method to design experiments. Data on the surface roughness of 32 test samples were analyzed using the ANOVA method to evaluate each process parameter's in6luence on surface roughness. Minitab version 18 software was used for optimization. The research results have identi6ied an optimal set of parameters suitable for most open-source machines using liquid plastic materials today, with a signi6icantly improved surface roughness Ra value of the test specimen.

ID_192: Design of roller feeding assembly for 3D printer using powder materials.

Trong Hieu Bui[1,3], My Le Du [2,3], Anh Khai Nguyen [1,3], Huu Nghi Huynh[1,3*]

[1]Faculty Of Mechanical Engineering, Ho Chi Minh City University Of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Faculty Of Environment And Natural Resources, Ho Chi Minh City University Of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[3]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Vietnam.
**E-mail: hhnghi@hcmut.edu.vn*

Abstract

Additive Manufacturing uses Powder bed Fushion – PBF powder material that is being used more and more widely in important industries such as manufacturing, aviation, space, et cetera. This technology can be used to create Rapid prototyping and product manufacturing, which help businesses quickly convert initiatives and ideas into actual products and effectively increase their competitiveness in today's ﬁerce battle. In Vietnam, 3D printing technology using powdered materials such as gypsum powder and metal is increasingly being researched and applied. The feeding cluster is an important part of equipment lines using this technology. The goal of the article is to design a roller feeding assembly for powder materials suitable for laboratory-scale equipment. As a result, the authors have designed a feeding cluster for Thermoplastic Polyurethane (TPU) material according to the one-tank method, studying the roller parameters affecting the powder material. From there, the designer can adjust the appropriate compression level for each different type of powder material to create better quality products.

ID_36: Exploring Difference Bi-LSTM Models In Solar Power Forecasting

Thi-Tinh-Minh LE[1,2], Truc Thi Kim Nguyen[3]

[1]Ho Chi Minh City University Of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Vietnam.
[3]The University of Da Nang
Email: le.thitinhminh@hcmut.edu.vn

Abstract

Solar energy, as a pivotal renewable resource, holds the potential to address global energy demands while mitigating the environmental impact of traditional energy sources. Accurate forecasting of solar energy output is essential for efficient power system management, ensuring grid stability, and facilitating informed decision-making in energy markets. Recent research has highlighted the integration of attention mechanisms into Long Short-Term Memory (LSTM) models, demonstrating their superior predictive capabilities in this domain. This study contributes to the field by exploring a Bi-directional LSTM (Bi-LSTM) model augmented with an attention mechanism, incorporating three time-series features for enhanced solar energy forecasting. The proposed predictive model is empirically compared to multi-variable time series models, revealing the efficiencies of the Bi-LSTM. The results are extensively evaluated on real solar power datasets

ID_41: Exploring The Efficiencies Of Bi-LSTM Model and Attention Mechanism In Solar Power Forecasting

Le Thi Tinh Minh[1], Ngo Tri Si[2], and Nguyen Thi Kim Truc[3*]

[1]Faculty of Electrical and Electronics Engineering, Ho Chi Minh University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam
[2]Faculty of Information Technology, Ho Chi Minh University of Science, VNU-HCM, Ho Chi Minh City, Vietnam
[3]Faculty of Electrical Engineering, University of Science and Technology, UD, Da Nang City, Vietnam
∗ Corresponding author: ntktruc@dut.udn.vn

Abstract

Solar energy, as a pivotal renewable resource, holds the potential to address global energy demands while mitigating the environmental impact of traditional energy sources. Accurate forecasting of solar energy output is essential for efficient power system management, ensuring grid stability, and facilitating informed decision-making in energy markets. Recent research has highlighted the integration of attention mechanisms into Long Short-Term Memory (LSTM) models, demonstrating their superior predictive capabilities in this domain. This study contributes to the field by exploring a Bidirectional LSTM (BiLSTM) model augmented with an attention mechanism (BiLSTM-Attn), incorporating three time-series features for enhanced solar energy forecasting. The proposed predictive model is empirically compared to multi-variable time series models, revealing the efficiencies of the BiLSTM-Attn. The results are extensively evaluated on real solar power datasets in Vietnam and overseas.

ID_51: Short-Term Traffic Flow Forecasting with XGBoost and Traffic Condition Classification via Gradient Boosting Machines

Duy-Anh Nguyen[1]*, Minh-Nhat Thai[1], Tat-Hien Le[1], Thanh-Nhat Luong[1] and Nguyen Duy Anh[1]**

[1] Ho Chi Minh City University of Technology (HCMUT), Viet Nam National University Ho Chi Minh City, Vietnam
**Email: ndanhcdt@hcmut.edu.vn, **duyanhnguyen@hcmut.edu.vn*

Abstract. This paper presents a short-term traffic flow prediction and traffic situation classification approach using XGBoost and Gradient Boosting Machines (GBM). The proposed methodology leverages historical traffic flow data and time-related features to accurately forecast traffic flow and classify traffic conditions. Experiments on a real-world dataset and simulations in the SUMO environment demonstrate the effectiveness of the approach. The method shows promise for enhancing intelligent transportation systems and aiding in proactive traffic management.

ID_95: Short-Term Load Forecasting for Extended Holidays with Variable Breaks: A Case Study of the Lunar New Year in Vietnam

Phuc Diem NGUYEN NGOC[1,2], Thanh Tuan HUYNH[1,2]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City
Email: nnpdiem@hcmut.edu.vn

Abstract

Short-term load forecasting (STLF) for extended holidays with varying breaks in countries utilizing the lunar calendar presents a significant challenge due to its inherent nonlinear characteristics. To address this, various methods, including expert systems, regression models, time series analysis, artificial neural networks, fuzzy logic systems, statistical algorithms, and machine learning techniques, have been proposed to enhance the accuracy of STLF. Despite these efforts, forecasting during these holidays often results in substantial deviations compared to regular days, primarily due to significant changes in societal electricity consumption patterns. In Vietnam, the annual short-term load forecasting results for the Lunar New Year typically exhibit considerable errors, representing a case that exemplifies the aforementioned challenges. This paper aims to develop a novel STLF method tailored for the Lunar New Year in Vietnam, employing a time series approach integrated with a multi-layer perceptron (MLP) neural network model and a sliding window technique to effectively capture the nonlinearities, cyclic behavior, temporal variations, and trends in electricity load data. The training dataset comprises historical electricity load data from the Lunar New Year holidays in a southern province of Vietnam.

ID_174: Building a set of assessment tools for the student outcomes of the Engineering Mechanics and Engineering Physics fields

Dang Le Cao[1,2*], Tuong Long Nguyen[1,2], Thi Nguyen Manh[3], Khai Nguyen Ngoc[1,2]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City
[3]Siemens Healthcare Vietnam Co., Ltd
Email: lecaodang@hcmut.edu.vn

Abstract

The paper focuses on methods and tools for assessing the personal and professional skill and qualities of Applied Science students with the student outcomes of the Engineering Mechanics and Engineering Physics fields. The method of measuring self-regulatory capacities using the HRV index was applied to the cohorts from K16 to K21. Learning motivation was assessed through interviews, specifically with two companies: Phuong Dong Medical Equipment Co., Ltd. and Siemens Healthcare Vietnam Co., Ltd. The research subjects were all students who had experienced isolation during the Covid period, lacked physical activity, and studied online, which could increase anaerobic activity. Family economic difficulties further exacerbated the decline in student health. Additionally, the increase in English proficiency requirements according to the program cirriculum made it even more difficult for students to complete their courses. The results may indicate some potential reasons for the decreasing on-time graduation rate of Applied Science students in later cohorts.

SESSION 5B: INNOVATION TECHNOLOGY

ID_182: Automated delineation of coconut rhinoceros beetle with a distributed surveillance system and machine vision tools

Daniel Jenkins[1], Mohsen Paryavi[1], Amy Li[2]

[1]*University of Hawai'i System*
[2]*University of Hawaii at Manoa*
Email: danielje@hawaii.edu

Abstract

An invasion of the Coconut Rhinoceros Beetle (CRB; Oryctes rhinoceros) was discovered on the island of Oahu in 2013, and in 2023 infestations became widespread on Oahu, and was reported on other Hawaiian Islands (Kauai, Maui, and Hawaii). CRB is a serious threat to cultivated, ornamental, and endemic palms across the Pacific, and there is also concern that it could be accidentally introduced to commercial palm plantations in California. We have developed an embedded surveillance system to deploy in panel traps to enable remote trap checking, saving on travel and labor expenses for regularly checking thousands of traps. Data from early deployments of the system illustrated that CRB are crepuscular, with most catches occurring within 3 hours after evening twighlight. The system was instrumental in the first adult CRB detection on the island of Hawaii, where efforts are underway for local eradication. Here we describe a web based machine vision tools to automatically process images uploaded through the cellular network to the server, to automatically illustrate locations of CRB trap catches each day.

ID_25: A system for detecting scratches on the surface of small-sized metal shafts after the grinding process using optical techniques combined with computer vision

Sy Hieu Dau[1*], Khang Le Nguyen An[1], Phuc Dang Thi[2]

[1]*Department of Applied Physics, Applied Sciences Faculty, Ho Chi Minh city University of Technology, Vietnam National University HCMC, Ho Chi Minh City, Vietnam*
[2]*Department of Computer Science, Faculty of Information Technology, Industrial University of Ho Chi Minh City, Ho Chi Minh City, Vietnam*
**E-mail: dausyhieu@hcmut.edu.vn*

Abstract

During the grinding process of metal machine parts requiring a high degree of smoothness, the use of diamond-surfaced grinding tools, specialized grinding stones, or high-hardness metals are common choices. However, during grinding, surface tool damage or misalignment between grinding surfaces can cause defects such as cracks, scratches, or complete surface destruction. Detecting small scratches is one of the biggest challenges due to their size and distribution, making it difficult to quickly identify them using the human eye. Automated systems, on the other hand, struggle to highlight scratches because automatic optical lighting systems face strong reflections from the metal surface, especially cylindrical surfaces after being polished. As a result, the images obtained lack controlled reflection positions and contrast between normal and scratched areas, leading to inefficiency in detecting these scratches. In this study, we propose an optical system combined with lighting techniques to highlight scratches on the surface of a cylindrical machine part after polishing, thereby detecting and classifying these defects to make pass-fail decisions in practical production line applications.

ID_20: Arc flash analysis during short circuit failure on the power system

Trieu Nguyen Ngoc[1,2], Nhat Nam Nguyen[1,2], Mai Ba Loc[1,2*]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City
Email nnnam@hcmut.edu.vn

Abstract

Arc flash analysis during short circuit failure on a power system is an exciting issue that has significant implications for electrical system design, management, maintenance, and operation of power systems. The thesis has introduced principles, and analytical techniques in addition to the model theory of arc blast. The results of the analysis are compared with the power system model that has undergone arc analysis and been published in IEEE. Subsequently, undertake arc flash analysis on a realistic power system model.

The thesis has established the factory's entire electrical system with voltage levels of 33kV, 11kV, and 0.4kV, following the typical operational characteristics of the factory. The short circuit study is performed for the most significant operating configurations to determine the maximum and minimum short circuit current magnitudes in the various buses of the electrical network. The protective device settings are plotted on time current curves (TCC). The incident energy level and arc flash boundary are indicated. Provide recommendations such as achieving as much grading as possible while balancing arc flash incident energy limit. A mitigation strategy has been proposed, implemented, and compared to reduce the incident energy level.

The ETAP software version 21.0.2 of Operation Technology, Inc (OTI) has been introduced which is a leading global solution for the simulation, design, analysis, and monitoring of power systems.

ID_71: Academic and Mobility Behavior Analysis for Student's Daily Stress recognition

Hoang Khang Phan[1,3], Tu Nhat Khang Nguyen[2,3] and Nhat Tan Le[1,3]

[1]Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Faculty of Computer Science and Engineering, Faculty of Computer Science and Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[3]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
E-mail: khang.phan2411@hcmut.edu.vn, lenhattan@hcmut.edu.vn

Abstract

Mental stress, a common psychological disorder, has a significantly negative influence on life quality and work performance, especially for students who are under pressure to perform well in school. It is essential to handle this psychological issue well in order to minimize negative consequences and enable timely intervention. This study uses smartphone data - a ubiquitous tool in modern life - to develop a powerful approach to remotely monitor and manage stress. In this research, statistical features based on conversation duration and stationary duration; location with regard to time-based metrics (time spent at school, at home, for dining out, etc. in the morning, noon, or whole day) derived from GPS data; mobility status with respect to time features (moving time, recreational activity time, etc. in the morning, noon, or whole day); estimation of skipped class instances by aligning class schedules with student locations; the upcoming deadlines of student; and time-based features like the cosine of the day of the week and week number in the semester extracted from the StudentLife dataset [1]. The stress detection was tested in two scenarios of two-class classifications (stress/no stress) and three-class classifications (feeling happy, a little stressed, and stressed out). In both scenarios, we tested three popular machine learning models: SVM, XGBoost, and Random Forest. The result shows that, in two-class classifications, the performance of Random Forest reached up to 79% accuracy and 63% macro F1 score and it also dominated the three-class classification by the accuracy and macro F1 score of 66% and 51% respectively. Moreover, we have also employed Shapley Additive exPlanations (SHAP) to evaluate insights from these extracted features. The results revealed that the 'week in the semester' feature is most characteristic of student stress levels. It is also worth mentioning that students who skip classes have a marginally higher likelihood of experiencing stress on that day, and a lower chance of facing stress the next day compared to their counterparts. These insights are invaluable for future research and offer practical approaches to stress detection and management.

ID_79: Aspects in vessel system offsets survey using 3-D laser scanning system

Tuan Le-Dinh[1,2*], Hai Tran[1,2]

[1] Department of Naval Architecture and Marine Engineering, Ho Chi Minh City University of Technology (HCMUT), Vietnam
[2] Viet Nam National University – Ho Chi Minh City (VNU-HCM), Ho Chi Minh City, Vietnam
**E-mail: tuan-ledinh@hcmut.edu.vn*

Abstract

Recently, the shipbuilding industry has paid more attention to laser scanning technologies due to their ability to quickly and accurately provide and evaluate 3D data. This innovative solution brings benefits as it increases the accuracy of the ship construction and associated production information. This measure is even more advantageous because it significantly shortens the survey time when establishing the positions, and installation angles of mounted equipment and systems onboard ships. The paper describes a vessel system offsets survey that needs to ensure accurate locations and alignment of sensors and equipment on a new building ship before her sea trial. These include the physical vessel offsets and angular rotational offsets of mounted equipment such as GNSS antennae, wind sensors, MGC gyro compass units, range guard sensors, scene scan sensors, etc. The paper also mentions the construction of a reference coordinate system associated with the actual survey on a new building ship, the reference plane, reference points, and offset measurement results of the mounted equipment mentioned above. The measurement results and evaluation of measurement accuracy against the design values show that the application of laser scanners is worthwhile, especially in the shipbuilding industry.

ID_191: Analysis of text-to-speech conversion techniques based on silence trimming and amplitude analysis

Ta Thi Nha Linh[1,2], Dang Nguyen Chau[1,2*]

[1]Department of Telecommunications Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam
**E-mail: chaudn@hcmut.edu.vn*

Abstract

Along with the strong development of artificial intelligence (AI), textto-speech (TTS) has also become an important and growing trend in today's digital age. Although it has existed for a long time, this field has received a lot of attention globally, and recently research on text-to-speech by applying AI or machine learning methods have become more and more popular, opening up many new opportunities in creating natural and high-quality speech from text. In this study, we focus on exploring and processing speech through parameters instead of applying new technologies such as artificial intelligence to understand more clearly the influence of parameters to convert them as audio. In this paper, we compare different cases in text to speech conversion based on silence trimming combined with amplitude median or amplitude average for each word of an input sentence. The results show that using a function to calculate the median amplitude for each word before concatenation gives the best result. We also try different speeds for each sentence to see how well the speed matched the number of words in the sentence. The results show that sentences with more words had a higher speed parameter than sentences with fewer words, specifically a speed of 1.5 for long sentences and 1.25 for short sentences.

ID_94: Which is better for Signature Forgery Detection: Contrastive or Triplet Loss?

Pham Hoang Minh Tram[1,2], Dang Nguyen Chau[1,2]

[1]*Faculty of Electrical and Electronics Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72555, Vietnam.*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, 71308, Vietnam.*
E-mail: chaudn@hcmut.edu.vn

Abstract

In recent years, the proposed methods based on Neural Networks have demonstrated significant potential which have a wonderful recognition accuracy in signature image verification. However, a weakness of these systems based on Neural Networks in general is that recognition accuracy decreases dramatically if the quantity of signatures with too few resources are taken to be database, especially, it seems unattainable with the case only having a sole signature for recognition that is called one-shot learning. In many practical applications it is a challenge to collect signatures data because of their personal security, so, researching the one-shot learning is considered as an necessary task more than ever. Siamese Neural Network is a type of Neural network architecture which is typically used in the one-shot learning approach to image recognition. The ability to learn from very little data has made Siamese networks become an optimal choice in signature verification. There are many researches that propose Siamese Neural Networks applied Contrastive or Triplet loss function which help to learn the embeddings that can capture the similarity or dissimilarity of the data points. Nevertheless, the effect on the efficiency between using Contrastive or Triplet Loss for signature recognition systems hasn't been mentioned yet. We relieve this problem by using both of them to evaluate the Siamese model performance whether Contrastive or Triplet loss leads to better results. Experimental results show that our method achieves high performance to recognize signatures which achieves impressive configures such as accuracy, precision and recall with 96.8%, 94.63%, 98.77% respectively when using Contrastive loss function and achieves 85.46%, 91.3% and 90.37% respectively when using Triplet loss function. Although Triplet's accuracy is not as high as Contrastive, testing on other datasets which have not trained before, Triplet loss leads to amazing results in predicting multilingual handwritten signatures rather than Contrastive, however.

ID_144: Influence of Powder Mixing Techniques on the Performance of TiN/420SS Composites Manufactured by Selective Laser Melting

Duc Tran[1], Huu-Nhan Tran[1], Jeng-Rong Ho[2*]

[1]*Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), Vietnam National University Ho Chi Minh City (VNUHCM), Ho Chi Minh City, Vietnam*
[2]*Department of Mechanical Engineering, Nation Central University (NCU), Tao-yuan City, Taiwan (R.O.C)*
E-mail: tranducoto@hcmut.edu.vn, jrho@ncu.edu.tw

Abstract

Selective Laser Melting (SLM) of metal matrix composites offers substantial benefits across various industries, including moulding and automotive, through the integration of Titanium Nitride (TiN) and 420 stainless steel (420SS). The incorporation of TiN ceramic particles not only enhances the hardness and strength of the 420SS matrix but also improves its corrosion resistance. Furthermore, the ability to fabricate complex shapes without the need for traditional moulds significantly reduces post-processing time, thereby accelerating the time to market. In our previous studies focused on optimizing the SLM processing parameters, the TiN content and applying different post-processing heat treatments for SLM TiN/420SS. One of the primary challenges identified is the initial powder preparation, where the differing properties of metal (420SS powders) and ceramics (TiN powders) lead to issues such as agglomeration and contamination, ultimately diminishing the quality of the SLM products. To address these issues, we explored several mixing methods for TiN/420SS composite powders and their effects on surface roughness, hardness, and tensile properties of the SLM-manufactured samples. Our findings indicate that while the rolling method results in significant agglomeration and the tumbling method leads to contamination—both adversely affecting the mechanical properties—the wet mixing method achieves a high-quality powder blend. This method ensures even distribution of TiN within the 420SS matrix, resulting in superior surface finish of 4.6 ± 0.3 μm and enhanced mechanical properties, including a hardness of 720 ± 15 HV, and a tensile strength of 1776 ± 50 MPa, in the optimal SLM samples.

