

# CONFERENCE PROGRAM

*In-person & Virtual / MAY 26-27, 2023*

**Duy Tan University, Danang, Vietnam**

**ICCRI  
2023**

***2023 6th International Conference on Control, Robotics and Informatics***

**ICSCCT  
2023**

***2023 12th International Conference on Software and Computing Technologies***

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# WELCOME ADDRESS



Welcome to attend the 2023 6th International Conference on Control, Robotics and Informatics (ICCRI 2023) and 2023 12th International Conference on Software and Computing Technologies (ICSCT 2023), which will be held hybrid (on-site and online) in **Duy Tan University**, Danang, Vietnam, during MAY 26-28, 2023

The Conference aims to gather researchers, scholars, and industry professionals all over the world for the presentation and exchange of past experiences, research results and new advances in the field of Control, Robotics and Informatics, and Software and Computing Technologies. Contributions that promote scientific contacts and exchanges of ideas between people all over the world are welcome.

We want to express our sincere gratitude to the Conference Committee members, whose work in encouraging participation made the Conference possible and to all the authors who submitted their papers.

Special thanks go to the keynote speakers, who accepted to contribute to the Conference by sharing their expertise: Prof. Jan Peters, IEEE Fellow, Technische Universitat Darmstadt (TU Darmstadt), Germany; Prof. Xingjian Jing, IEEE Senior Member, City University of Hong Kong, Hong Kong, and Assoc. Prof. Dr. Minh T. Nguyen, Thai Nguyen University of Technology; Thai Nguyen University, Vietnam.

This year, there will be 3 keynote speeches and 2 sessions on Modern Information Theory and Image Processing Technology and Mechanical Control System Design and Automation.

Wishing all of you an unforgettable and perfect experience at the conference, we hope that you all find your participation fruitful and rewarding and that you may get from it new inputs for your researches and the possibility of establishing future collaborations.

We look forward to meeting you again on the occasion of ICCRI/ICSCT 2024.

**The Organizing Committee**

# CONFERENCE COMMITTEES

<b>Honorary General Chair</b>	Dr. Le Nguyen Bao	Duy Tan University, Vietnam
<b>International Advisory Committee</b>	Prof. Jan Peters	Technische Universitat Darmstadt (TU Darmstadt), Germany
<b>General Chair</b>	Prof. Dr. Thuong Le-Tien	Ho Chi Minh City University of Technology, Vietnam
<b>Conference Co-chairs</b>	Prof. Rajender Singh Chhillar	Maharshi Dayanand University, India
	Assoc. Prof. Pham Quoc Thai	University of Science and Technology, the University of Danang, Vietnam
	Assoc. Prof. Dr. Ha Dac Binh	Duy Tan University, Vietnam
<b>Program Chairs</b>	Prof. Xingjian Jing	City University of Hong Kong, Hong Kong
	Dr. Tran Thuan Hoang	Duy Tan University, Vietnam
	Dr. Tran Nhat Tan	Duy Tan University, Vietnam
	Dr. Hoang Thang	University of Science and Technology, the University of Danang, Vietnam
<b>Program Co-chairs</b>	Assoc. Prof. Nguyen Quang Vinh	Military Institute of Science and Technology, Ministry of National Defence, Vietnam
	Assoc. Prof. Nguyen Tuan Minh	Thai Nguyen University of Technology, Vietnam
	Assoc. Prof. Dr. Nguyen Chi Ngon	Can Tho University, Vietnam
<b>Publication Chair</b>	Prof. Seifedine Kadry	Noroff University College, Kristiansand, Norway
<b>Technical Program Committee</b>	Tran Le Thang Dong	Center of Electrical Engineering, Duy Tan University, Vietnam

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Assoc. Prof. Piotr Artiemjew	University of Warmia and Mazury in Olsztyn, Poland
Assoc. Prof. Souad Bezzaoucha	École d'Ingénieurs généraliste (EIGSI), France
Dr. Shin Horng Chong	Universiti Teknikal Malaysia Melaka, Malaysia
Prof. Yaojung Shiao	National Taipei University of Technology, Taiwan

# CONFERENCE COMMITTEES

Dr. Mauro Gaggero	Institute of Marine Engineering, CNR-INM, Italy
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Dr. Hai Dinh Tuan	Technische Universität Berlin, Germany
Assoc. Prof. Hoang Ngoc Ha	Duy Tan University, Vietnam
Dr. Vo Nhan Van	Duy Tan University, Vietnam
Dr. Dang Viet Hung	Duy Tan University, Vietnam
Assoc. Prof. Dang Xuan Kien	Ho Chi Minh University of Transport, Vietnam
Assoc. Prof. Hassen Fourati	University Grenoble Alpes, France

# CONFERENCE VENUE

## FOR ONSITE PRESENTATION

### Conference Venue

- Duy Tan University
- Address: 254 Nguyen Van Linh, Tp. Danang, Vietnam
- **Spot: Duy Tan Tower, 03 Quang Trung**



### Sign-in

**SPOT** Duy Tan Tower, 03 Quang Trung (Lobby, 6F)  
**TIME** 10:00-17:00 | MAY 26, 2023, Friday

### Conference Rooms

Level	Meeting Room	MAY 27, 2023
6F	Meeting Room 1	★ <b>Main Room</b>
	Meeting Room 1 & 3	● <b>Technical Sessions</b>