ID_196: Application of drone in detecting drain cover damages on road

Nguyen Dinh Hoang[1*], **Ngo Khanh Hieu**[1,2]

[1]*Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam.*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam.*
**E-mail: hoang.nguyentoteo288@hcmut.edu.vn*

Abstract

Vietnam is a country mainly traveling by motorbike. However, on roads full of damaged drain covers, motorcyclists and cyclists often fall, especially when it rains, the road is slippery and wet, the difference between the drain cover and the road surface causes the steering wheel to turn. Especially for pedestrians, cyclists, and motorcyclists who are close to the roadside, the above damage can cause accidents and injuries. In fact, in the past time, especially during the rainy and stormy season, Ho Chi Minh City in particular and the whole country in general have recorded many tragic accidents due to the damaged condition of the drain covers. However, the current solution method is limited and takes time, effort, and money. This project was born to contribute to the innovation of that method. This topic applies unmanned aerial vehicles and YOLOv8 model to create a new dataset and train a damaged drain cover model to help supervisors apply technology to detect drain cover failures early.

SESSION 6: WAVE ENERGY – SIMMULATION AND PROTOTYPE APPROACH

ID_56: Numerical Analysis of Wells Turbine Performance with Optimized Chord Length for Enhanced Wave Energy Conversion

Kha Tuan Tran Huynh[1,2], Khoa Anh Vo[1,2], Vay Siu Lo[1,2] and Thien Tich Truong[1,2*]

[1]Department of Engineering Mechanics, Faculty of Applied Sciences, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam.
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam.
**E-mail: tttruong@hcmut.edu.vn*

Abstract

This paper investigates the enhancement of Wells turbine blades by modifying the chord length design parameter. The Wells turbine, a promising device in wave energy conversion systems, faces a limited operating range due to flow separation, which restricts its efficiency at higher flow rates. Enhancing the performance of the Wells turbine is crucial for effective wave energy exploitation. The computational simulations in this study are conducted using ANSYS Fluent. Turbine performance is evaluated based on non-dimensional torque, pressure torque, and efficiency, derived from solving the steady 3D incompressible Reynolds Averaged Navier-Stokes equations. The results are validated against reliable references, showing good agreement. The numerical findings reveal that altering the turbine chord length significantly impacts efficiency. Optimizing the chord length enhances the Wells turbine's performance in wave energy conversion, making it a more viable option for renewable energy power generation.

ID_57: Analysis of the Efficiency of Wave Energy Exploitation by Various Devices in Vietnamese Coastal Waters

Binh Ngo Khanh[1,2], Thuc Dang Tri[1,2], Vay Siu Lo[1,2], Andrew Cashman[3] and Thien Tich Truong[1,2*]

[1]Department of Engineering Mechanics, Faculty of Applied Sciences, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
[3]Department of Mechanical, Biomedical & Manufacturing Engineering, Munster Technological University, Ireland
**E-mail: tttruong@hcmut.edu.vn*

Abstract

Wave energy represents a substantial and highly promising resource for our country, with the potential for significant exploitation. While numerous previous studies have concentrated on analyzing the energy potential along our coastal regions, there remains a critical gap in the research regarding the operational efficiency of wave energy conversion devices in these areas. Addressing this gap, the present paper aims to provide a comprehensive assessment of the wave energy exploitation potential in our coastal waters through the use of two distinct types of devices: AquaBuoy and Oscillating Water Column (OWC). To achieve this, the study will employ both analytical and simulation methodologies to calculate and compare the operational efficiencies of these devices under various conditions. Additionally, by utilizing the most recent data from the Vietnam Hydrometeorological Administration (2022) alongside international reports detailing the costs associated with the construction and installation of these devices, this paper will develop a comprehensive set of Levelized Cost of Energy (LCOE) parameters. These parameters will serve as critical metrics for evaluating the economic viability and effectiveness of wave energy exploitation in our coastal regions. The insights gained from this study are expected to contribute significantly to the strategic planning and implementation of wave energy projects in our country, thereby promoting sustainable energy development.

ID_58: Analysis of Wind-Wave Impact on Open Wave Channel Systems

Hung Thai Le[1,2], Huy Hoang Truong[1,2], Vay Siu Lo[1,2], Nha Thanh Nguyen[1,2] and Thien Tich Truong[1,2*]

[1]Department of Engineering Mechanics, Faculty of Applied Sciences, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: tttruong@hcmut.edu.vn*

Abstract

The growing demand for renewable energy has driven research and development in harnessing wave energy. Oscillating Water Column (OWC) systems are a promising technology that utilizes the oscillation of water columns to generate power. his paper explores a novel wave generation method, contrasting traditional sinusoidal wave functions, by examining waves generated by wind, which cause the wave shapes to become complex rather than sinusoidal. Although the sinusoidal wave approach is widely used, it does not accurately reflect offshore conditions where waves are primarily windgenerated and exhibit complex profiles. This paper aims to analyze the impact of these complex waveforms on key parameters such as pressure and flow velocity in energy conversion devices like OWC systems. The study's findings provide insights into how wind-affected waves influence the performance of OWC systems, leading to recommendations for optimizing the design and operation of wave energy harvesting technologies. This study contributes to understanding the efficiency of turbines and significantly aids in the strategic implementation of OWC systems in Vietnamese waters.

ID_97: Hydrodynamic Analysis of Point Absorber Wave Energy Converters Using ANSYS Aqwa

Dat Thanh Ta[1,2], Quyen Ngoc Phan[1,2], Vay Siu Lo[1,2] and Thien Tich Truong[1,2*]

[1] Department of Engineering Mechanics, Faculty of Applied Sciences, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2] Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam.
**E-mail: tttruong@hcmut.edu.vn*

Abstract

This study presents an analysis of a point absorber wave energy converter (WEC) system, employing advanced numerical modeling and timedomain simulations to evaluate and optimize the device's performance. The wave energy converter consists of a single floating body coupled with a spring-mass damper system. Buoys with different drafts are analyzed to maximize the energy absorption of the wave energy converter. The numerical examples in this work were implemented using the boundary element method via the ANSYS Aqwa software. The hydrodynamic parameters analyzed in the paper include excitation force, added mass, radiation damping coefficient, response amplitude operator (RAO), and the wave energy absorption power of the buoy. From the obtained results, the hydrodynamic behavior characteristics, overall cost optimization, and power absorption of buoys with different drafts can be evaluated to ensure their energy absorption.

SESSION 7: ONLINE

ID_199: Application of infrared technique in identifying white spot lesions

Thi Hai Mien Pham [1,2*]

[1] *Ho Chi Minh city University of Technology, Ho Chi Minh City, Vietnam*
[2] *Vietnam National University in Ho Chi Minh City, Linh Trung Ward, 71308 Thu Duc City, Ho Chi Minh City, Vietnam*
**E-mail: phamhaimien@hcmut.edu.vn*

Abstract

White spot lesions are early-stage dental lesions which are difficultly identified and analysed by common diagnostic methods such as clinical examination or radiography. In contrast, in recent years, a number of research has showed that the infrared technique could be applied for identifying early – stage dental damages like white spot lesions due to the difference in optical properties between damaged and healthy tooth tissues. Sound enamel is nearly transparent under infrared light while damaged tissues appear darker. The aim of the present study was to apply the infrared technique to diagnosis of white spot lesions at early stages. In this research, the optical system with 850-nm LEDs was designed and manufactured based on scattering and transmission techniques and used for observing in vitro the tooth sample with white spot lesions. A number of 100 tooth samples were assayed with the infrared technique and traditional methods (clinical observation combined with radiography) at the same time. Then, Cohen's Kappa coefficient was figured to evaluate the agreement in diagnosis between the mentioned methods. The low Kappa coefficient (only 0.01) indicates the low consensus between clinical-radiography assessment and the infrared technique and suggests that the infrared technique is more effective than the traditional methods in detecting white spot lesions.

ID_92: Fabrication of Reusable Electrochemical Platform based on the Host-Guest Interaction

Zhi Jia Chen[1], Muhammad Aneeq u Rehman[1], Chian-Hui Lai[1*]

[1]*National Chung Hsing University*
**Email: chianhuilai@dragon.nchu.edu.tw*

Abstract

In recent years, electrochemical sensors have garnered significant attention in biosensor design due to their numerous advantages, including high sensitivity, low cost, and practicality. Currently, most biosensors are disposable; while this helps prevent sample contamination, it hinders downstream analysis. Moreover, increasing the usage of electrochemical sensors can help reduce costs, making it essential to develop reusable electrode surfaces.

In this study, our goal was to develop an electrochemical platform that is pH or oxidation responsive and can be reused, based on the host-guest interaction between β-cyclodextrin (β-CD) and our various chosen molecular like benzimidazole (BM) or ferrocene (Fc) derivatives. Due to the nonspecific interaction, we improved the electrode by testing with various anti-fouling modification, along with optimized procedures. We utilized GCEβ-CD/antifouling to investigate the host-guest interaction and found that the electrochemical signal exhibited dynamic behavior.

Our electrode exhibited various potential usage based on testing with different analytes, by focus on different analyte it can apply on diverse field from food safety to cancer cell detection.

ID_195: Study On The Critical State Of Axial Compressor In Gas Turbine Engine In Exploitation Of Dusty Invironment

Quoc Toan Tran[1], Ngoc Thanh Huynh[1]*

[1]*Faculty of Electro-Mechanic, Vietnam Naval Academy, Vietnam*
**E-mail: ngockhangminh269@gmail.com*

Abstract

Studying and evaluating the technical condition of axial compressors in gas turbine engine during operation in dusty environments is a concerned issue to experts and manufacturers as well. To accurately evaluate and standardize its parameters, based on the comparison of values collected from reality with their limited values is necessary to solve the problems of increasing service life and maintain a high level of reliability in exploitation for the engines. The research results in this article have evaluated the effects and consequences caused by erosion on compressor blades in gas turbine engine being used in the marine sector. The data are obtained from actual operations under conditions characterized by the level of dust in the air. Analysing the theoretical basis of the methods to evaluate the erosion of compressor blades with erosion models based on components such as pressure distribution, temperature and velocity for the air flow, and the movement of dust particles under the solid state in an environment with two phases of fresh air and dust, abrasion mechanism on the blade surface and disc. In-depth analysis of the corrosion process caused by dirt mixed in the air flow when impacting on the surface of compressor blade in gas turbine engine, allows us to fully and effectively study methods to protect components of the engine. The article also evaluates the results of studying the erosion of compressor blades in gas turbine engine DR76 through experiments and computation by modelling the blades in 3D model in the software application ANSYS-CFX. Accordingly, it has been analysed the erosion rules of the blades and then compared and evaluated them with the results obtained from practice. From the analysis of the changes in parameters during erosion of the compressor will show the level of reduction in compressor efficiency and power caused the losses in the gas turbine engine is close to reality.

ID_175: The Effectiveness of Inhaling Illuminated Oxygen by Firefighters After Physical Activity or During Firefighting Operations

I-Hsiang Lin[1,2] , Cheng-Chung Chang[1*]

[1]*National Chung Hsing University, Graduate Institute of Biomedical Engineering, Taichung, Taiwan.*
[2]*Show Chwan Memorial Hospital, Nursing Department, Changhua, Taiwan.*
E-mail: jenny88104@yahoo.com.tw

Abstract

Purpose: The main purpose of this study is to investigate the effectiveness of inhaling light oxygen by firefighters after exercise or firefighting duty.
Objective: Based on the above literature, the main purpose of this study is to investigate the effectiveness of inhaling light oxygen by firefighters after exercise or firefighting duty.
Method: A total of 9 participants were recruited, with 7 assigned to the experimental group and 2 to the control group. Data Collection:Firefighters who had just completed firefighting duties or physical exercise were selected.Carbon monoxide (CO) levels and lactate levels were initially measured, and vital signs were recorded.Following this initial assessment, participants inhaled illuminated oxygen for 30 minutes.After the inhalation period, CO and lactate levels were measured again, and vital signs were recorded once more.
Conclusion: The Experimental Group showed a significant decrease in CO compared to the Control Group.

ID_1: Determining areas for potential groundwater recharge in industry premises using GIS

Meghana Kashyap[1*], Vishnu Sharma Atikukke[2], Chinmaya Delampady[2], Praveen Kumar Reddy[3]

[1]*JSS Mahavidyapeetha*
[2]*Aapaavani Environmental Solutions Pvt. Ltd., Baikampady, Mangalore, 575011, India.*
[3]*Aapaavani environmental solutions*
Email: meghanakashyap.work@gmail.com

Abstract

Groundwater is a vital resource that plays a significant role in sustaining many different industries. To ensure the long term availability of this resource, it is essential to identify potential groundwater recharge points within industrial premises. This study focuses on the determination of optimal locations for groundwater recharge within industrial sites. Through a combination of geospatial analysis, hydrological modelling, and site specific assessments, potential recharge points are identified based on factors such as land use/land cover, soil type, hydrogeological conditions, along with rainfall patterns. The methodology involves integrating geographic information system (GIS) data, hydrological modelling techniques, and field investigations. By identifying suitable areas for groundwater recharge, industries can implement sustainable water management practices that enhance groundwater availability, mitigate water scarcity, and contribute to the overall environmental sustainability of industrial operations. The findings of this study provide valuable insights for decision makers and industrial stakeholders seeking to establish effective groundwater management strategies within their premises. In this study, a fruit processing/beverage industry situated in Narimogaru a village in Puttur Taluk, Dakshina Kannada District, Karnataka is the area of study within the extent, 12° 12° 45.54’N, left: 75° 75° 15.24’E and of area 63155.5 sq. km. It was determined to have 4 main classifications of land use/land cover, namely barren, buildings, greenery and paved. The soil group was identified as HSG C and possible runoff of 110.4 million litres during the wet season of the year was calculated from the daily rainfall data for the wet season of the previous year.

SESSION 8: POSTERS

ID_5: Application Of Optical Imaging Technique In Diagnosing Breast Abnormality

Quy Tan Ha[1,3], Hong Duyen Trinh Tran[1,3], Anh Tu Tran[2,3] and Trung Nghia Tran[1,3*]

[1]Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT) 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Laboratory of General Physics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT) 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[3]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: ttnghia@hcmut.edu.vn*

Abstract

Early detection of breast abnormalities is crucial for successful breast cancer treatment and improved patient survival. While various methods are currently employed for breast abnormality diagnosis, they often face limitations such as radiation safety concerns, high cost, and limited accuracy. Therefore, developing a novel approach for breast abnormality diagnosis is highly desirable. This study investigates the potential of optical imaging for breast abnormality diagnosis. An optical model was established to acquire optical images of a simulated breast phantom at 660 nm, 800 nm, and 940 nm wavelengths using a Raspberry Pi 3B+ microcontroller system and Raspberry Camera V2.1. In this study, a LED system at wavelengths of 660 nm, 800 nm and 940 nm was used as the illumination source for the optical system. To evaluate the feasibility and effectiveness of the proposed method, this study uses the simulated left breast model ASIN B08CVHWPVD. Inside the phantom, a tumor and a blocked milk duct were implanted. These lesions simulate common pathological conditions in the breast, creating favorable conditions for evaluating the ability of the proposed imaging diagnostic method to detect and classify lesions. Accordingly, LED lights are placed around the edge of the simulated breast phantom to illuminate and are placed opposite the camera to capture optical images. A limited FOV method is implemented in the optical model to enhance brightness and contrast of the optical image. Image processing and enhancement algorithms were applied to detect lesions hidden within the breast phantom. The results demonstrated the potential of optical imaging at the investigated wavelengths for detecting hidden lesions within the simulated breast phantom, particularly at 660 nm. This study highlights the promising potential of optical imaging for breast abnormality diagnosis, paving the way for further development and clinical applications. Further research and development are needed, but this study offers a glimpse into a potentially safer, more affordable, and more accurate way to detect breast cancer.

ID_63: An Analysis of Medical Cost Dataset using Unsupervised Machine Learning Techniques

Hoang Nhut Huynh[1,2*], Trung Nghia Tran[1,2]

[1]Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam
∗ E-mail: hhnhut@hcmut.edu.vn

Abstract

This study relies on a data set that includes expenses related to health purposes, including factors such as daily living habits, health indicators, gender, and geographic location that can influence health and treatment costs. In addition, unsupervised machine learning techniques such as the elbow and k-means neighbor method were deployed to categorize the parameters and pinpoint the health factors that correspond to the expenses incurred, along with a confidence interval 95% delineating a range of plausible values for each coefficient. By offering these insights, this study clarifies the interplay between the various factors that impact health and medical costs.

ID_64: Feasibility Study of Electrical Impedance Tomography for Detecting Abnormal Structures Around Boreholes

Quoc Tuan Nguyen Diep[1,2], Hoang Nhut Huynh[1,2,*], Nguyen Chau Dang[2,3], Tich Thien Truong[2,4] and Trung Nghia Tran[1,2]

[1]Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam.
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam
[3]Department of Telecommunication Engineering, Faculty of Electrical and Electronic Engineering, Ho Chi Minh City University of Technology (HCMUT), VNUHCM, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City 72409, Vietnam
[4]Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), VNUHCM, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City 72409, Vietnam
∗E-mail: hhnhut@hcmut.edu.vn

Abstract

This study conducts simulations to investigate the feasibility of inspecting and observing abnormal structures around boreholes using Electrical Impedance Tomography. An abnormal structure was placed at various positions relative to the boreholes using a simulation setup comprising a cylindrical model and boreholes. The EIT system used in this study consisted of 16 electrodes arranged around the model. Quantitative evaluation metrics such as sensitivity, specificity, and reconstruction error were employed to assess the performance. The results demonstrate that the Electrical Impedance Tomography system could detect and visualize abnormalities with a sensitivity of 92.2%, specificity of 88.7%, and an average reconstruction error of 5%. These findings highlight the potential applicability of Electrical Impedance Tomography in various engineering and medical fields to detect abnormalities near boreholes.

ID_68: Feasibility Study for Detecting Buried Landmines using Electrical Impedance Tomography

Hoang Nhut Huynh[1,2], Quoc Tuan Nguyen Diep[1,2,*], Thanh Nha Nguyen[2,3], Tich Thien Truong[2,3], Anh Tu Tran[1,2], Trung Nghia Tran[1,2]

[1]Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam
[3]Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), VNUHCM, 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City 72409, Vietnam
∗E-mail: ndqtuan.sdh231@hcmut.edu.vn

Abstract

This paper proposes a simulation to assess the feasibility of an Electrical Impedance Tomography for detecting buried landmines. An electrode matrix was configured on the surface by applying an alternating current of 10 mA at a frequency of 200 kHz to survey the soil for the presence of buried landmines, particularly those encased in plastic shells, which are typically challenging to detect using current methods. This study aims to analyze the impedance variations caused by the presence of landmines, providing detailed simulations to demonstrate the sensitivity and resolution of the system. The preliminary results indicate that Electrical Impedance Tomography can distinguish between different subsurface objects based on their impedance profiles, suggesting a promising approach for enhancing landmine detection. The potential benefits of this technique include increased safety and efficiency in landmine clearance operations and the ability to identify non-metallic mines often undetected by traditional methods. Further experimental validation and optimization of the electrode configuration and signal processing algorithms are recommended to improve detection accuracy and operational deployment.

ID_69: Optimization of Electrode Shapes in Electrical Impedance Tomography

Ven Huynh Thanh[1,2], Hoang Nhut Huynh[1,2], Quoc Tuan Nguyen Diep[1,2], Minh Quan Cao Dinh[1,2], Ngoc An Dang Nguyen[1,2], Tran Anh Tu[1,2,*], Trung Nghia Tran[1,2]

[1]*Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam*
∗ Email: tranatu@hcmut.edu.vn

Abstract

In this study, a simulation analysis is presented to optimize the shape of the electrodes in electrical impedance tomography systems. The objective was to enhance the image reconstruction quality by investigating various electrode geometries, including circular, rectangular, and triangular shapes. Simulations were conducted using a 3D cylindrical model with 16 electrodes evenly spaced around the circumference. The influence of the shape of each electrode on the sensitivity distribution and overall image reconstruction accuracy was evaluated. Quantitative metrics, such as image resolution, signal-to-noise ratio, and reconstruction error, were employed to assess performance. The results show that spherical electrodes provided the best sensitivity and boundary accuracy, followed by cylindrical electrodes, with rectangular electrodes showing the least precision in capturing object boundaries. These findings highlight the importance of optimizing electrode geometry in EIT systems, which can enhance the accuracy and reliability of imaging, particularly for clinical diagnostics and monitoring applications.

ID_111: Investigation of the Difference Between the Absolute and the Observed Signal in Electrical Impedance Tomography Image Reconstruction

Minh Huy Bao Bui[1,2], Hoang Nhut Huynh[1,2,*], Minh Quan Cao Dinh[1,2], Tan Loc Huynh[1,2], Dang Khoa Trinh Vo[1,2], Hai Anh Nguyen Thi[1,2], Quoc Tuan Nguyen Diep[1,2], Anh Tu Tran[1,2], Trung Nghia Tran[1,2]

[1] *Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam*
∗ E-mail: hhnhut@hcmut.edu.vn

Abstract

This study investigates the differences between the real and absolute values of signals in Electrical Impedance Tomography image reconstruction, focusing on their impact on image accuracy and quality. We performed simulations using a finite element method mesh with three distinct inclusions with varying conductivity values. The inclusions were characterized by high contrast: one highly conductive, one poorly conductive, and one with moderate conductivity. The experimental setup involved 16 electrodes placed equidistantly around the circular domain, applying a current-injection pattern, and measuring the resulting boundary voltages. The absolute signal reconstruction depicted in the center image tends to smooth out sharp conductivity contrasts, leading to significant artifacts and less accurate localization of the inclusions. The real signal reconstruction, shown on the right, more accurately represents the true conductivity distribution, preserves the sharp contrasts, and provides better inclusion localization. Quantitative analysis indicated that the mean squared error of the absolute signal reconstruction was 0.38, whereas that of the real signal reconstruction was 0.12. These results highlight the importance of considering the real value of the signal in Electrical Impedance Tomography image reconstruction to achieve a higher accuracy and fidelity in the reconstructed images.

ID_126: Classification of Lumbar Spine Degeneration Using Vision Transformer with the RSNA Dataset

Hoang Nhut Huynh[1,2,*], An Dang Nguyen Ngoc[3], Trung An Dang Nguyen[3], Minh Hoang Phan[4], Van Chinh Nguyen[3], Trung Nghia Tran[1,2]

[1]*Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam*
[3]*University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City,700000, Vietnam*
[4]*Ho Chi Minh City Hospital for Rehabilitation - Professional Diseases, 313 Au Duong Lan, Ward 2, District 8, Ho Chi Minh City, Vietnam*
* *E-mail: hhnhut@hcmut.edu.vn*

Abstract

This study presents a deep-learning approach for classifying lumbar spine degeneration using the RSNA dataset by employing a Vision Transformer model. The classification task was divided into three categories normal/mild, moderate, and severe. The dataset comprises approximately 2000 MRI studies annotated by spine radiology specialists to indicate the presence, vertebral level, and location of any lumbar spinal stenosis. The methodology involves preprocessing the MRI and training a Vision Transformer to classify degeneration severity. The Vision Transformer model was chosen for its ability to capture global image dependencies and superior performance in medical image analysis tasks. The quantitative results demonstrate the effectiveness of our approach, with an accuracy of 93.6%, a precision of 92.3%, and a recall of 89.8%. The proposed method achieves high classification performance and aids in the early detection and treatment planning for lumbar spine degeneration. The significance of this research lies in its potential to automate and enhance the diagnostic process, providing reliable and rapid assessments that can support clinical decision-making and improve patient outcomes.

ID_134: Integrating Meta-information and Imaging for Breast Cancer Detection using RSNA Screening Mammography

Hoang Nhut Huynh[1,2], Anh Tu Tran[1,2,*], Trung Nghia Tran[1,2]

[1] *Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, 72409, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc, Ho Chi Minh City 71308, Vietnam*
* *E-mail: tranatu@hcmut.edu.vn*

Abstract

This study proposes a deep-learning approach for breast cancer detection using an RSNA Screening Mammography dataset. The methodology includes multi-stage training of deep neural networks to optimize performance. Initially, a single-view model was pre-trained at a 1280 × 1280 resolution with an external dataset, followed by fine-tuning at a 1536 × 1536 resolution without external data. Subsequently, this model was used to refine the dual- and multilateral-view models. Data preparation involved manual annotation of breast bounding boxes in approximately 300 images, using a Faster R-CNN model to crop these regions and exclude extraneous body parts. We applied data augmentation techniques, such as shift scale rotation, random flip, random augment, and random erasing, to enhance model generalization. A ConvnextV1 small model was used throughout the study. The top-performing models were fine-tuned single-view and dual-view variants, leveraging additional metadata such as age, implant status, and machine ID. The quantitative results show the promising performance of our models in breast cancer detection, with the dual-view model achieving 0.94, 0.92, and 0.92 recall. In conclusion, while the multilaterality dual-view model shows promise in comparing left and right breasts for cancer detection, further optimization is needed.

ID_23: An Image Processing-based Method for Determining the Geometry Transmission Ratio of a Continuously Variable Transmission Gearbox

Dang Long Tran[1,3] and Tri Nhut Do[2,3,*]

[1]Department of Automotive Engineering, Faculty of Transportation Engineering, Ho Chi Minh University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Department of Embedded Systems and Robotics, Faculty of Computer Engineering, University of Information Technology, 71308 Thu Duc City, Ho Chi Minh City, Vietnam
[3]Vietnam National University in Ho Chi Minh City, Linh Trung Ward, 71308 Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: trinhutdo@gmail.com, trinhutdo@uit.edu.vn*

Abstract

Nowadays, there are many applications based on image processing methods deployed to bring convenience in use due to its outstanding superior features. This paper proposes an image processing-based method for determining the geometry transmission ratio of a continuously variable transmission (CVT) gearbox made up of a push-belt and two pulleys with synchronized width adjustments. The proposed method is demonstrated by many experiments on a real system consisting of 1 Logitech C992 Pro Webcam camera and 1 CVT gearbox. The experiments were conducted on more than 100 images. The experimental results show that the method's error is between 0.7% and 2.3%; and the average processing time of 1 image is 0.07 seconds. This error depends on whether the camera position is absolutely parallel to the CVT gearbox's cross-sectional plane or not. Furthermore, the reliability of the method is evaluated by the RMSE method up to 99%.

ID_91: Hybrid Feature Extractor for Enhanced Breast Tumor Discrimination on Ultrasound Images

Thanh Hang Nguyen[1,2], and Nhat Tan Le[1,2*]

[1]Department of Biomedical Engineering, Ho Chi Minh University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam.
[2]Vietnam National University in Ho Chi Minh City, Linh Trung Ward, 71308 Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: lenhattan@hcmut.edu.vn*

Abstract

Accurate detection and categorization of breast cancer can significantly reduce patient risk by enabling timely treatment. Ultrasound, being a low-cost, non-invasive, and non-radiative method, is effective for accessing breast anatomy and characterizing breast tumors. Despite the challenges of lower resolution and complexity in ultrasound images, advancements in artificial intelligence-based systems have greatly enhanced breast tumor classification. In this work, we propose a framework that leverages both traditional handcrafted features and deep learning-based features for breast mass classification on ultrasound images. We extracted a total of 81 handcrafted features and 2049 deep learning features. To address the issue of limited image data, we utilized Data Augmentation techniques to enhance the pre-trained deep ResNet model. We evaluated the performance of three traditional machine learning models: Support Vector Machine (SVM), Random Forest (RF), and Extreme Gradient Boosting (XGB), using three different feature sets: handcrafted features, deep learning features, and their combination. The combination of deep learning models through ResNet and radiomics for benign-malignant classification demonstrated substantial improvements. The best performance was achieved with an accuracy of 0.92 across all three models: RF, SVM, and XGB. In both the Random Forest and XGB models, the macro F1 score reached 0.89, and the weighted F1 score reached 0.92. The SVM model also showed significant improvements, achieving macro F1 and weighted F1 scores of 0.88 and 0.91, respectively. These results indicate that hybridizing handcrafted and deep learning-based feature extraction methods significantly enhances breast tumor classification performance.

ID_131: Fitness Tracker Data Analysis for Sleep Quality Forecasting

Ngoc Xuyen Nguyen[1,2] and Nhat Tan Le[1,2*]

[1]Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
E-mail: lenhattan@hcmut.edu.vn

Abstract

Sleep quality management plays an essential role in improving both work and life performance. With the rapid development of wearable devices and data-driven tools, sleep pattern information can now be recorded and analyzed using fitness trackers. In this study, 30 days of fitness tracker data from 14 out of 30 participants were utilized to forecast sleep quality. We proposed a framework that processes and extracts information related to activities (such as calories burned, steps taken, etc.) and time to reflect daily rhythms. Data from three consecutive days, including the previous day's sleep pattern, were used to train five different regression models. The results demonstrated considerable performance in sleep quality forecasting, with the Random Forest Regressor achieving a mean absolute error of approximately 2.2% in intrapersonal validation. Traditional regression models, particularly linear regression, performed better in interpersonal validation scenarios, highlighting the challenges posed by demographic variability and small datasets. This work presents a promising framework for sleep management using fitness tracker data. However, further analysis with larger and more diverse datasets is needed to improve forecasting accuracy and ensure the models' applicability to broader populations.

ID_49: Analysis of head injuries of motorcyclist colliding with cars in traffic conditions in Vietnam

Du Hồ Trọng[1*], Hung Anh Ly[2], Trang Nguyen[1].

[1]Ho Chi Minh City University of Technology and Education
[2]Vietnam National University Ho Chi Minh City
**Email: duht.ncs@hcmute.edu.vn*

Abstract

In Vietnam, motorbikes are a commonly used means of road transport because of their high mobility and low price. Therefore, traffic accidents involving motorbikes are increasing. When an accident occurs, the motorcyclist is the most vulnerable to injury and death. The majority of deaths of motorcyclists are related to head injuries. The objective of this study is to analyze head injuries of motorcyclists by simulating a car-motorbike accident. The THUMS AM50 (Total Human Model for Safety-50th percentile adult male) human model is scaled to fit the average stature of men in Vietnam and is named V-THUMS (Vietnamese -Total Human Model for Safety). The finite element models of cars and motorbikes have been verified for correctness. Furthermore, a completely newly constructed half-helmet finite element model fits the head circumference of V-THUMS. Then, the V-THUMS model was set up to ride a motorbike and collide head-on with a Sedan car under different conditions (car velocity, motorbike velocity, impact angle, wearing a helmet, not wearing a helmet). To ensure accurate simulation, the grip force of the V-THUMS hand on the motorcycle handlebar was set. In this study, LS-PREPOST software was used to set up the simulation and LS-DYNA software to run simulations, output results. Parameters such as cerebral Von Mises stress, cerebral MPS (maximum principal strain) and intracranial pressure are used to analyze head injuries. The results show that half-helmets play an important role in protecting and minimizing head injuries for motorcyclists. In all cases, the V-THUMS head hit the windshield during the initial impact, and the severity of head injuries increased with the velocity of the car and motorbike. At an impact angle of 0 degrees, the V-THUMS head suffered the most severe injury. This study provides comprehensive knowledge about head injuries in motorcyclists and confirms the important role of helmets in protecting motorcyclists from head injuries. Thereby, contributing to the development of injury prevention measures and protective equipment for motorcyclists.

ID_62: Evaluating minimum inhibition concentration of ampicillin and rifamycin encapsulated in different nanoparticles

Lac Tran-Ha[1], Yu-Xuan Chen[1], Tzu-Chien Wu[1], Chian-Hui Lai[1]

[1]National Chung Hsing University, Taiwan
Email: thlac@hcmus.edu.vn, chianhuilai@dragon.nchu.edu.tw

Abstract

The emergence of antibiotic resistance poses a significant threat to global health. While many antibiotics exhibit potent antimicrobial activity, their efficacy is often hampered by limitations in targeting specific infection sites and penetrating bacterial biofilms, potentially leading to damage of healthy tissues. Nanoparticle-based antibiotic delivery systems have emerged as a promising strategy due to their unique properties. These microscopic carriers can be engineered for targeted delivery to infected sites, minimizing systemic exposure and associated side effects. Additionally, nanoparticles can protect antibiotics from degradation within the body, ensuring a higher concentration reaches the target infection. This targeted approach is particularly advantageous for overcoming the challenge of biofilms, a dense protective layer that renders traditional antibiotics ineffective.

Here, we explore the potential of employing small molecules with affinity for bacterial surface components to further enhance the targeting ability of nanoscale delivery systems. We synthesized different polymers via RAFT (Reversible addition-fragmentation chain transfer) polymerization using two small molecules at varying molar ratios. These polymers then self-assembled into nanoparticles and encapsulated ampicillin (a hydrophilic antibiotic) or rifampicin (a hydrophobic antibiotic). The minimum inhibitory concentration (MIC) of these ampicillin- and rifampicin-loaded nanoparticles was evaluated against Escherichia coli (E. coli) and Staphylococcus aureus (S. aureus).

While encapsulation appeared to negate the antimicrobial effect of ampicillin on both strains, three rifampicin-loaded nanoparticles demonstrated a modest inhibitory effect on E. coli. Notably, two nanoparticles exhibited MIC values of 0.064 μg/mL and one another exhibited MIC values of 0.128 μg/mL against S. aureus. Although encapsulation slightly increased the MIC of rifampicin compared to the free drug, these nanoparticles demonstrated the ability to inhibit bacterial growth. This approach warrants further investigation against antibiotic-resistant strains and biofilm-forming bacteria.

ID_75: Applying convolutional neural networks in identifying and classifying Acute Lymphocytic Leukemia and its subtypes using Matlab

Phan Nguyen Bao Huy [1,2]*, Tran Thien Hau[1,2].

[1]Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
** Corresponding address: huy.phan2912@hcmut.edu.vn*

Abstract

Leukemia is a type of blood cancer that originates in the bone marow, thereby creating a series of abnormal blood cells that affect the exertion and effectiveness of blood cells. According to Globocan, statistics for 2022 show that Viet Nam has 180,480 new cancer cases and 120,184 deaths, of which leukemia has 5,789 new cases, ranking 8th among cancer types (accounting for 3.2%) and 4,330 deaths, ranking 6th in mortality rate among cancer types (accounting for 3.6%). Leukemia is categorized as either acute or chronic based on how rapidly the condition progresses. Acute leukemia affects blood cells in the early stages of development, causing the disease to become more severe, while chronic leukemia affects more developed blood cells, the disease tends to develop slowly. Leukemia is also classified according to the cells it affects, including myeloid cells or lymphocytes. So that, the four main types are: Acute lymphoblastic leukemia (ALL), Acute myelogenous leukemia (AML), Chronic lymphoblastic leukemia (CLL), Chronic myelogenous leukemia (CML). In this article, I focus on identifying and classifying ALL blasts in the most prevalent childhood cancer type using transfer learning of the Alexnet network model in Matlab software. Diagnosing ALL disease using peripheral blood smear (PBS) images helps screen and treat the disease early, contributing to improving treatment effectiveness for patients. Laboratory users often face challenges when examining PBS images, as the non-specific signs and symptoms of ALL can result in frequent misdiagnoses and diagnostic errors. This work developed a new classification model for peripheral blood smear that distinguishes between hematogenous and the ALL group with three subtypes of malignant lymphoblasts: Early Pre-B, Pre-B, and Pro-B ALL. The ALexnet model will be trained in 3 different ways including: Train with no parameters (Training a Neural Network from Scratch), train the pre-trained model but change the fullyConnected layer at the end and train the pre-trained model but change the 14th layer onwards. The results show that the model using the second training method achieves the best performance when reaching 98.77% accuracy on the validation set, while methods 1 and 3 are 91.88% and 84.48% respectively. Finally, the second model is saved and used to design the user application using AppDesigner.

ID_82: Performance Evaluation of Cross-Polarized Imaging and Image Fusion for Cervical Image Enhancement

Cat Phan Ngoc Khuong[1,2*], Thu Le Nguyen Bao[1,2] and Tien Tran Van[1,2]

[1]*Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Viet Nam National University Ho Chi Minh City (VNU-HCM), Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*
**E-mail: pnkhuongcat@hcmut.edu.vn*

Abstract

Image fusion techniques offer significant potential for enhancing diagnostic capabilities in colposcopy by effectively combining multiple image modalities. This study proposes a novel image fusion approach to improve the detection of blood-rich regions in cervical images. A dataset comprising polarized white light images of cervical bleeding, cervicitis, polyps, and blood vessels from 20 patients was acquired. These images were decomposed into their RGB channels and subsequently recombined, leveraging the unique absorption properties of hemoglobin. This process significantly enhanced the contrast between blood region and the surrounding tissue, facilitating their visualization. Morphological operations, including top-hat and bottom-hat transformations, were applied to further refine the image, emphasizing both bright and dark features. Experimental results demonstrate that the proposed image fusion method substantially outperforms conventional techniques in terms of blood contrast, as evidenced by the contrast ratio and contrast-to-noise ratio metrics. These findings highlight the potential of this approach for advancing cervical cancer screening and diagnosis.

ID_96: An Image-Classifying-Based Diagnostic Method Applied to Electronic Fuel Injection System for Gasoline Engine

Quang T. D. Pham[1,2], Phat Lam Huynh[1,2], Quan Pham Van[1,2], Duong Nguyen Thai[1,2], and Long Tran Dang[1,2*]

[1]*Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
**E-mail: trandanglong@hcmut.edu.vn*

Abstract

The electronic fuel injection (EFI) system significantly governs modern gasoline engine performance. Dirty sensors, weak actuators, broken electric wires, shorted circuits, and mechanical issues are most causes of abnormal system operations. Technicians can use the integrated onboard diagnostic (OBD) function to monitor system behaviour and then apply a standard Symptom-SystemComponent-Cause (SSCC) diagnostic process to determine what are causing rough idling, hesitate acceleration, excess exhaust gas emissions, and reduced fuel economy. This is a complicated and time-consuming procedure that is prone to human errors, particularly when mechanical causes occur, requiring skilled and experienced technicians. This study aims to demonstrate the feasibility of an automatic diagnostic solution for identifying causes of bad symptoms in EFI systems. Engine live data are collected from the OBD system while the engine is running through a diagnostic engine speed cycle. Live data features are then extracted and visualized as a radar-chart-type diagnostic image, which contains the signatures of normal or abnormal engine operations and can represent a specific cause of failure. By classifying the obtained diagnostic image, the cause of failure is identified. Experiments were conducted with a 4A91 engine, which calculates intake mass air flow from engine speed and intake air density instead of using an air flow meter. Mechanical issues such as cracked intake manifold, evaporative purge valve leak, and weak fuel pump were generated with different degrees of failures. Various pruned versions of the VGG-16 deep learning model were applied to classify diagnostic images thereby can indentify the causes of failure. The results showed that in the case VGG-16 model reduces 2 convolutional layers and 1 dense layers, it is most suitable for this automatic diagnostic application. The proposed diagnostic method can be further improved to detect multi-cause failures as well as predict system degradation trends for early warning and preventive maintenance.

ID_105: Design of 3D coated structures by topology optimization

Nha Thanh Nguyen[1,2*], Minh Ngoc Nguyen[3], Vu Nguyen Hoang[1,2]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam
[3] Duy Tan University, Vietnam
**Email: nhanguyen@hcmut.edu.vn*

Abstract

This paper presents a novel approach for design of three-dimensional (3D) coated structures by topology optimization. Both the coating layer and the substrate structure are taken into the optimization process. Instead of using the gradient-norm technique, which requires complicated calculation, the much simpler technique of two-step filter by Yoon and Yi, 2017, is employed to identify the coating layer. In particular, the design variables are firstly transformed into the physical densities by a density filter and a Heaviside projection. The physical densities are further modified by a two-step coating filter, which includes one step for a second density filter, and one step for s-shape mapping. The coated and substrate layers are identified by combination of both the modified densities and the physical densities. In addition to simple calculation, the two-step coating filter technique allows controlling of the coating thickness via the second density filter. Here, the extended domain for coating layer is not defined. The approach is further developed to 3D problems. A comparative study on the choices of the second density filter and the s-shape mapping function within the two-step coating filter, in the context of 3D structures, is presented.

ID_113: Utilizing Dermoscopy Methods With Machine Learning And Deep Learning Algorithms To Diagnose Skin Lesions

Duong Tan Gia Bao, Le Tuan Kiet, Tran Anh Tu, Tran Thien Hau *

Faculty of Applied Science, Ho Chi Minh City University of Technology – Vietnam National University HCMC
**E-mail: tthienhau@hcmut.edu.vn*

Abstract
Artificial intelligence is fast-growing and applied in a wide range of industries nowadays, including the healthcare sector. Dermatology is one of the areas where AI has a big influence, particularly when it comes to dermoscopy-based skin lesion diagnosis. This paper aims to develop useful techniques for disease image classification that make use of deep learning and machine learning techniques. Continuously, looking at and making suggestions for improvements is to raise the model's efficacy during the training phases. The convolutional Neural Network (CNN) model was developed, trained, and evaluated on the Skin Cancer MNIST: HAM10000 data set, and subsequently deployed on Kaggel software using Python and the Keras framework. The results are mostly 0.95 or higher, models with Precision and Recall measurements are relatively stable. In particular, for cases like actinic keratosis, benign skin tumors, and vascular lesions, the values of Precision and Recall both reached level 1, indicating that there were no instances of incorrect predictions.

ID_156: Manufacturing mobile vaccine storage cabinets using Peltier electrothermal effect

Huu Xuan Mai[1,2*]

[1] *Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
**E-mail: maihuuxuan@hcmut.edu.vn*

Abstract

Along with the evolution of society, epidemics are also becoming more complex and dangerous, especially the current situation in Vietnam as well as the World. The problem of overcoming the epidemic caused by the new strain of n-Covid virus and the consequences it causes is a huge, unresolved disease prevention problem for humanity. Bringing vaccines to all those who need them quickly while ensuring the most effectiveness is still an extremely necessary issue in today's times. Mobile storage cabinets need a large amount of cold storage bags surrounding them to keep the vaccine at the necessary cold temperature to avoid spoilage, this causes the vaccine storage capacity to decrease, leading to a decrease in the amount of vaccine stored. On average, the capacity reduction is about 50%, not taking into account time and temperature, which is difficult to control accurately, and the safety of the vaccine is unstable. In 1934 Peltier discovered that if a direct current passes through a closed loop of wire consisting of two different metals, one connector will heat up and the other end will cool. This effect is called the Peltier electrothermal effect. We apply this principle to manufacture a mobile vaccine refrigeration device that uses DC power from the battery to control the temperature, time of the battery source, and charging circuit for the battery.The device has dimensions of (390x 170x300) mm with a usable capacity of (200x 150x190) mm, temperature at (2-8) degrees Celsius and usage time of 3.5 hours.The device operates stably and transports easily with 3 times the amount of vaccine compared to using cold storage bags.

ID_165: Fabrication and Characterization of Flexible Piezoresistive Pressure Sensors Using Spinosum Structured PANI/PVA Hydrogel

Nguyen Gia Huy[1,2], **Nguyen Xuan Thanh Tram**[1,2*]

[1]*Division of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology, Ho Chi Minh City 70000, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City 70000, Vietnam*
**E-mail: nxttram@hcmut.edu.vn*

Abstract

In this study, flexible piezoresistive pressure sensors with a spinosum structure surface were fabricated from Polyaniline/Polyvinyl Alcohol (PANI/PVA) hydrogel. First, PANI powder was fabricated and mixed with a PVA solution. The mixture was blended at a 1:1 ratio with a 10% PVA solution before this solution was scraped on sandpaper to replicate the spinosum microstructure. The hydrogel film was dried at ambient temperature and then carefully removed from the sandpaper to obtain the spinosum micro structured PANI/PVA hydrogel thin film. The hydrogel thin film was cut to a size of 2 cm x 2 cm and placed above integrated copper electrodes to fabricate piezoresistive pressure sensors. The spinosum structure was evaluated by Scanning Electron Microscopy (SEM). The chemical characterization of the hydrogel thin films was analyzed by Fourier Transform Infrared spectroscopy (FTIR). The mechanical strength of the hydrogel thin film was assessed using a stress–strain curve. The results showed that the pore sizes of the spinosum structure affected the resistance and mechanical strength of the hydrogel thin film. The piezoresistive pressure sensors were capable of producing current responses to different masses. Furthermore, the sensors were able to identify different handwriting styles, demonstrating their potential for applications in biometric recognition and personalized electronics.

ID_166: The Modeling of Non-invasive Measurement of Fruit Sweetness using Near-Infrared (NIR) Spectroscopy Method

Hong Duyen Trinh Tran*[1,3], Trung Nghia Tran[1,3], Tran Anh Tu[2,3]

[1]Laboratory of Laser Technology, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT) 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[2]Laboratory of General Physics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT) 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam
[3]Vietnam NaƟonal University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam
**E-mail: tt_hd2005@hcmut.edu.vn*

Abstract

The sugary content in fruit requires knowledge for both the maker and the consumer. Methods of evaluating the level of sweetness in fruits as previously described, for example through chemical means, is a long and tedious process. This paper demonstrates the beneϐits of using NIR in determining fruit sweetness as a rapid, non-destructive, and accurate technique compared to the conventional methods. Near infrared spectroscopy (NIR spectroscopy) is a rapid non-destructive technique for measuring the physical and chemical properties of fruit by analyzing the light absorption in the proximal part of infrared spectrum (780-2500 nm). This paper aims to determine the potential of applying food quality NIR spectroscopy spot check, at a wavelength of 940 nm, in the reϐlectance mode for the evaluation of the sweetness of apples. When light from a 940 nm LED is directed to illuminate the surface of the fruit, some of it is absorbed while the rest is reϐlected. The reϐlected light is detected using a photodiode then converted to an electrical quantity using a conversion circuit after which it is passed to a microcontroller. The study was conducted on 30 different apple samples to develop a model, with sweetness quantiϐied using a Brix refractometer. The obtained results were used to construct a linear regression model, showing the correlation between the measured voltage values and the Brix values. The model yielded a correlation coefϐicient (R^2) of 0.6261, demonstrating the feasibility of using the 940 nm near-infrared wavelength to non-invasively measure fruit sweetness. These preliminary results help us understand the experimental design and develop techniques to measure fruit sweetness using light at other wavelengths in the future.

ID_30: First-principles studies on the work function changes of ZnO(2110) surfaces induced by NO and NO_2 adsorption for gas sensors

Cheng-Lung Yu[1], Guan-Yu Chen[1], Congo Tak Shing Ching[2], and Po-Liang Liu[1,3,*]

[1]Graduate Institute of Precision Engineering, National Chung Hsing University, Taiwan
[2]Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taiwan
[3]Department of Applied Materials and Optoelectronic Engineering, National Chi Nan University, Taiwan
**E-mail: pliu@dragon.nchu.edu.tw*

Abstract

This study employs first-principles calculations based on density functional theory to investigate the work function changes induced by the adsorption of nitric oxide and nitrogen dioxide on clean ZnO(2110) surfaces and Ag-decorated ZnO(2110) surfaces. The results indicate that the maximum work function change for NO adsorption on clean ZnO(2110) surfaces is -0.78 eV, while the maximum work function change for NO_2 adsorption on Agdecorated ZnO(2110) surfaces is -1.74 eV. On the Ag atom initially adsorbed on the Zn site of the ZnO(2110) surface denoted as the Ag-ZnO-Zn surface, the work function change induced by NO_2 is approximately 0.89 eV more negative than that induced by NO. On the Ag atom initially adsorbed on the O site of the ZnO(2110) surface denoted as the Ag-ZnO-O surface, the work function change induced by NO_2 is approximately 0.87 eV more negative than that induced by NO. In contrast, NO adsorption on Ag-decorated ZnO(2110) surfaces leads to notable work function changes (-0.74 eV and -0.87 eV), especially on Ag-ZnO-O surfaces, showing higher sensitivity. The largest work function changes are observed for NO_2 adsorption on Ag-decorated ZnO surfaces (- 1.63 eV and - 1.74 eV), particularly on Ag-ZnO-O surfaces, indicating extremely high sensitivity. These findings suggest that Ag-decorated ZnO surfaces exhibit the highest sensitivity to NO_2, especially on Ag-ZnO-O surfaces, making them the optimal choice for designing high-efficiency NO_2 gas sensors. Furthermore, Ag-decorated ZnO materials also show high potential in sensing NO. These results provide important references for designing high-performance gas sensors, particularly in the context of environmental monitoring and health protection. Further research and experiments can validate these theoretical results and lead to the development of practical sensor devices.

ID_136: A Comparative Analysis of YOLOv5 and YOLOv7 Object Detecting Models For Speed-Limit Traffic-Sign Recognition

Lam Tran Quang[1,2], Thinh Vo Truong[1,2], Phi Duong Ly[1,2], Phi Lam Nhat[1,2], and Long Tran Dang[1,2*]

[1]*Faculty of Transportation Engineering, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
**E-mail: trandanglong@hcmut.edu.vn*

Abstract

Traffic sign recognition is a key element in automatic driver assist systems and autonomous vehicles, significanlty improve driver's comfort and driving safety. The You Only Look Once (YOLO) family of deep-learning-based object-detection algorithm has been widely adopted due to their real-time capabilities and ease of implementation. In this study, we compared the performance of Small-YOLOv5 and Tiny-YOLOv7, two recent variants of the YOLO architecture, on various traffic sign detection benchmarks. Our evaluation focused on three aspects: accuracy, speed/inference time and performance/computational complexity. The two models of YOLOv5 and YOLOv7 were trained with the same data set which consists of 3206 images representative for 7 different speed-limit signs including 50, 60, 70, 80, 90, 100 and 120 km/h, 2 signs of residential area entrance and exit, and 1 sign of all-limit removal. These images were collected in various real-life environmental conditions such as daylight, nighttime, rain, and motion blur from a Raspberry Pi V2 8MP Camera with a resolution of 3280x2464 pixels and a focal length of 3.04 mm. Comparisons were conducted in different scenarios of image quality, distance from camera, and computer resources. In terms of image quality, performance decreased significantly as image quality dropped with YOLOv5, especially in low light, blurry images, and bad weather. Meanwhile, YOLOv7 maintained better performance in various environmental conditions. YOLOv7 was found to be more stable and reliable than YOLOv5 when image quality dropped. In terms of speed/processing time, when running on a system with high resources (such as Google Colab T4), YOLOv7 outperformed YOLOv5 in speed/inference time. On low-end resources (Jetson Nano), YOLOv7 was also slightly better than YOLOv5. Finally, YOLOv7 was able to maintain better performance than YOLOv5 when the subject was at different distances from the camera. The findings of this study suggested that the Tiny-YOLOv7, when combined with a high-level computing platform, could be beneficial for real-time traffic sign recognition.

ID_138: Research on the ability to generate electric current of the H/Pd(100) system in a fuel cell

Thai Pham[1,2], Hanh T.T. Tran[1,2*]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
Email: thuhanhsp@hcmut.edu.vn

Abstract

In the search of emerging sustainable energy, hydrogen fuel cells are one of the most effective solutions for producing electricity. To investigate the electric current intensity generated in the fuel cell, the adsorption of hydrogen on the Pd(100) surface is simulated based on dentisy functional theory (DFT) with a vacuum environment. In this work, we study the convergence of the initial k-point selection for the Pd system both in the presence and absence of hydrogen atoms. The chemical bond stability states in the model are specifically examined through the hydrogen adsorption sites. By comparing the simulation results with experimental observations, our approach has shown the agreement in the electronic properties of Pd bulk through analyses of band structure and band-gap calculations.

ID_140: IoT-based Smart Agriculture System: Design of Farming Diary

Thien B. Nguyen-Tat[1,2], Kha Ninh Nguyen Phuc[1,2], Tri Nhut Do[1,2,*]

[1] *University of Information Technology, Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
**E-mail: trinhutdo@gmail.com, trinhutdo@uit.edu.vn*

Abstract

Agriculture has played an important role in human society since ancient times, providing livelihoods and contributing significantly to the economy of a country. Nowadays, climate change is increasingly having a direct and profound impact on crop productivity. These changes affect soil nutrients, pests, and water levels. To mitigate these impacts and increase crop productivity, IoT (internet of things) technology has been and is being utilized to transform agricultural cultivation processes not only to improve production methods, reduce costs, but also ensure traceability and enhance environmental sustainability. In this paper, a smart farming diary is designed and implemented on mobile and web applications based on IoT technology. The system allows farmers to record detailed farming activities, including information on seeds, fertilizers, pesticides, weather, and other factors affecting crops. All data is collected from sensors, IoT terminal devices for statistics, stored as logs and analyzed to evaluate the effectiveness of the system.

ID_142: Research in Detection and Evaluation of Green Spaces Using UAV and Artificial Intelligence

Ta Dinh Khoa[1,2], Phan Nguyen Quoc Duy[1,2] and Ngo Khanh Hieu[1,2]

[1] *Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
Email address: *khoa.ta1810@hcmut.edu.vn, duy.phanmarcoduy@hcmut.edu.vn, ngokhanhhieu@hcmut.edu.vn*

Abstract

Numerous efforts have been made to evaluate green areas, ranging from manual methods like tree and leaf counting to more modern approaches such as using satellite imagery. However, these methods have limitations, including high costs, resource-intensive processes, and lack of real-time capabilities. Therefore, our research team developed a method that improves performance and allows for real-time updates. In this study, we utilized an ultra-lightweight unmanned aerial vehicle (UAV) to create a non-image dataset of green vegetation. We trained a deep learning computer vision model using this dataset to recognize and segment green areas. The resulting accuracy was then computed to determine real-world coverage. Although our initial results were not as expected, this approach shows promise for addressing the stated problem, and further in-depth research is necessary to enhance the process and outcomes. In our study, we faced several challenges while developing and implementing our approach. One critical aspect was selecting appropriate hyperparameters for training our deep learning model. Let's delve into some of these considerations: Mean Average Precision (mAP), Confidence Threshold, Overlap (IoU), Training Data, Error Messages during Training and Number of Epochs and Batch Size. Despite these challenges, our preliminary results demonstrate the potential of this approach. Real-time green area assessment using UAVs and deep learning holds promise for environmental monitoring. Further research will refine our methodology and address limitations.

ID_173: A study on laser plane interpolation for vision-based robot seam-tracking accelerated GPU

Duong-Huu-Duyen Nguyen[1,2*], Phuong-Tung Pham[1,2], Quoc-Chi Nguyen[1,2], and Thanh-Huy Phung[1,2]

[1] *Faculty of Machanical Engineering, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Thu Duc, Ho Chi Minh City, Vietnam*
**E-mail: duyen.nguyenduong@hcmut.edu.vn*

Abstract

Industrial robots have been popular for enhancing production efficiency, especially in heavy and hazardous tasks such as welding. Although robotic welding has marked significant advancements, robot operation by pointto-point teaching requires considerable effort and time. Changes in profiles or systems require reteaching, and profile alterations during welding can yield unsatisfactory results. Therefore, seam tracking using laser-vision systems has been proposed. Here, accurate and rapid construction of the laser plane is essential to determine the trajectory of the robot, necessitating research on plane interpolation methods. In this study, a laser plane is constructed by capturing a series of images of the laser line on a reference plane, extracting the line from the images, converting the coordinates of the points on the line from the image coordinate system to the camera coordinate system, and applying plane interpolation methods to derive the plane from the point cloud. The methods are then compared, combined, and optimized for speed and accuracy using parallel computing on a GPU to determine the most efficient method. The final model explains 91.11% of the points in the point cloud. Moreover, combining multiple interpolation methods with parallel computation show that the excution time can significantly reduce from 50.73 seconds to 5.72 seconds. The substantial reduction in computation time demonstrates the effectiveness of CUDA-based parallel processing, and the high percentage of points explained by the model indicates high accuracy of the interpolated plane. The results show that the proposed approach provides a robust solution for seam tracking in robotic welding, highlighting the potential for improved efficiency and precision in industrial applications.

ID_197: Application GIS and remote sensing in building a map of ecosystem services: A case study in the Thu Duc City, Ho Chi Minh City

Dao Thi Viet Huong[1*], Nguyen Thi Cam Tien[2]

[1] *Faculty of Environment and Natural Resources, Ho Chi Minh City University of Technology, Ho Chi Minh city, Vietnam*
[2] *BKS company, Ho Chi Minh City, Vietnam*
**E-mail: viethuongdao@hcmut.edu.vn*

Abstract

This study demonstrates the application of GIS, combined with remote sensing data, to assess the economic value of ecosystem services (ESV) in Thu Duc City, Ho Chi Minh City. The study area encompasses various ecosystems, including urban areas, grass, rivers/lakes, wetlands, cropland, and green spaces. The assessment involved analysing land cover changes from 1975 to the present using Landsat satellite imagery. The results revealed signi6icant shifts in land cover, with urban areas expanding while vegetation cover and bare land decreased. The total ESV of Thu Duc City in 2024 was estimated to be over 388,000 thousand USD, with 6ish pond (wetlands) contributing the highest value around 187,000 thousand USD. This study underscores the importance of integrating GIS and remote sensing in ecosystem service valuation and provides valuable insights for urban planning and sustainable development in Thu Duc City.

ID_176: Highspeed recognition of printed characters on packages with parallel computing and Machine Learning

Trung Hieu Vo[1,2], Long Duy Khuu[1,2], Huu Dang Huynh[1,2], Quoc-Chi Nguyen[1,2] and Thanh Huy Phung[1,2,*]

[1] Department of Mechatronics, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet, Ward 14, District 10, Ho Chi Minh City 70000, Vietnam
[2] Vietnam National University Ho Chi Minh City, Quarter 6, Linh Trung Ward, Thu Duc, Ho Chi Minh City 70000, Vietnam
**E-mail: huypt@hcmut.edu.vn*

Abstract

The recognition of printed characters on products is an essential application in the industry for various purposes, such as tracking, quality inspection, and monitoring. When applied in the production sector, manufacturers increasingly require devices to recognize characters at highspeed following the parameters of products on the line to ensure efficiency and continuity. Therefore, high-speed and high-accuracy capabilities are crucial. This study aims to overcome the aforementioned challenges of enhancing the accuracy and speed of character recognition by using CUDA-based systems. For this purpose, a facile detection technique is proposed. The technique uses a synchronized imaging system to obtain product photos, followed by a pre-processing image process using numerous methods such as perspective transform, binary conversion, morphological operations, and contour identification. Subsequently, these images are passed through a Support Vector Machine (SVM) model for recognition. All processing is performed directly at the manufacturing site using CUDA-based algorithms with the CuPy library in Python [1], ensure high-speed detection. The suggested technique is used to speed up the identification process, cutting the entire processing time to approximately 22 ms per product, including approximately 12 ms for image pre-processing and 9 ms for prediction using SVM. The SVM successfully satisfied the system requirements with an accuracy of about 99% for both the training and testing sets. The results show a promising opportunity to apply the proposed technique for the highspeed manufacturing system.

ID_178: Smart System for Monitoring and Controlling Dragon Fruit Quality in Cold Freight Trucks in Vietnam

Phuong-Tung Pham[1,2*], Tung Vu[1,2], Huu Anh Kiet Nguyen[1,2], Thanh Huy Phung[1,2]

[1] Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet, Ward 14, District 10, Ho Chi Minh City 70000, Vietnam
[2] Vietnam National University Ho Chi Minh City, Quarter 6, Linh Trung Ward, Thu Duc, Ho Chi Minh City 70000, Vietnam
**E-mail: pptung@hcmut.edu.vn*

Abstract

Vietnam faces significant challenges in preserving the quality of dragon fruit during export transportation. The quality of dragon fruit is closely influenced by micro-transportation factors such as relative humidity, temperature, oxygen, carbon dioxide, and ethylene, which can accelerate degradation. Effective storage of dragon fruit requires precise control of temperature, humidity, and gas concentrations, particularly CO2. Maintaining the optimal temperature prevents chilling injuries and extends shelf life, while proper humidity management avoids moisture loss or excessive accumulation. Monitoring and adjusting gas concentrations, especially CO2, are crucial for maintaining fruit quality and reducing spoilage from fermentation. This paper introduces the development of an intelligent system for monitoring and controlling the quality of dragon fruit during transportation in cold freight trucks in Vietnam. The system, designed to be installed on container trucks, utilizes cutting-edge technologies, including the Internet of Things (IoT). The system features (i) highly reliable IoT modules for real-time environmental data collection and (ii) a controlled atmosphere system to regulate temperature, humidity, and CO2 concentrations. A prototype cold container was constructed to validate the system. Experimental results demonstrate the effectiveness of the developed module, highlighting its potential to enhance the quality and longevity of transported dragon fruit under Vietnam's climatic and transport conditions.

ID_154: Evaluating Zirconia vs. Lithium Disilicate RBFDPs: An FEA Study on Load Conditions and Framework Designs

Cuong Nam Tran[1*], Yen Hoang Truong[2], Long Nguyen Tuong[1], and Dang Le Cao[1]

[1]*Faculty of Apllied Sciences, Ho Chi Minh City University of Technology, Ho Chi Minh City, Vietnam*
[2]*Department of Prosthodontics - The Faculty of Odonto-Stomatology, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, VietNam*
**E-mail: tncuong.sdh231@hcmut.edu.vn, ntlong@hcmut.edu.vn, ms.hoangyentruong@gmail.com, lecaodang@hcmut.edu.vn*

Abstract

The article aims to determine which kind among three-kinds of resinbonded fixed dental prostheses (RBFDPs) framework design has the better behavior when increased concentrated loads on the right maxillary first molar (R12), through the Finite Element Analysis examination of two factors, the maximum equivalent stress on stress concentrated regions and the relationship between input load and corresponding stress. The Micro-CT film of Human Jaw Bone and two human dry teeth - the right central canine (R11) and the right central incisor (R13) from the University of Medicine and Pharmacy at Ho Chi Minh City database were reconstructed as STL 3D models. Then, through the reconstructing surfaces process using the NURBS technique, the solid model, which can be used to determine the physical boundary and to design the RBFDPs framework is ready for the next phase. Three kinds of RBFDPs design are based on the previous model and fabricated using Autodesk Inventor software. The result is the assembly of solid models to form complete RBFDPs resembling human jaw at R11 to R13 teeth after successfully installing prostheses. Finally, the model was analyzed using the Finite Element Analysis (FEA) method under difference concentrated force loaded on top of the R12 tooth, tangent to the tooth's outer surfaces. The magnitude ranges from 50 to a maximum of 300 N, divided into five separate cases. The equivalent stress regions were analyzed to determine the concentration that possibly caused the structural failure of the RBFDPs.The result shows concentration regions focus on the "neck" of the retainer in each design, the shape of the region also shows a concentrated line horizontally. The average equivalent stress at maximum force 300 N reach … on …design. In conclusion, the prostheses applied for the molars teeth, and left-retainer design have better performance than others, due to the low increment rate in equivalent stress corresponding to increased force magnitude.

ID_180: Optimization of Functional Rehabilitation Support Devices with 3D Printing Technology

Thai Hien Nguyen[1,2*], Truc Linh Nguyen Thi[1,2], Hoai Thuong Nguyen Thi[1,2], Trung Nghia Tran[1,2]

[1]*Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet, Ward 14, District 10, Ho Chi Minh City 70000, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Quarter 6, Linh Trung Ward, Thu Duc, Ho Chi Minh City 70000, Vietnam*
**E-mail: thnguyen@hcmut.edu.vn*

Abstract

Currently, the process of designing medical devices based on personalized medical models and the application of 3D printing technology in functional rehabilitation support orthopedic devices is a notable advancement in the field of medicine. The design process, which is based on personalization for each patient, compared to traditional manufacturing methods, meets both the structural and functional requirements. The design process involves 3D scanning of the patient, obtained through precise measurements, followed by modeling and optimizing the design; finally, 3D printing technology is applied to achieve the most suitable results for each patient. The objective of the research is to demonstrate the development and application of a new process for designing and manufacturing orthopedic devices by combining scanning technology and 3D printing with topology optimization and FEM simulation. This approach aims to provide efficiency in the rapid and accurate production of orthopedic devices, reducing patient waiting time, improving compliance, reducing pain and minimizing adverse conditions. The personalized approach in the design of medical devices brings several benefits, including increased patient satisfaction and treatment outcomes.

ID_181: Failure Through Crack Propagation in Photoelasticity Using Isogeometric Analysis of Phase-Field Models

Duy Khuong Nguyen[1,2,*], Quoc Kien Minh Phan[1,2]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*

Abstract

Crack propagation in brittle materials is a critical factor in the design, optimization, and safe operation of numerous structures and devices. Understanding the mechanisms of crack initiation and growth is essential for mitigating potential failure risks under diverse loading conditions. Brittle materials, including transparent materials such as glass, polycarbonate, mica, and PMMA, are widely employed in various applications. The unique property of these materials, known as photoelasticity, where the refractive index is sensitive to internal stress, allows for the visualization of stress patterns during load bearing. This phenomenon provides a valuable tool for identifying structural weaknesses and facilitating experimental testing and optimization. Despite the importance of brittle materials in engineering, research on crack propagation in these materials remains relatively limited. This study addresses this gap by presenting a numerical approach to investigate crack initiation and propagation in polycarbonate. The accuracy of this approach is validated through comparison with experimental data obtained from photoelasticity experiments. The study utilizes Isogeometric Analysis (IGA) for structural discretization, coupled with the phase-field cohesive zone model to simulate the crack propagation process. IGA, recognized for its high convergence capabilities, offers a significant advantage in terms of accuracy and computational efficiency when combined with the phase-field method. Furthermore, this research aims to determine optimal material properties for polycarbonate through a reverse engineering approach, leveraging the insights gained from the numerical-experimental comparisons.

ID_184: Impact of oxygenated palm-biodiesel on combustion characteristics under various levels of EGR in simulated CI-engine condition

Chau Tan Vo[1*], Au Hai Ho[2,3], Hoa Nam Ho1, Tai The Mai[2,3]

[1] *Industrial University of Ho Chi Minh City (IUH), Ho Chi Minh City, Vietnam*
[2] *Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[3] *Vietnam National University Ho Chi Minh City (VNU-HCM), Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam*
**E-mail: votanchau@iuh.edu.vn*

Abstract

Diesel engines, known for their high compression ratios, are extensively used in various sectors including industry, transportation, agriculture, and construction. However, they face significant challenges in meeting strict emission standards. Fossil-derived diesel fuel is cited as a major contributor to serious issues like high environmental pollution, harmful health effects, and the energy crisis. Promoting the development of high technology related to clean fuel is crucial. Exploring the impact of combining high-pressure fuel injection with low oxygen concentration as a form of exhaust gas recirculation (EGR) for oxygenated biodiesel, to enhance fuel efficiency and emission mitigation, presents a promising avenue of research. This work aims to investigate the influence of various levels of EGR on the combustion properties of palm biodiesel (B100) and conventional diesel (B0) under a high fuel injection pressure of 1200 bar and a constant injection time of 2.0 ms in a constant volume combustion chamber. The compression ignition (CI) engine operating conditions, characterized by an incylinder ambient pressure of 43 bar, were investigated under three cases of volumetric oxygen concentrations simulating various EGR levels in diesel engines: no EGR (21% O2), medium EGR (15% O2), and heavy EGR (10% O2). A piezoelectric transducer sensor was utilized to record the combustion pressure, from which combustion characteristics, including ignition delay period, heat release rate, and integral heat release, were analyzed. The findings revealed that the ignition delay of B100 is shorter than that of B0 under no EGR conditions and prolongs when reducing the oxygen content to 10%. Increasing the EGR ratio leads to a significant decrease in the integral heat release, zenith of the apparent heat release rate, and peak combustion pressure for both fuel types. Nevertheless, a longer diffusion combustion phase was observed compared to conditions with higher ambient oxygen concentrations. Furthermore, the combustion characteristics of palm biodiesel are also lower than those of diesel under test conditions.

ID_84: Investigating the impacts of anhydrous ethanol and biodiesel as an emulsifier on macroscopic spray characteristics of Diesel-Ethanol and tri-fuel blends in a Constant Volume Vessel

Tran Quang Khai[1], Vo Tan Chau[1*]

[1]*Industrial University of Ho Chi Minh City (IUH), Ho Chi Minh City, Vietnam*
**E-mail: votanchau@iuh.edu.vn*

Abstract

This paper investigates the macroscopic spray characteristics of the dieselbiodiesel-ethanol blends, as well as evaluates their availability to be introduced to compression ignition engines. Based on the literature review, representative of the blends, DE20 (20% of anhydrous ethanol by volume) and B20E20D60 (1:1 ratio by volume of anhydrous ethanol and biodiesel) are chosen to conduct the experiment before making comparisons with the baseline fuels, namely the pure diesel and pure anhydrous ethanol (99,9%). The fuel blending has been preliminarily studied to guarantee the stability and ratio of the ternary blends chosen from the time/temperature ternary phase diagrams to prevent crystalline or gel structures occurrence of the blends. Utilizing a constant volume vessel (CVV) for optical accessibility, spray images are captured and analyzed to data the spray penetration length, spray cone angle, and also the spray area. Conditions of the experiments were similar to the working conditions of the CI engines, with the injection pressure of 1100 bar, injection duration of 1600 µs, and in-chamber ambient pressure of 15-30 bar of Nitrogen for non-vaporizing condition simulation. The results of the paper indicate that the addition of biodiesel into the fuel blend not only prevents phase separation, and sufficient stability but also enhances the overall fuel properties, showing very close spray characteristics to that of the diesel fuel. Additionally, it can be drawn that fuel properties contribute minimally to the spray penetration length of the fuels, meanwhile spray cone angle is greatly affected by the surface tension and kinematic viscosity. On a quantitative comparison among the fuels' spray areas, B20E20D60 appears to be the widest regardless of the E100's spray area nature.

ID_117: Nonlinear Analysis of Stiffened Laminated Composite Plates Using SHELL181 Elements in ANSYS

Hau Phuc Tran Pham[1,2], Loc Tan Ho [1,2], Nghia Trong Doan[1,2], Vay Siu Lo[1,2] and Thien Tich Truong[1,2*]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam.*
**E-mail: tttruong@hcmut.edu.vn*

Abstract
This paper investigates the nonlinear static behavior of stiffened laminated composite plates using finite element analysis (FEA). The analysis is conducted using the SHELL181 element in ANSYS, which is well-suited for modeling the complex geometries and material properties of composite structures. The study includes detailed modeling of the laminated composite plates with orthogonal stiffeners and examines the impact of various parameters on their structural behavior under static loads. Nonlinear analysis is performed to capture the intricate response of the stiffened plates, accounting for geometric nonlinearity. The results demonstrate the effectiveness of the finite element approach in accurately predicting the behavior of stiffened composite plates. The findings are validated against established results, showing good agreement and confirming the reliability of the SHELL181 element for such analyses. This research provides valuable insights into the design and optimization of stiffened laminated composite structures in engineering applications.

ID_19: A Combined Segmentation and Classification Pipeline for Breast Tumors Analysis on Ultrasound Image

Cong Thanh Nguyen[1,2], Nhat Tan Le[1,2], Quang Linh Huynh[1,2]

[1] *Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Vietnam*
**E-mail: thanh8183@gmail.com; huynhqlinh@hcmut.eu.vn; lenhattan@hcmut.edu.vn*

Abstract

Breast cancer is a life-threatening disease characterized by the abnormal and uncontrollable growth of breast cells, leading to tumor development. Currently, ultrasound is a crucial non-invasive medical imaging modality used to assess the characteristics of breast tumors. During the diagnostic process, radiologists perform tumor segmentation and classification into benign or malignant categories. This manual process presents challenges due to the need for high accuracy to ensure effective diagnosis. Therefore, an automated approach is necessary to enhance precise tumor segmentation and classification as a technical diagnostic tool. This study designed a tool that combines automatic segmentation and classification of breast tumor ultrasound images using deep learning models. Firstly, the tumor segmentation process was implemented with a Deep Residual UNET model to identify the suspect region on breast ultrasound images. The original breast ultrasound image was then combined with the identified tumor area from the segmentation process to increase the information available during the classification process. Finally, the VGG16 model was utilized to classify breast tumors as benign or malignant. These two deep learning models were trained on a public breast ultrasound dataset comprising 437 benign and 210 malignant tumors. Model validation was conducted using 5-fold crossvalidation. The segmentation-alone model achieved an accuracy of 98.93% ± 0.4% and a Dice coefficient of 89.57% ± 2.16%. The classification model and the combined model achieved mean accuracies of 98.3% and 78%, respectively, and weighted F1-scores of 98.3% and 78.27%, respectively. This work presents a combined breast tumor segmentation and classification tool with considerable performance. However, further efforts are needed to improve the combined model's performance.

ID_201: Analcime zeolite beads prepared from mineral clays for CO2 capture application

Le Tu Hieu[1,2], Phan Vo Vinh San[1,2], Tran Duc Thang[1,2] Nguyen Thi Truc Phuong[1,2] and Nguyen Quang Long[1,2*]

[1] *Faculty of Chemical Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet, District 10, Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City, Vietnam*
**E-mail: nqlong@hcmut.edu.vn*

Abstract

This research focuses on the CO2 capture capacity and physical properties of granulated beads using zeolite ANA synthesized from metakaolin as the raw material, followed by hydrothermal treatment in an alkaline solution at ambient conditions without adding any extra silica or alumina sources. The resulting powder was then granulated with bentonite to improve mechanical strength and sodium alginate to perform a cross-linking reaction with barium chloride. The synthesized zeolite powder ANA and the beads were characterized by X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) with EnergyDispersive Spectroscopy (EDX). The mechanical strength and moisture content of the beads were also examined. The CO2 adsorption capacity of the beads was investigated using a CO2/N2 mixed gas stream with activation conditions in vacuum environments at 150 °C, 200 °C, and 300 °C, respectively. It was observed that the mechanical strength of the beads gradually decreased with increasing activation temperature, as a result of sodium alginate degradation. In addition, the highest CO2 adsorption capacity was recorded about 0.46 mmol/g on the sample which was activated at 200 °C.

ID_204: Investigation of Bacterial Cellulose Production from NonHydrolyzed Orange Peel Extract Without Additional Nutrient Supplements

Pham Thi Tuyet[1,2], Nguyen Minh Hung[1,2], Nguyen Van Dung[1,2], and Nguyen Quang Long[1,2*]

[1] *Faculty of Chemical Engineering, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam*
**E-mail: nqlong@hcmut.edu.vn*

Abstract

Bacterial cellulose (BC) is a key product of acetic acid bacteria fermentation. BC possesses extraordinary properties, including high mechanical strength, excellent water retention, a high crystallinity index, biodegradability, and biocompatibility. These superior physical and mechanical characteristics make BC is considered a potential material that can be applied in many fields. However, high production costs and low fermentation efficiency are still noteworthy problems that need to be addressed to produce BC on a large scale. To address this issue, agricultural waste materials offer an abundant and cost-effective alternative. This study investigates the use of orange peel extract, without any hydrolysis treatment, as a carbon source for BC production. The objective was to optimize fermentation conditions to maximize BC yield from orange peel extract and characterize the resulting BC. After harvesting, the BC was dried at 50°C for 24 hours to remove moisture. The results revealed that the optimal conditions for BC production included the orange peel extract of 100%, an initial pH medium of 10, a fermentation temperature of 30°C, a fermentation duration of 14 days, and a bacterial concentration of 15%. Advanced analytical techniques were employed to characterize the synthesized BC. X-ray diffraction (XRD) analysis indicated that the BC produced from orange peel extract had a high crystallinity index of 86.92%. Scanning electron microscopy (SEM) revealed that the BC possessed a robust microfibrillar structure, confirming its superior physical properties. This study proves that orange peel can be used as a sustainable and cost-effective alternative carbon source for BC production

---

ID_15: Convergence of the solutions for weak vector quasi-equilibrium problems

Xuan Dai Le[1,2], Nguyen Van Hung[3], Hong Phuc Nguyen[1,2], Xuan My Nguyen[1,2]

[1] *Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Vietnam*
[3]*Posts and Telecommunications Institute of Technology*
Email: ytkadai@hcmut.edu.vn

Abstract

In this paper, we first establish weak vector quasi-equilibrium problems in finite dimensional spaces. After that, we introduce the auxiliary solution sets and the concept of Rp+-quasi-convexity of the objective functions for weak vector quasi-equilibrium problems. Finally, based on the auxiliary solution sets and the concept of Rp+-quasi-convexity, we study the Painleve-Kuratowski lower convergence and convergence of the solution sets with a sequence of mappings converging continuously for these problems. Many examples are given for the illustration of our results. Our results in this paper are new and different some main results in the literature.

ID_80: Fluorescence Turn-On Probe Based Detection of Orchid Viruses

Xuan-Yu Chen[1], Ryan Liou[1], Cheng-Chung Chang[1,2]

[1]*Graduate Institute of Biomedical Engineering, National Chung Hsing University*
[2]*Intelligent Minimally-Invasive Device Center, National Chung Hsing University*
**E-mail: ccchang555@dragon.nchu.edu.tw*

Abstract

Taiwanese agriculture faces multiple challenges, including declining food self-sufficiency rates, labour shortages, food safety issues in agricultural products, and excessive use of fertilizers. To address the pressing issue of food safety, this study develops an orchid rapid screening fluorescent kit which containing several fluorescence turn-on molecules. All the fluorescence signals can be revealed as barcode by spectra deconvolution, and then give a licensee for every virus. This method features low detection limits, high selectivity, and ease of use, aiming to improve the quality and health of agricultural products while reducing the use of pesticides and fertilizers, thereby promoting sustainable agricultural development. The fluorescent molecules in this kit can react with specific amino acid, lysine, cysteine, histidine, tryptophan to present the relative fluorescence signals, respectively. By resolving these fluorescence spectra and analyzing the amino acid ratios, the system can create unique virus-specific barcodes to facilitate quick and accurate identification of orchid viruses. This protocol cannot only make timely decisions about crop treatment and protection, but also reduce need for chemical inputs contributes to a healthier environment and safer food supply. Overall, this advancement represents a significant step forward in modern agricultural practices, offering substantial benefits to both producers and consumers. The application of this technology extends beyond virus detection, with potential uses in other agricultural areas such as soil health monitoring and crop nutrient status assessment. By providing real-time, accurate data, farmers can implement precision agriculture strategies, optimizing resource use, increasing yields, and reducing environmental impact. This innovative approach has the potential to drive agriculture towards a smarter, more sustainable future, contributing to food security in Taiwan and globally.

ID_85: Cancer Theranostic Evaluation from the Intracellular Dark/Photo-toxicity Investigation of Benzothiazole Derivatives

Ryan Joshua Liou1, Xuan-Yu Chen1 and Cheng-Chung Chang1,2*

[1]*National Chung Hsing University Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taichung, Taiwan*
[2]*Intelligent Minimally-Invasive Device Center, National Chung Hsing University, Taichung, Taiwan*
**E-mail: ccchang555@dragon.nchu.edu.tw*

Abstract

Cancer has been a long-standing health issue for humanity. According to statistics from the World Health Organization, approximately one in five people suffer from cancer, with around 20 million new cases each year and about 10 million deaths annually. However, traditional treatment methods such as surgery, chemotherapy, and radiotherapy often lead to significant side effects due to large wounds or toxicity, resulting in longer recovery periods. Therefore, developing new treatment methods such as minimally invasive surgery, immunotherapy, and targeted therapy is crucial. Among them, photodynamic therapy (PDT) is a non-invasive treatment method aimed at killing specific cancer or diseased cells while preserving the integrity of surrounding tissues. It involves irradiating a light source at specific wavelengths to produce reactive oxygen species (ROS), where photosensitizers (PS) play a crucial role. The effectiveness of hotosensitizers as photodynamic therapy drugs depends on their targeting ability and ROS production levels. The molecular structure significantly influences the chemical properties of photosensitizers, which in turn affect their behavior in cells. Additionally, ensuring the accuracy of cancer diagnosis and treatment requires high sensitivity and specificity, enabling selective detection and targeting of cancer cells. Fluorescence molecular imaging offers advantages over traditional detection techniques, including simplicity of operation, high sensitivity, and non-invasion. In this study, the structure-activity relationships (SAR) of 2-(2'-aminophenyl) benzothiazole (ABT)-based derivatives were developed, with conjugating 4- vinylpyridinium and boron difluoride (BF2), respectively. The unique optical and biological behaviors were evaluated and characterized with the criteria of molecular properties, twistintramolecular charge transfer (TICT), aggregation-induced emission enhancement (AIE), reactive oxygen species (ROS), intracellular localization and uptake, photo/dark-toxicity. Eventually, we conclude some compounds as potenially dual-toxic efficacy molecules because they exhibit selective dark cytotoxicity and photodamage efficient on cancer cells. More importantly, fluorescence signal display and switching allow us to inspect the uptake and tracing of molecules in cells more easily. In the future, we will support the optimal combinational treatment course for the best dual cytotoxicity efficacy.

ID_100: Enhanced Physiological Function and Improved Exercise Efficiency through Intelligent Oxygen

Chia-Feng Hsieh [1], Cheng-Chung Chang [*1] and Tun-pin Hung [2]

[1]*Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taichung, Taiwan*
[2]*Office of Physical Education, Tamkang University, New Taipei City, Taiwan*
**E-mail: ccchang555@dragon.nchu.edu.tw*

Abstract

So far, highly active oxygen-containing molecules still play an important role in various technological breakthroughs of scientific development in environmental, biotechnology, materials, medical, and defense sciences. Singlet oxygen, a form of reactive oxygen species (ROS), is produced by the electronic excitation of molecular triplets from oxygen, which can offer a relatively high energy of about 94 kJ/mol compared to the ground state molecular O2. Such reactivity of singlet oxygen has inspired a wide array of emerging applications in chemical, biochemical, and combustion phenomena. It is known that 75% of the oxygen inhaled in the air is exhaled without being utilized. To assist organisms in better utilizing the oxygen inhaled from the air, thereby supporting training and facilitating faster success, we designed and tested a device called Generator Singlet Oxygen (GSO) to convert the environmental air into energy-rich smart oxygen. The GSO device contained a light source (red light LED in this study), photosensitizer material, and an air pump. Based on the principle of photosynthesis, the photosensitizer was irradiated by light to stimulate oxygen to generate singlet oxygen, and then release singlet oxygen energy (SOE) after the singlet oxygen relaxation process. We hypothesize that this energy can enhance physical stamina and efficiency during exercise. Based on data from 14 untrained volunteers, we designed and conducted experimental exercise tests to compare the effects of inhaling SOE generated by the GSO device respiratory system versus conventional techniques. This study found that intervention with singlet oxygen energy during exercise effectively reduces blood lactate levels and improves oxygen utilization. Lactate is cleared or metabolized under enough oxygen conditions, suggesting that singlet oxygen energy may enhance lactate removal and metabolic capacity. Results from submaximal running tests demonstrated significant reductions in running energy expenditure, decreased oxygen uptake, and improved running economy in a singlet oxygen energy environment, indicating more efficient oxygen utilization and higher efficiency.

ID_124: The Impact of Transcutaneous Vagus Nerve Stimulation on Depression in College Students

Ting Yi Shen[1], Pengta Liu[2], Congo Tak Shing Ching[1*]

[1]*National Chung Hsing University*
[2]*Changhua Christian Medical Foundation*
**E-mail tsching@nchu.edu.tw*

Abstract

Background: Depression, a common issue among college students, significantly affects their academic performance and overall quality of life. Transcutaneous vagus nerve stimulation (tVNS) through auricular points emerges as a potential solution for mitigating depressive symptoms.
Methods and Materials: This study involved nine college students (4 males, 5 females). Each participant was subjected to two tVNS stimulation protocols: Mode A (monophasic mode) and Mode B (biphasic mode). These modes were randomly assigned with a one-week interval. Each mode's electrical stimulation was administered for 15 minutes daily over a span of five days. Heart rate variability (HRV) parameters, including SDNN, SD1, SD2, NN50, and PNN50, were recorded. The outcomes were analyzed using Generalized Estimated Equation (GEE) models, including factors stimulation mode and treatment periods.
Results: No significant differences were observed in the main effects of stimulation type and treatment periods. However, notable changes were detected in HRV parameters (SDNN, SD2, NN50, and PNN50) between the first and second day. Mode A demonstrated higher HRV values compared to Mode B after tVNS stimulation.
Conclusion: The findings suggest that tVNS potentially influences HRV, indicating an indirect mechanism for depression improvement. To validate these initial findings, further research involving more frequent and extended stimulation sessions is recommended.

ID_155: Estimation of Vital Signs Appropriate for the Vietnamese Population Using Photoplethysmography Signals: Methodology Study

Quang Linh Huynh[1,2], Nguyen Son[1,2], Trung-Hau Nguyen[1,2], Le Quoc Khai[1,2]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Vietnam*
E-mail: huynhqlinh@hcmut.edu.vn

Abstract.

This study focuses on developing a methodology for estimating vital signs, specifically tailored to the Vietnamese population, using photoplethysmography (PPG) signals. PPG is widely used for monitoring vital signs such as heart rate and blood oxygen saturation, and it can also be used for estimating blood pressure and blood glucose levels. However, variations in physiological characteristics among different populations can affect the accuracy of these measurements. This study aims to develop a methodology that addresses these variations, focusing on the Vietnamese population. By methodology, main factors were considered as follows: (i) Data collection based on PPG signals will be collected from a diverse sample of the Vietnamese population, ensuring representation across different ages, genders, and health conditions; (ii) Advanced signal processing techniques will be employed to filter noise and enhance the quality of the PPG signals; (iii) Key features related to heart rate, blood oxygen saturation, and blood pressure will be properly extracted from the processed PPG signals; (iv) Model development based on machine learning models will be trained, validated and tested using the extracted features to estimate the vital signs accurately ; and (v) Population-specific adjustments will be made to the models to account for the unique physiological characteristics of the Vietnamese population. The pilot results present the feasibility and reliability of the developed models in estimating vital signs for the Vietnamese population. A comparative analysis with existing methodologies will also be provided to highlight the improvements achieved through population-specific adjustments. This study proposes a comprehensive methodology for estimating vital signs using PPG signals, specifically tailored for the Vietnamese population. The developed models show significant reliability, demonstrating the importance of considering population-specific characteristics in health monitoring systems.

ID_158: Exercise Stress Test In Detecting Coronary Heart Disease With Load Control Indoor Cycle

Dang Le Cao[1,2*], Nguyen Duy Anh Tran[1,2], Thai Ton Minh[1,2], Tuong Long Nguyen[1,2]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
E-mail: lecaodang@hcmut.edu.vn

Abstract

Nowadays, cardiovascular disease remains a top priority in safeguarding human health. Among them, coronary artery disease accounts for the highest proportion of cases and is increasingly affecting younger individuals. Additionally, a significant number of cases either exhibit no symptoms or present with atypical symptoms, nearly equaling those with classic symptoms. Exercise electrocardiography is regarded as a safe and effective method that can be performed outside medical facilities to detect and diagnose early abnormalities in coronary circulation. For our project, we utilized equipment available in the laboratory, such as stationary bicycles, to adjust the load to stimulate an increase in the participants' heart rate. Simultaneously, we recorded electrocardiographic signals and heart rates throughout the process using the Biopac MP36 system. From the collected signals, our team proceeded to analyze the electrocardiogram based on medical standards, consulting with experts in the field of medicine to derive the final results. Through the conducted experiments, our team identified a case with abnormalities in coronary circulation. The individual has been informed of the results to undergo more precise examinations at medical facilities, enabling them to assess their health status and pursue suitable improvements in the future. Exercise stress electrocardiography performed by our team with standardized exercises is a safe and effective method for diagnosing coronary artery conditions. It yields satisfactory results in capturing signals essential for subsequent diagnostic processes.

ID_167: Assessment of Muscle Fatigue via Surface Electromyography Signal Analysis using Higuchi Fractal Dimension with Tuning Parameter

Hung Anh Nguyen[1,2*]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam
E-mail: anh.nguyenk2020@hcmut.edu.vn

Abstract

Electromyography (EMG) measures muscle response or electrical activity in response to nerve stimulation of the muscle. Surface electromyography (sEMG) measures electrical signals from the surface of the skin that muscles emit. Researching and evaluating muscle fatigue using single-channel electromyographic signals with typical characteristic parameter is a new approach. Muscle fatigue is a common condition during both exercise and daily physical activity. Reduced muscle tone can affect the quality of performance and can even cause injury during exercise, which is muscle fatigue. The assessment of muscle fatigue is validated when applied with fractal dimension (FD) analysis. Data were collected by recording single-channel surface electromyography signals from the experimental group. In this study, muscle fatigue is analyzed through the Higuchi Fractal Dimension (HFD) algorithm and a selection of Kmax tunning parameters in the range from 2 to 100.

ID_28: The molecular dynamics simulation of fullerene properties in water

Phuc Le[1,2*]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam
E-mail: lvphuc.sdh231@hcmut.edu.vn

Abstract

In recent years, research on fullerenes and their compounds has attracted much attention from research groups around the world. The interaction of C60 and other fullerene solutes with the solvent environment has contributed to the developments in materials science research. Extraction and purification of fullerene from impurities requires a delicate choice of solvent for chromatographic separation. Hence, understanding the interaction of fullerene with many different solvents will provide useful information to make a reasonable choice of solvent so that fullerene can be purified economically and on a smaller scale. Solubility data plays an important role in the selection of stable phases and the type of chromatography used. With its unique cage structure, fullerene interacted with the solvent in a special way, providing useful information about the solute-solvent interaction mechanism. Fullerene is also a potential material for improving the performance of solution-processable organic thin-film transistors and bulk heterojunction solar cells because of its unique geometrical and electrostatic properties. In addition, fullerene can be used in a variety of medical fields thanks to its solubility, aggregation, and solvation properties. The solubility of nonpolar substances in water is currently a controversial issue compared to current theoretical methods. According to the theoretical description, small hydrophobic substances (d < 1nm) are introduced into the water hydrogen network accompanied by small perturbations into the water structure, and then their hydration process is accurately recorded by water density fluctuation. In contrast, large hydrophobic substances (d >1 nm) when placed in water are not able to form a stable hydrogen bond network, and their hydration is accompanied by a drying effect on the solute surface (forms a vapor-like layer when in contact with a hydrophobic substance). Therefore, the diameter-length dependence of hydrophobic hydration has influenced modern models of the hydrophobic effect. In the field of medical research, the substances used as drug carriers must meet the requirement of distribution within the body, while most of our body weight is water. As we know, cells are separated from the blood plasma by a lipid membrane. Therefore, drug carriers must be able to be absorbed through the membrane and dissolved in the polar solution of the blood. A carrier or an active ingredient that meets these conditions have high bioavailability. It is a fact that most organic compounds are poorly soluble in water, so they tend to be more lipophilic than hydrophilic. However, just because a substance is lipophilic does not mean it cannot be distributed in water. The hydration of C60 fullerene colloidal particles with a diameter of approximately 1 nm has been of interest to drug delivery researchers, as the carbon structure of C60 is at the boundary between small and large hydrophobic solutes on the length scale of hydration. In addition, fullerenes show quite special hydrophobic properties: not only are fullerenes insoluble in water showing their hydrophobicity at the macroscopic level but also shows their effective pairwise interaction in aqueous solution including the solvent-induced repulsive contribution. There is a comprehensive study of the solubility factors of fullerenes in water in terms of physicochemical properties, including solubility, free energy of dissolution, and entropy changes. However, the low solubility of fullerenes in water and high aggregation make it difficult to obtain the above data experimentally. Consequently, experiments mostly focuse on colloidal C60 rather than molecular C60 (a true solution).

ID_47: Comparison of water bamboo qualities and quantities harvested in different growth environments from Puli area in Taiwan

Chih-Chi Yang[1], Shu-Ning Lin[1], Ku-Fan Chen[1], Ming-Yu Kuo[2], Quang-Chi Bui[1] Nguyen Nguyet-Minh Phan[1] Huu-Khiem Nguyen[1] and Yung-Pin Tsai[1*]

[1]*Dept. of Civil Engineering, National Chi Nan University, 1, University Rd., Puli, Nantou, Taiwan*
[2]*Dept. of Applied Chemistry, National Chi Nan University, 1, University Rd.,Puli, Nantou, Taiwan*
**E-mail: yptsai@ncnu.edu.tw*

Abstract

As one of Taiwan's important agricultural crops,the harvest time of water bamboos is limited by environmental conditions such as season and temperature.In order to increase the total annual harvest of white bamboo shoots and improve economic efficiency, the night light filling technology is used to shorten the harvest time of Water bamboos and promote the growth of Water bamboos.Puli,as the city with the largest area of Water bamboos planted in Taiwan,currently uses the most commonly used fill lighting fixtures for light-emitting diodes(LEDs)and high-pressure sodium lamps(HPS). This study aims to examine the differences in various quality parameters of water bamboo grown under different environmental conditions, including total plant weight, plant height, basal circumference, shoot yield ratio, moisture content, ascorbic acid content (hereinafter called AsA), 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging, 2,2'-Azinobis-3-ethylbenzthiazoline-6-sulphonate) (ABTS) radical scavenging, total phenolic content, and flavonoid content. The samples of water bamboo were collected from real lands in Puli areas where water bamboos were cultivated in different season, supplementary light at night and farming practice conditions. The experimental results showed that in terms of the basic characteristics of water bamboo, there were no significant differences in plant height, basal circumference, and moisture content among water bamboos harvested under different supplementary lighting conditions and agricultural practices in the Puli area in 2022. Water bamboo yields under supplementary light irradiations at night were majorly higher than those harvested without supplementary lighting. Summer time (12.9±0.96cm /105.7±15.3g/ 31.1±2.85cm) got significantly higher yields than those of water bamboos harvested in Autumn (11.2±1.40cm/83.1±18.3g/29.4±2.63cm). For vitamin C content, water bamboos obtained using eco-friendly farming method (6.48±0.49mg /100g Sample) was significantly higher than that obtained by customary farming method (5.77±0.63mg/100g Sample) under the condition of no supplementary light. Under the eco-friendly farming method, terms of vitamin C contents in water bamboo obtained by LED irradiation and without supplementary light irradiation (6.92±0.81mg/100g Sample and 6.48±0.49mg/100g Sample) were significantly higher than that obtained by high-pressure sodium lamp irradiation (5.40±0.47mg/100g Sample). In terms of antioxidant properties, when comparing different harvest times in the water bamboo fields planted in Puli in 2022, water bamboo harvested in autumn exhibited significant differences in DPPH/ABTS radical scavenging efficiency compared to those harvested in spring. Water bamboos harvested in summer also got significantly higher levels of total phenolic content and flavonoid content compared to those harvested in spring.

ID_76: Ferrite Process for PVA Wastewater Treatment from 3D Printing: Efficiency Evaluation and Precipitate Characterization

Vincent Hsiao[1*]

[1]*National Chi Nan University*
E-mail: vincent1972@gmail.com

Abstract

This study investigates the application of the ferrite process for treating polyvinyl alcohol (PVA) wastewater generated from 3D printing. PVA, widely used as a support material in 3D printing, poses environmental challenges due to its water solubility. We conducted a comprehensive analysis of the ferrite treatment method, focusing on its efficiency and the characteristics of the resulting precipitates. Initial experiments determined the saturation concentrations of PVA in P400SC solution (37.7 g/L) and NaOH solution (76.3 g/L). The ferrite process was then applied to PVA solutions of varying concentrations (3-7 g/L), using a combination of Fe(II) and Fe(III) salts in a 1:2 ratio. Fourier-Transform Infrared Spectroscopy (FTIR) analysis of pre- and post-treatment samples revealed that the ferrite process effectively trapped soluble PVA from water during precipitation. However, the removal efficiency decreased with increasing PVA concentration, indicating a potential limitation of the method at higher PVA levels. X-Ray Diffraction (XRD) analysis of the precipitates showed poor crystallization, suggesting the presence of various iron species including Fe(OH), Fe3O4, Fe2O3, and FeO. This unexpected result implies that the presence of PVA may interfere with the ideal ferrite formation process, necessitating further investigation to enhance performance. Ongoing and future work includes Chemical Oxygen Demand (COD) analysis, exploration of pre-oxidation processes using H2O2, and investigation of pH effects through controlled adjustments. These additional studies aim to optimize the treatment process and provide a more comprehensive understanding of the ferrite method's applicability to PVA wastewater from 3D printing. This research contributes valuable insights into sustainable practices in additive manufacturing, addressing the critical need for effective treatment of PVA-contaminated wastewater. The findings pave the way for developing more efficient and environmentally friendly 3D printing processes.

ID_118: Preliminary Study: Ultrasonic/microwave-assisted extraction from orange pomace by-products: evaluation of their antioxidant and antibacterial ability

Yung-Kai LIN[1*]

[1]National Taiwan Ocean University
E-mail" nitrite.tw@gmail.com

Abstract
Orange juice processing generates approximately 50% of waste, accounting for environmental impacts and economic loss. Ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE) reduce the use of chemical solvents and reduce energy consumption and solvents while obtaining more functional compounds. This study subjected orange waste to microwave/ultrasound-assisted extraction using different solvents and powers and compared it with conventional extraction at 75°C. The experimental results showed that the optimal group for total polyphenol content was water extract using ultrasound 300 W /microwave 1250 W (U300M1250W), with a measured content of 13.70 mg (Gallic acid equivalent, GAE)/g DW. The optimal group for flavonoid content was extracted at 75°C using distilled water, with a content of 24.15 mg (Quercetin equivalents, QE) /g DW. HPLC analysis revealed a 21% increase in quercetin content in the ethanol extract using ultrasound 300 W /microwave 1250 W (U300M1250E) compared to conventional ethanol extraction at 75°C.

Similarly, there was a 41% increase in hesperidin content in the ethanol extract using ultrasound 300 W /microwave 1250 W (U300M1250E) compared to conventional ethanol extraction at 75°C. Due to the excellent antioxidant and antibacterial properties of quercetin and hesperidin, the optimal group for antioxidant capacity (ABTS) was the ethanol extract using ultrasound 300 W /microwave 250 W (U300M250E), with a content of 26.93 mg ascorbic acid equivalent/mL DW. Finally, the extraction conditions for antioxidant capacity (ABTS, DPPH, FRAP) were optimized using response surface methodology, resulting in a water extract using ultrasound power 228 W/microwave power 425 W. The ethanol extract using microwave ultrasound 300 W /1250 W (U300M1250E) exhibited significant antibacterial activity against Escherichia coli, with an inhibition zone size of 14 mm and a measured minimum inhibitory concentration (MIC) of 25 mg/mL. The optimized conditions for antimicrobial activity (MIC, minimal bactericidal concentration (MBC), inhibition zone) against Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albican s were ultrasound power 300 W /microwave power 1250 W with 40% ethanol extraction. Sustainable extraction methods to citrus extracts, reducing citrus waste issues and increasing the added value of food by-products. Extracted compounds can be used in food preservation, factory cleaning, medical industries, or functional additives in feed to promote environmental sustainability.

ID_119: The establishment and optimization of the photoreactive culture system of Dunaliella salina

Yung-Kai LIN[1*]

[1]National Taiwan Ocean University
E-mail: nitrite.tw@gmail.com

Abstract

Since human cannot synthesize carotenoids by themselves and must be ingested from the food. In addition to being rich in carotenoids, Dunaliella salina can be accumulated abundant carotenoids and exhibits colorful appearance under adversical environment. The objective of prensent study was light intensity and medium supplements can be controlled by the light reaction culture system to obtain a high biological weight and high carotenoid culture after mass culture of Dunaliella salina conditions, the subsequent induction was adjusted to biological resources rich in green, yellow and red algal pigments, the culture method was optimized by the reaction surface method, and it was found that 6 μM Fe2+, 3mM NO3-, 6 μM Fe2+, 0mM NO3-, 3 μM Fe2+ and 3mM NO3-, there will be better accumulation of carotenoids (33 pg/cell) and cell weight, and it can be understood that Fe2+ is an important factor for carotenoid-induced growth, and NO3- can promote cell growth.
After obtaining the culturing conditions of Dunaliella salina, the ultrasonic and microwave-assisted extraction systems were optimized to extract green, yellow and red algal pigments through different power combinations. Then the obtained pigments are combined with water, glycerol, chitosan polysaccharides, surfactants, etc. to analyze the characteristics of color, physical properties, bacteriostatic ability and cytotoxicity, and are actively used in the field of food safety and future food development.

ID_202: A Bi-Level Simulation for Assessing the Traffic Impact of Priority Bus Lanes in Mixed Traffic: A Case Study of Ho Chi Minh City

Hong Tan Van[1*]

[1]Faculty of Civil Engineering, Ho Chi Minh City University of Technology (HCMUT), VNU-HCM, Ho Chi Minh City, Vietnam.
**Email: vhtan@hcmut.edu.vn*

Abstract

This article introduces a bi-level simulation approach for evaluating the impacts of implementing dedicated bus lanes. We illustrate this method with a case study of a specific route in Ho Chi Minh City, which involved using iterative simulations to make incremental adjustments to reflect any changes in bus service quality or other transport system modifications. By using this approach, it is possible to minimize negative impacts and implement appropriate mitigation measures, thereby increasing the chances of successfully implementing priority bus lanes particularly in mixed traffic condition. It is important to note that the priority bus lanes itself should be seen as a mitigation measure, as it not only offers additional capacity along the corridor but also provides a safer, more reliable, and possibly more comfortable alternative transport mode for students and employees in Ho Chi Minh City, all at a lower cost.

ID_130: Synthesis of Fe/chitosan-bentonite beads for H2S adsorptive removal

Hung Nguyen Manh[1,2]**, Nguyễn Thị Trúc Phương**[1,2]**, Nguyen Quang Long**[1,2*]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam
E-mail: nqlong@hcmut.edu.vn

Abstract

In this study, the bead-like materials were successfully synthesized from a combination of bentonite and chitosan by phase inversion followed by different quantities of iron immersion for H2S gas treatment in biogas. Characterizations of the material include XRD, FTIR, and mechanical strength. Experiments of H2S adsorption happened in the continuous fixed-bed column system under various temperature conditions, the dosage of used materials, and H2S concentration in the gas stream. Two procedures used to evaluate the material's regenerated capacity include blowing air through the materials and exposing them to air after the samples adsorbed H2S for the first time. The results show that the adsorption capacity of Fe/chitosan-bentonite beads impregnated with 0.09M FeCl3.6H2O solution reached 23.9 mg_H2S/g_materials at conditions of 30oC, 0.3 g materials, and 1300 ppm H2S. In addition, this material can be over 90% regeneration after 12 hours of continuous air blowing or exposure to air.

ID_149: Health protection equipment for motorbike drivers

Tuong Long Nguyen[1,2*], Huu Kha Dang[1,2], Nguyen Hung Pham[1,2], Dinh Kien Nguyen[1,2]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam
Email: ntlong@hcmut.edu.vn

Abstract

Through the original idea of upgrading, improving the balance and stability of the motorcycle to bring comfort to the user by upgrading the front fork and the headset, specifically in the motorcycle. First, the headset of the motorcycle, our team has to change the contact position of the inner ring of the headset with the shaft of the motorcycle to increase the contact area and disperse the pressure on the inner ring of the headset, thereby helping the motorbike increase the shock absorption capacity. Second, in the fork, our group changes the size of the inner valve on the rod so that the fluid moves to meet the maximum possible shock absorption capacity. In short, our team aims to increase the shock absorption capacity to bring the most satisfaction and comfort to the driver and the passenger. Specifically, it helps the rider not to have numb hands through the parameters sent from the glove with an integrated measuring device. Next, it is to minimize neck and back fatigue of the passenger on the vehicle, which is recorded and has data in advance. From all the parameters received, our team will re-adjust the front fork and headset together to bring the best feeling to the driver and protect human health when they ride on bumpy roads.

ID_157: Investigation of bacterial cellulose production from orange peel extract

Pham Thi Tuyet[1,2*], Nguyen Minh Hung[1,2], Dung Van Nguyen[1,2], Nguyen Quang Long[1,2]

[1]Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam
**E-mail: phamtuyet@hcmut.edu.vn*

Abstract

Bacterial cellulose (BC), a principal product of acetic acid bacteria fermentation, stands out due to its remarkable purity and crystallinity, which can reach up to 80%. BC possesses extraordinary properties, including high mechanical strength, excellent water retention, a high crystallinity index, biodegradability, and biocompatibility. These superior physical and mechanical characteristics have fueled increasing research interest, particularly concerning its diverse potential applications. However, large-scale production of BC remains a significant challenge, primarily due to the high costs associated with fermentation media. Traditional culture media are expensive, making the process economically unfeasible on a large scale. To address this issue, agricultural waste materials present an abundant and cost-effective alternative. This study investigates the utilization of orange peel extract, without any hydrolysis treatment, as a carbon source for BC production. The objective was to optimize fermentation conditions to maximize BC yield from orange peel extract and to characterize the resulting BC. After harvesting, the BC was dried at 50°C for 18 hours to eliminate moisture. The result revealed that the optimal conditions for BC production included a fermentation temperature of 30°C, a fermentation duration of 14 days, and a bacterial concentration of 15%. Advanced analytical techniques were employed to characterize the synthesized BC. X-ray diffraction (XRD) analysis indicated that the BC produced from orange peel extract had a high crystallinity index of 83.2%. Scanning electron microscopy (SEM) revealed that the BC possessed a robust microfibrillar structure, confirming its superior physical properties. The study demonstrates the potential of using agricultural waste, such as orange peel extract, as a sustainable and cost-effective alternative for BC production. This approach not only reduces production costs but also adds value to agricultural by-products, contributing to a more sustainable and circular economy. Further research could focus on scaling up the process and exploring other agricultural wastes to enhance the commercial viability of bacterial cellulose production.

ID_162: Evaluate CO_2 adsorption capacity of modified GIS zeolite through cation exchange with alkaline and alkaline earth metals

Duy Bach Ngoc Nguyen[1,2*], Nguyen Quang Long[1,2], Duong Tran Hoang Ngo[1,2], Nguyễn Thị Trúc Phương[1,2]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
E-mail: bachngocnguyenduy.1612@gmail.com

Abstract

Zeolite materials containing GIS capillary structures have theoretical potential for application in CO2 capture. This study synthesizes zeolite ZP with a GIS structure and zeolite ZPY with a GIS-FAU structure, and modifies these two types of zeolites by exchanging cations with alkaline and alkaline earth metals, thereby investigating the effects of these components on the CO2 adsorption capacity of modified zeolite. Investigation of material structure characteristics was also studied through XRD, SEM-EDS, BET and moisture absorption capacity. The CO2 capture process took place under dynamic adsorption conditions of CO2/N2 gas flow, flow rate of 60 ml/min after activating the material at 300 oC for 2 hours. The results obtained show that the K+ cation exchange level is the highest among the cations, and the material ZPY with K+ cation exchanged has a CO2 adsorption capacity of 113.38 mg_CO2/g_material. This mixture also shows good regeneration ability under temperature conditions of 150 oC after 90 minutes of vacuum.

ID_163: Proactive Drowsiness Alert System for Motobike Riders

Tuong Long Nguyen[1,2], Thu Ha Pham[1,2], Thuy Hang Le Thi[1,2], Thien Phuc Nguyen[11,2]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
Email: ntlong@hcmut.edu.vn

Abstract

In Vietnam, road traffic connectivity systems within inner cities or between large cities and satellite cities have increased rapidly, in recent years, leading to a high increase in electric motorcycles traffic, especially in Ho Chi Minh City. In case of long travel, or poor health, motorbike or electric motorcycle riders get tired easily. Furthermore, when the riders hit the brake suddenly or they are in the event of a collision, they oftern lean forward, which can cause a traffic accident. First, the article focuses on designing and manufacturing sensors attached to helmets to monitor steering movement, acceleration and force impacts on the rider's head. This proactive alert system helps to alert the motorbike riders any signs of drowsiness. Finally, the features of stimulating acupuncture points in the rider's head is researched to help them regain consciousness.

ID_164: Innovation in Caring for and Protecting the Health of Motorbike Riders using CDSIO Tools

Tuong Long Nguyen[1,2], Dai Hung Hua[1,2], Huu Kha Dang[1,2], Anh Tai Le[1,2]

[1]*Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vietnam*
Email: ntlong@hcmut.edu.vn

Abstract

In this article, the calculation function, virtual and reality simulation of the motorbike riders by using CDSIO toolis applied to electric motorcycles. The innovation process is built according to the reverse design process, to overcome disadvantages such as the large vibration amplitude of the electric motorcycles frame, the ability to resonate in the multi-body mechanical system. First, patents on forks or neck cups of electric motorcycles are referenced and analyzed using the finite element method, through ANSYS/ LS-DYNA software. After that, the motorcycle assembly was proposed to be improved, to help manufacturers have more basis for balancing the frame structure, or auxiliary equipment, based on virtual and real data in the CDSIO.

ID_186: Nonlinear bending of an agglomerated CNT-reinforced composite sandwich beam and frame structure

Nguyen Dinh Kien[1,2], Tran Thi Thu Huong[3], Tran Quang Vinh [3] and Bui Thi Thu Hoai[3,4,*]

[1]*Institute of Mechanics, VAST, Hanoi, Vietnam*
[2]*VNU University of Engineering and Technology, 144 Xuan Thuy, Hanoi, Vietnam*
[3]*Faculty of Vehicle and Energy Engineering, Phenikaa University, Yen Nghia, Ha Dong, Hanoi 12116, Vietnam*
[4]*School of Mechanical Engineering, Hanoi University of Science and Technology, Hanoi, Vietnam*
**E-mail: hoai.buithithu@phenikaa-uni.edu.vn*

Abstract

The nonlinear bending of composite sandwich beam and frame structure reinforced by carbon nanotubes (CNTs) is studied considering the influence of CNT agglomeration. The sandwich structure is composed of a homogeneous polymer core and two composite face sheets with effective properties being estimated by Eshelby-Mori-Tanaka homogenization scheme. A corotational beam element is derived and used to establish the nonlinear equilibrium equation. Newton-Raphson based iterative procedure is adopted in conjunction with the arc-length method to compute the response of the sandwich structure. Numerical results reveal that the agglomeration of CNTs has a significant influence on the bending of the structure, and the nonlinear response is more pronounced when the agglomeration degree is more severe. The effects of the CNT volume fraction and the agglomeration degree of CNTs on the nonlinear behavior are studied in detail. The influence of the core-to-thickness ratio on the nonlinear response of the sandwich beams and frames is also examined and highlighted.

INVITED SPEAKER: From Curiosity to Innovation: Bridging Boundaries in Research and Collaboration

ASISSTANT PROFFESSOR CHRISTINA GARCIA ALVAREZ[1]

[1]*Department of Human Intelligence Systems Graduate School of Life Science and Systems Engineering, Kyushu Institute of Technology, Japan.*

This presentation delves into the journey from curiosity to innovative research. It highlights global opportunities for collaboration and scholarships, including the Monbukagakusho (MEXT). Discover research in AI-driven healthcare and human activity recognition. Learn how to connect with leading institutions worldwide. Expand your potential through international research and innovation.

W1: Polyvinyl alcohol/Chitosan/Gelatin hydrogel incorporated with betel leaves for enhanced wound care management

Tran Tam Nha[1,2*], **Nguyen Xuan Thanh Tram**[1,2]

[1] *Division of Biomedical Engineering, Falculty of Applied Science, Ho Chi Minh University of Technology, Ho Chi Minh City 70000, Vietnam*
[2] *Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City 70000, Vietnam*
[*]*E-mail: nha.tran181103@hcmut.edu.vn*

Abstract

Wound care management is crucial in healthcare, prompting the development of advanced materials to facilitate effective healing. Researchers efficiently prepared the PVA/Chitosan/Gelatin hydrogel, thoroughly examining its physicochemical properties. Overall, this innovative hydrogel holds promise for wound care strategies. Furthermore, the hydrogel exhibited excellent compatibility with human cells, supporting its potential for in vivo applications. Animal studies further evaluated its effectiveness in promoting wound closure, tissue regeneration, and reducing inflammation.
Hypothesis: The betel leaves, known for their antimicrobial and anti-inflammatory properties, enhance the hydrogel's therapeutic potential.
Objectives: Investigate the concentration of betel leaf powder to determine the optimal concentration for the PVA/Chitosan/Gelatin mixture for wound healing applications.
Preliminary Results/Progress: Had found the suitable ratio of PVA/Chitosan/Gelatin incorporated with betel powder and tested the antibacterial properties of each betel concentrations. Evaluate the antibacterial test by using other types of bacteria and SEM/FTIR for further analysis.
Conclusion: This study has determined that the PVA/Chitosan/Gelatin in a ratio of 2:1:1, with an addition of 15% betel concentration, stands out as a suitable and stable choice in comparison to other concentrations.

W2: The effect of freeze-thaw treatment on the properties of gelatin/carbonate apatite membrane for nerve regeneration scaffold

Dao Minh Khanh Tuyen[1,2*], **Nguyen Xuan Thanh Tram**[1,2]

[1]*Division of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology, Ho Chi Minh City 70000, Vietnam.*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc District, Ho Chi Minh City 70000, Vietnam*
[*]*E-mail: tuyen.daominhkhanh@hcmut.edu.vn*

Abstract

Nerve injuries present significant challenges due to the complexity of nerve tissue, necessitating the development of effective scaffolds for regeneration. Gelatin, known for its biocompatibility, is commonly used but lacks the necessary mechanical strength for nerve regeneration. Carbonate apatite (CO_3Ap), a mineral similar to human bone, offers the potential for improving scaffold properties. This study explores how freeze-thaw treatment influences the mechanical, biodegradability, and permeability properties of gelatin-CO_3Ap membranes for use in nerve regeneration scaffolds.
Hypothesis: Freeze-thaw treatment improves the mechanical strength, biodegradability, and molecular permeability of gelatin-carbonate apatite (CO_3Ap) membranes, making them more suitable as scaffolds for nerve regeneration.
Objectives: The research focuses on developing gelatin-CO_3Ap membranes, experimenting with different gelatin-CO_3Ap ratios, and evaluating the impact of freeze-thaw treatment. The goal is to enhance mechanical strength, biocompatibility, and degradation rates to create an optimal scaffold for nerve repair.
The research methodology involves synthesizing gelatin-carbonate apatite (CO_3Ap) membranes using a freeze-thaw process to improve their mechanical properties for nerve regeneration scaffolds. CO_3Ap particles are synthesized by collecting and cleaning chicken bones to remove soft tissue and impurities, removing organic matter, calcining at 500°C for 2 hours, and grinding to a particle size 200 µm. The gelatin-CO_3Ap membranes are created in different ratios and subjected to freeze-thaw cycles to induce physical cross-linking. Mechanical properties like tensile strength and elasticity are tested. Biodegradability is assessed by monitoring the membranes' degradation in phosphate-buffered saline (PBS), while swelling capacity and permeability to glucose are also evaluated. Platelet loading and release profiles are studied using platelet-rich plasma (PRP) from Wistar rats to measure the membrane's ability to support nerve regeneration. Analytical techniques like XRD, FTIR, and statistical analysis are employed to assess structural properties and evaluate the impact of freeze-thaw cycles on the scaffold's performance.

W3: Biomechanical Impact Analysis of Cage Positioning in Lumbar Interbody Fusion by the Finite Element Method

Le Duy Nguyen Ho[1,4], Thi Hoang Thuy Le[1,4*], Thuc Tri Dang[2,4], Truc Tam Vu[3], and Thien Tich Truong[2,4*]

[1]*Department of Biomedical Engineering, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[2]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), Ho Chi Minh City, Vietnam*
[3]*Spine Department B, Hospital for Traumatology and Orthopedics, Ho Chi Minh City, Vietnam*
[4]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam.*
[*]*E-mail: tttruong@hcmut.edu.vn, thuy.lehoang@hcmut.edu.vn*

Abstract

Transforaminal Lumbar Interbody Fusion (TLIF) is a surgical procedure used to treat chronic lumbar conditions, such as degenerative disc disease and spinal stenosis, and acute issues like trauma and tumours, by stabilizing the spine when conservative treatments fail. The procedure involves removing the intervertebral disc and inserting a bone graft with a cage to provide support and eliminate movement between vertebrae. This present paper utilizes a finite element model (FEM) to analyze the effects of different cage positions on facet joint forces, vertebral body strains, and posterior rod stabilization in lumbar fusion, aiming to determine the optimal cage placement for clinical outcomes and initial fusion stability.

The L4-L5 segment was selected for the TLIF model due to its higher incidence of degeneration. A three-dimensional FEM was developed from the CT scan data of a healthy 32-year-old woman's lumbar spine. The process involved segmenting the CT scan using Mimics 21.0, creating non-uniform rational b-spline (NURB) surfaces in SolidWorks, and importing them into ANSYS for meshing and material assignment. The cage, made of PEEK, and the screws and rods, made of titanium, were placed in two positions: anterior and posterior. The model assigned distinct material properties, including Young's modulus and Poisson's ratio, for cortical bone, cancellous bone, fusion cage, and posterior elements. Table 1 in Appendix illustrates the varieties of elements and material parameters for each component of the implanted model. To simulate body weight on the L4-L5 segment, a vertical load of 400N was applied to the top of the L4 vertebra, with L5 inferior fixed as a stationary base. All contacts between the vertebrae, cage, and rods were modeled as bonded. The evaluation involved recording von Mises equivalent stress on the vertebrae, fusion cage, and posterior rods, focusing on the L5 facet joint and upper endplate. Additionally, strains in the L5 cancellous bone were observed, and positive rod stress indicating tension, negative stress indicating compression.

W4: Buckling analysis of Reissner-Mindlin plates made of functionally graded material by using meshfree method

Hoang Ngoc Dang[1,2], Duy Tien Le[1,2], Sang Minh Thai[1,2] and Thien Tich Truong[1,2*]

[1]*Department of Engineering Mechanics, Faculty of Applied Science, Ho Chi Minh City University of Technology (HCMUT), 268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam.*
[2]*Vietnam National University Ho Chi Minh City, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam.*
**E-mail: tttruong@hcmut.edu.vn*

Abstract

Recently, a new type of material called FGMs (Functionally graded materials) has been widely researched. This material can adjust the manufacturing properties such as physical, mechanical, and thermal properties. Because of that, FGMs is now used for various fields as the main material. Besides that, in material research progress, Meshfree method has shown more advantages than other methods, especially FEM (Finite element method). In this research, we will use the meshfree method to analyse and examine the Buckling of Reissner-Mindlin plate made by FGMs.

We are studying the Reissner-Mindlin plates, we can calculate when it is buckled. And we are using the meshfree method for this study, which is better in building and using than another mesh methods. So that when it is buckled, we don't need to build another mesh anymore. What we want in this study is to compare the value we a going to calculate with the value in another study using another mesh methods or another material. Base on that, we want to check the variety of FGMs with others material and the benefit if we use meshfree method than another mesh methods. Base on this study, we will try to find how FGMs plate can be applied into the normal life with the more advantage and less disadvantage than now. And also, we want to apply this meshfree method in another type of study to see more benefit this method brought. This research will calculate and compare the result of meshfree method with other completed research using different methods to confirm the accuracy. The advantages of the meshfree method and FGM plates will lead to wider use of FGM plates in practical problems.

W5: Assess Student Spiritual Life Quality Based On Mobility And Behavioural Data

Hoang Khang Phan[1,3*], Tu Nhat Khang Nguyen[2,3], Anh Tuan Ha[2,3], Nguyen Phat Vo[2,3], Nhat Tan Le [1,3]

[1]*Department of Biomedical Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[2]*Faculty of Computer Science and Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam.*
[3]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: khang.phan2411@hcmut.edu.vn, lenhattan@hcmut.edu.vn*

Abstract

The prevalence of student absenteeism in contemporary educational settings is a concerning issue. While both intentional and unintentional absences occur, psychological issues are named as a common underlying factor. For instance, in recent years, there has been a growing recognition of the importance of student well-being and its impact on academic performance. Traditional methods of assessing student well-being, such as surveys and interviews can be time-consuming and may not fully capture the nuances of student behavior in certain situations. To address the limitations, smartphone data serves as a dedicated resource to investigate. Specifically, the use of mobile technology to continuously monitor and analyze student behavior (e.g attending class, going shopping, etc.), providing a more comprehensive and more intuitive of their well-being. In addition, mobile devices are the most popular devices used among people, which facilitate the process of collecting and gathering data.

By integrating sensors and data analysis techniques into smartphones, real-time data on student movement patterns, emotional states, and environmental factors can be collected which offers more insight over traditional methods. With these behavioral indicators in conjunction with other relevant factors, this research aims to gain a comprehensive understanding of the underlying causes of student absenteeism and develop effective strategies to mitigate the psychological issues of students.

W6: Mitigating Uv-Induced Skin Damage: Design And Evaluation Of A Uvb Detection Device

Huu Tho Nguyen [1,2], Cao Dang Le[1,2] and Trung Tin Tran[1,2]

[1]*Department of Biomedical Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: trtrtin@hcmut.edu.vn*

Abstract

Ultraviolet (UV) rays, especially UVB rays ranging from 280-315 nm, have a significant impact on human skin. It has been evaluated that sun based bright radiation accounts for roughly 93 percent of skin cancers and approximately half of lip cancers. This interprets to roughly 4,500 life-threatening cancers (cutaneous dangerous melanoma) per year in Canada, as well as 65,000 less genuine cancers [1]. This study develops and evaluates a wearable device to detect UVB radiation intensity and its absorption through human skin. The device incorporates an Arduino Nano, an LTR390UV01 photodiode circuit, LEDs operating at 365-375 nm and 280-320 nm wavelengths, and machine learning algorithms for signal processing. By correlating measured UVB intensity with known skin absorption characteristics, the device aims to provide real-time warnings to users, allowing them to take protective measures against harmful UV radiation. The research objectives include evaluating the accuracy and reliability of the device under various environmental conditions, assessing the impact of UVB radiation on skin health, and providing practical solutions to mitigate these impacts through timely monitoring and warning. Using this device is especially important on days with a high UV index, helping to reduce the risk of exposure to harmful UV rays, especially for people who work outdoors, who are at higher risk of developing the disease due to the requirement to spend time outdoors [9].

W7: A Study Of The Impact Of Relaxation Music Through Electrocardiography

Nguyen Thanh Hien Hoa[1,3]*, Bui Thien Thanh Tu [1,3], Tran Mai Phuong[2,3], Nhat Tan Le[1,3]

[1]*Department of Biomedical Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[2]*Faculty of Computer Science and Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[3]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: hoa.nguyen352003@hcmut.edu.vn, lenhattan@hcmut.edu.vn*

Abstract

Stress and anxiety in the academic environment tend to be common among university students and significantly affect their performance. Music therapy was introduced as a field of research that applied music in healthcare. Music can make our senses calmer and create relaxed responses, but this healing way is inherently immeasurable, because of the lack of standardization. The impact of music can be objectively evaluated through physiological parameters. Therefore, looking for a method which can help students improve their mental health, such as listening to music, has been suggested to have a positive impact on well-being by reducing stress and promoting relaxation.

The aim of this research is to investigate the influences of relaxing music on the physiological responses of university students and is measured by using electrocardiography (ECG). By monitoring changes in heart rate, heart rate variability (HRV) and other indicators derived from ECG, this study aims to objectively assess the impact of relaxing music on the physiological state of students. Knowing the musical characteristics that can optimally enhance relaxation and mental well-being.

W8: Leveraging Large Language Models for Medical Reporting from X-ray Images in a Chatbot

Thi Mong Xuyen Nguyen[1,2*], Mai Long Trinh[1,2] and Nhat Tan Le[1,2*]

[1]*Department of Biomedical Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: xuyen.nguyen1305@hcmut.edu.vn, lenhattan@hcmut.edu.vn*

Abstract

Recent advancements in deep learning and large language models have opened new avenues for understanding clinical language, leading to the development of systems that assist decision- making, shorten diagnostic times, and enhance treatment efficacy. This progress holds immense benefits for medicine, especially considering the lengthy training required for clinical practitioners to achieve proficient diagnostic skills, all while the volume of medical knowledge continues to expand. Chatbots simulate human conversations and have become an important application in this context. Advances in Natural Language Processing (NLP) combined with large language models (LLMs) have demonstrated impressive performance across various tasks. LLM-powered chatbots are now being deployed in multiple biomedical settings, serving as effective references for patients seeking consultation and deeper understanding of their imaging results. These chatbots possess the capability to synthesize vast amounts of medical data. By automating the analysis of X-ray images and extracting critical features to diagnose patient conditions, they contribute significantly to the advancement of healthcare. Furthermore, the communication abilities of chatbots have the potential to supplement human interaction with healthcare professionals.

W9: Autism Spectrum Disorder Classification on EEG Signal: A Spectrogram and Deep Learning Approach

Tu Nhat Khang Nguyen[1,2*], Minh Quang Tran[1,2] and Doi Hirokazu[3]

[1]*Faculty of Computer Science and Engineering, Ho Chi Minh City University of Technology, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
[3]*Department of Information & Management Systems Engineering, Nagaoka University of Technology, Nagaoka, Niigata, Japan*
**E-mail: khang.nguyentusteven@hcmut.edu.vn*

Abstract

Autism Spectrum Disorder (ASD) is a neurodevelopmental disability. The brain structure in those with and without ASD is different. This difference causes those with ASD to have difficulty in social interactions and behave or perform tasks such as learning differently than others. ASD diagnosis currently relies on the work of psychiatrists. Because of this, people have to wait for months or years to get an ASD assessment for their child, or for themselves. EEG, on the other hand, can be less expensive, and more accessible, while providing a very accurate view into the innerworkings of ASD. For the classification task, Jacek et al. proposed using classical machine learning methods on the power of standard frequency bands and PLV connectivity score between electrodes. Jie et al., on the other hand, proposed linear SVM combined with time and frequency domain features, specifically peak voltage, and mean power of the alpha band. Meanwhile, others have utilized spectrogram images generated from EEG and deep learning for the task. Al-Quazzaz et al. have proposed a transfer learning and hybrid learning method on EEG spectrograms for the classification task, with an accuracy of 87.8% and F1 of 94.8% for 4 classes of ASD severity. Meanwhile, Tawhid et al. proposed their own model for binary classification on EEG spectrogram with an accuracy of 94.8% and 100% F1. In this study, we are using the spectrogram approach, as it can represent accurately the frequency and time domain features extracted by Jacek et al. and Jie et al. on a single image. Furthermore, CNNs can discover complex patterns in the spectrogram that machine learning models cannot on an extracted set of features.

W10: Design of wheelchair bed combined with phototherapy for stroke patient

Minh Man Nguyen[1,2*], Mai Huu Xuan[1,2]

[1]*Faculty of Applied Science, Ho Chi Minh University of Technology, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: man.nguyen0406@hcmut.edu.vn*

Abstract

Stroke, or cerebrovascular accident, refers to conditions related to damage to the nervous system that affects the body's functions. Clinically, strokes are mainly divided into two types: ischemic stroke and hemorrhagic stroke. The rate of ischemic stroke in Vietnam predominates, and the major sequelae it leaves for patients is motor paralysis. For patients to recover and regain lost functions, it is essential during the early stages—when the patient cannot move independently and when neuroplasticity is at its best—to perform repetitive therapeutic exercises on the affected side, as the areas responsible for that function will develop more with increased activity. Additionally, for patients with motor paralysis, prolonged bed rest can lead to several other complications; thus, it is necessary to frequently change the patient's position and uplift their spirits by taking them outside rather than keeping them confined to a single spot. Currently, devices on the market, such as beds and wheelchairs, are independent, and risks can occur when moving patients between these devices. Some beds are equipped to change positions but tend to be quite large, and although they have wheels, they are not suitable for transporting patients. Water constitutes a significant part of cells, serving as the primary absorber of infrared radiation; therefore, a thermal effect occurs in most cells. For individuals who have had a stroke and are paralyzed, muscle atrophy commonly occurs, so to mitigate this, infrared light can be incorporated to enhance blood circulation and improve oxygen exchange. Additionally, red light, while not penetrating as deeply as infrared light, can help increase blood circulation at a shallower level. Based on the limitations and benefits of light in treatment, it is necessary to design a device capable of automatically converting from a bed to a wheelchair and vice versa, while also supporting rehabilitation exercises, such as leg exercises, and integrating phototherapy to enhance recovery outcomes for patients.

W11: Spinal Decompression Belt With Infrared Light

Duy Anh Pham[1,2*], Mai Huu Xuan[1,2]

[1]*Faculty of Applied Science, Ho Chi Minh University of Technology, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
[*]*E-mail: anh.phamduy03@hcmut.edu.vn*

Abstract

In Vietnam, back pain and spinal disorders are becoming increasingly prevalent, especially among middle-aged and elderly individuals. A recent study revealed that up to 30% of the Vietnamese population has experienced back pain at least once in their lifetime. Sedentary lifestyles, improper working postures, prolonged stress, and natural aging are the primary causes of this condition. Alarmingly, spinal disorders not only affect physical health but also significantly reduce the quality of life, hindering daily activities and work. The impact of back pain and spinal degeneration can lead to a decreased quality of life, disrupted sleep, impaired work performance, and limited mobility, causing stress and fatigue. Additionally, these conditions can increase healthcare costs, as the treatment of back pain and spinal degeneration is expensive, burdening both patients and society. Given the current prevalence of back pain and spinal disorders, I have conceived a novel back brace that combines spinal fixation, traction, and infrared light therapy. This advanced medical device is designed to aid in the treatment of spinal conditions.

W12: Research On Applying Synthesizer Model On Health Record Data

Tran Phuc Nhat Mai [1,3]*, Nguyen Phat Vo[2,3], Nhat Tan Le[1,3]

[1]*Department of Biomedical Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[2]*Faculty of Computer Science and Engineering, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[3]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: nhat.maitranphuc@hcmut.edu.vn, lenhattan@hcmut.edu.vn*

Abstract

The pervasive threat of disease has spurred intense scientific inquiry into its prediction and prevention. Researchers, driven by a commitment to improving human health, are delving deeper into the intricate mechanisms underlying disease development, progression, and potential outcomes. However, the pursuit of knowledge is often hindered by the sensitivity of medical data, which raises significant privacy concerns. To overcome these challenges and advance disease research, scientists must navigate ethical considerations, develop robust data protection measures, and foster collaboration among researchers, healthcare providers, and patients. By addressing these critical issues, we can unlock the potential of medical data to drive innovation, improve disease prevention and treatment, and ultimately enhance the quality of life for individuals and communities worldwide. In out approach, we utilize and research the efficiency of Gaussian Copula Synthesizer and a Conditional Generative Adversarial Network (CTGAN) Synthesizer to generate synthetic data that more closely aligns with the specific requirements of our research objectives. This approach enables us to capture the intricate statistical dependencies inherent in the original data while also incorporating the generative capabilities of deep learning models, resulting in synthetic data that can be public and reamin its privacy. With data being synthesized, we aim to make furthur prediction and research on how different diabetes may occur.

W13: Cervical Spine Traction Device Combined with Infrared Light Therapy

Thanh Vinh Le[1,2] and Huu Xuan Mai[1,2*]

[1]*Faculty of Applied Science, Ho Chi Minh University of Technology, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
[*]*E-mail: vinh.le2003@hcmut.edu.vn*

Abstract

In the era of rapid advancements in information technology and the prevalence of office-based occupations, the incidence of cervical spine disorders has seen a significant increase. These conditions are primarily attributed to improper posture, non-ergonomic work habits, and prolonged use of computers, which can result in a range of health complications, particularly those affecting the cervical spine. Such issues may lead to serious conditions, including cervical spondylosis, cervical disc herniation, and the increasingly prevalent condition of cervical kyphosis. Cervical spine traction devices play a crucial role in the therapeutic management of cervical spine pathologies. By applying traction, these devices alleviate pressure on intervertebral discs, enhance blood circulation, and help maintain proper alignment of the cervical spine, thereby supporting the rehabilitation process. These devices can also be utilized by individuals suffering from cervical kyphosis, contributing to improved motor function and overall quality of life. Furthermore, the integration of infrared light therapy in such devices, through the use of specific wavelengths, can effectively mitigate pain by targeting nociceptive nerve cells and accelerating the healing process. This technology offers significant advantages in the treatment and rehabilitation of cervical spine disorders, making it highly beneficial for patients undergoing therapy for spinal conditions and impaired cervical mobility, as well as for individuals who frequently engage in extended computer or phone use and require posture correction.

W14: Therapy support equipment - Infrared heat massage belt

Dinh Hung Nguyen[1,2], Huu Xuan Mai[1,2]

[1]*Faculty of Applied Science, Ho Chi Minh University of Technology, Ho Chi Minh City, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
[*]*E-mail: hung.nguyendhismee@hcmut.edu.vn*

Abstract

Massage therapy has been researched and proven to be an effective method of reducing pain and improving overall health. In particular, back massage can help reduce muscle tension, improve blood circulation and relieve chronic back pain. A therapeutic massage belt is a device that can provide these benefits in a convenient and effective way, especially for those who do not have the time or means to go to professional therapy centers. Evaluate the effectiveness of massage belts: Conduct clinical trials to evaluate the level of pain relief and improvement in users' quality of life. Optimize design: Based on user feedback and test results, draw the advantages and disadvantages that the device has, thereby optimizing the design of the massage belt to improve efficiency and convenience.

W15: Geometry Optimization Models of Curcumin (Cur) and Beta-Cyclodextrin (β-CD) Molecules: A Computational Simulation Study

Quan Dac Nguyen[1,2], Hanh Thi-Thu Tran[1,2]*

[1]Laboratory of Computational Physics, Faculty of Applied Science, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam
[2]Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.
**E-mail: thuhanhsp@hcmut.edu.vn*

Abstract

Background: Curcumin (CUR), known for its extensive biological activities, including anti- inflammatory and anti-cancer properties, has gained significant attention in various therapeutic applications. Despite these benefits, CUR faces challenges in clinical use due to its poor solubility, stability, and bioavailability. The large landscape, our research aims to address these limitations by optimizing the molecular encapsulation of CUR using β-cyclodextrin (β-CD), a molecule known for enhancing the solubility and delivery of hydrophobic compounds. The study focuses on determining which provides more accurate and resource-efficient results for modeling CUR and β-CD interactions. This study employs Density Functional Theory (DFT) to model the interaction between CUR and β-CD. Geometry optimizations are performed using two basis sets: HF/6-31G(d) and B3LYP/6- 31G(d). Both methods aim to minimize the energy of the system while considering molecular vibration frequencies and energy band gaps (EBG) as key metrics for comparison. The models are optimized to their lowest energy configurations using self-consistent field (SCF) iterations. One key challenge has been balancing the computational efficiency of the HF/6-31G(d) method with the need for accuracy in modeling the electron correlation effects. Another challenge is ensuring that the IR spectra obtained from DFT simulations. This research highlights the importance of using appropriate computational methods for optimizing the interaction between Curcumin (CUR) and β-cyclodextrin (β-CD). While the B3LYP method has proven to be more accurate, the HF/6-31G(d) method offers computational efficiency but with reduced accuracy in certain aspects.

W16: Interaction of curcumin with fullerene: a simulation method.

Nguyen Du Que Tram[1], Le Huynh Thanh Tung[1] and Tran Thi Thu Hanh[1,*]

[1] Laboratory of Computational Physics, Faculty of Applied Science, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam
[2] Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.
**E-mail: thuhanhsp@hcmut.edu.vn*

Abstract

In 1985, Harry Kroto, using a telescope, discovered strange carbon chain molecules billions of kilometers away. Together with Richard Smalley and Robert Curl, he simulated the environment around that distant star and discovered several carbon structures, most notably C60, which has a spherical shape and was named Fullerene. This was the first symmetrical carbon-based nanomaterial to be discovered and was quickly applied to drug delivery systems. Numerous experimental studies have used this material to create drug delivery systems, showing significant efficacy. Curcumin, a natural compound extracted from turmeric, has been shown to possess various pharmacological properties. In this study, we focus on simulating and analyzing the interaction between curcumin and fullerene.

The logarithm of the partition coefficient (LogP) between n-octanol and water, has been extensively used in quantitative structure-activity relationship research to describe the degree of lipophilicity and it is a component of Lipinski's Rule of 5. In this paper, we use an online version software called the XlogP3-aa to predict the LogP values of various fullerenes.

We expect to calculate the LogP values of fullerenes with different sizes, then compare these values with Lipinski's Rule of 5 to select the fullerene with the most suitable size and LogP value for drug delivery. In this paper, we aim to focus on C60 as the subject for our simulation. C60 has a diameter of 1.0 nm, which is significant for its behavior and potential applications, making it a promising candidate for drug delivery and interactions with biological systems.

In conclusion, the curcumin molecular model inside fullerene can be obtained after calculating the energy of the system. The holes on the surface of the fullerene molecule are intended to create space for the curcumin molecule to escape and reach the desired target.

W17: Study of Bombyx mori fibroin in an acidic environment

Huy Nhat Le, Hanh Thi-Thu Tran*

[1]*Laboratory of Computational Physics, Faculty of Applied Science, Ho Chi Minh city University of Technology, Ho Chi Minh city, Vietnam*
[2]*Vietnam National University Ho Chi Minh City, Ho Chi Minh City, Vienam.*
**E-mail: thuhanhsp@hcmut.edu.vn*

Abstract

Bombyx mori fibroin has been utilized in textiles since antiquity owing to its strength, luster, biocompatibility, simplicity of chemical manipulation, and gradual disintegration rate. Fibroin molecules of Bombyx have been intensively investigated in recent years. These findings suggest a novel approach to incorporating appropriate materials capable of establishing hydrophobic interactions with fibroin to improve the characteristics of its complexes. In an effort to improve the properties of fibroin, a recent study has focused on carbon nanotubes because they have special qualities like being excellent at conducting electricity, being clear to the naked eye, and being very strong mechanically. These are some of the many appealing features that make them useful in a variety of situations. Because of their one- dimensional ballistic conductor properties, they are able to transport electrons over extremely long distances. The distinct warm conductivity at a variety of temperatures provides an excellent illustration of a one-dimensional quantization of the phonon band structure. This motivates us to conduct a study on the reciprocal relationship between graphene and FibNT.

The MD and DFT methods are used to study the system. Specially, the AMBER and GROMACS software are used. The simulation had five stages. The model's energy reduction was achieved using the steepest descent technique. We heated the system from 0 K to 300 K, and then thermalized it at 300 K.

Root Mean Square Deviation (RMSD) calculations were performed on the FibNT-CNT complex using atomic elements (MD) recreations. The purpose of these calculations was to evaluate the auxiliary deviations that occurred throughout the course of time. In atomic reconstructions, the root-mean-squared deviation (RMSD) is an essential statistic because it quantifies the usual displacement of nuclear sites in relation to the initial structure. This metric offers insights into the stiffness and conformational changes that occur within the system.

This research aimed to examine the interaction between carbon nanotubes (CNTs) and FibNT using molecular dynamics (MD) simulations. We have started to look at the stability and tightness of the composite structure over time by computing some basic measurements, such as root mean square deviation (RMSD) and radius of gyration.