## FOR ONSITE PRESENTATION

### Oral Presentation

- The duration of a presentation slot is 15 minutes. Please target your lecture for a duration of about 10 minutes for the presentation plus about 5 minutes for questions from the audience.
- Your punctual arrival and active involvement in each session will be highly appreciated.
- Get your presentation PPT or PDF files prepared and backed up. You can use USB flash drive (memory stick), make sure you scanned viruses in your own computer. Each speaker is required to meet her / his session chair in the corresponding session rooms 10 minutes before the session starts and copy the slide file (PPT or PDF) to the computer.
- It is suggested that you email a copy of your presentation to your personal inbox as a backup. If for some reason the files can't be accessed from your flash drive, you will be able to download them to the computer from your email.
- Laptops, projector & screen, laser sticks will be provided by the conference organizer.

### Name Badge

- For security purposes, delegates, speakers and staff are required to wear their name badge to all sessions and social functions. Entrance into sessions is restricted to registered delegates only. If you misplace your name badge, please replace at the registration counter.

### Notes and Tips

- ☞ Your paper ID will be required for the registration.
- ☞ One best oral presentation will be selected from each oral session. The Certificate for the best one will be awarded at the end of each session.
- ☞ After the session, there will be a group photo for all presenters in this session.
- ☞ Please kindly make your own arrangements for accommodations.

### Security

- Please ensure that you take your belongings with you at all times when leaving a room. Do not leave bags or laptops unattended. Please note that the ICCRI&ICSCCT 2023 and the onsite staff will not accept liability for any kind of damage, losses or injuries occurring to persons or personal belongings during the conference.



## FOR ONLINE PRESENTATION

### Oral Presentation

- The duration of a presentation slot is 15 minutes. Please target your lecture for a duration of about 10 minutes for the presentation plus about 5 minutes for questions from the audience.

### Platform

- ZOOM Meeting
- For Users from mainland China please download: <https://zoom.com.cn/download>
- For Other Users please download: <https://zoom.us/download>

### Sign-in & Join

**STEP 1** Install the ZOOM

**STEP 2** Join the meeting using Meeting ID or through the link provided

**STEP 3** After entering the meeting, connect to PC Audio and make sure you can hear and be heard

**STEP 4** Get familiar with the following: mute/unmute, rename, chat, raise hands, and screen share, etc

#### ▪ Time Zone

1. Vietnam Standard Time (CST) UTC/GMT+07:00
2. Please make sure that the clock and the time zone on your computer are set to the correct Time

#### ▪ Environment

1. Quiet Environment & Proper lighting
2. Stable Internet Connection

#### ▪ Voice Control

1. Please keep muted when you are listening to the talks.
2. Speakers can unmute microphone when it is his or her turn for presentation.

### Device

- A computer with an internet connection (wired connection recommended)
- USB plug-in headset with a microphone (recommended for optimal audio quality)
- Webcam (optional): built-in or USB plug-in

### Conference Recording

- The whole conference will be recorded. We appreciate your proper behavior and appearance.
- The recording will be used for the conference reports among the committee, which won't be distributed to or shared with anyone else, and it shall not be used for commercial or illegal purpose. It will only be recorded by the staff; the presenters are not allowed to record.



## Naming Manner

Role	Format	Example
<b>Keynote Speaker:</b>	Keynote-Name	Keynote-Prof. Abby
<b>Session Chair</b>	Session Number-SC-Name	S1-SC-Prof. Adam
<b>Author</b>	Session Number-Paper ID-Name	S1-CD1001-Alex
<b>Listener</b>	Listener-Name	Listener-Aron

## Online Room

ROOM	MEETING ID	MEETING LINK
1	823 0178 1941	<a href="https://us02web.zoom.us/j/82301781941">https://us02web.zoom.us/j/82301781941</a>
2	846 5643 8941	<a href="https://us02web.zoom.us/j/84656438941">https://us02web.zoom.us/j/84656438941</a>

## Online Testing

Friday, MAY 26	Room ID: 823 0178 1941 <a href="https://us02web.zoom.us/j/82301781941">https://us02web.zoom.us/j/82301781941</a>
Vietnam Standard Time (GMT+7)	Paper ID
10:00-12:00	CR11, CR100, CR19, CR16, CR38, SCT005, CR22, SCT002, SCT007, SCT003, SCT006, SCT012, SCT023
14:00-17:00	CR37, CR10, CR02, CR06, CR07, CR13, CR14, CR28, CR30, CR36, CR33
17:00-17:30	For those who fail to test at allocated time

## Online & Onsite Connection

Activity	Meeting Room	Online Room
<b>Keynote Speech</b>	Meeting Room 1 (6F)	Room ID: 823 0178 1941
<b>Technical Session 1</b>		
<b>Technical Session 2</b>	Meeting Room 3 (6F)	Room ID: 846 5643 8941

# AGENDA OVERVIEW

## Day 1 | May 26, 2023, Friday

Vietnam Time	Activity	Venue
10:00-17:00	Sign-in and Conference Kit Collection	03 Quang Trung (Lobby, 6F)
16:00-17:30	Online Test	Room ID: 823 0178 1941 <a href="https://us02web.zoom.us/j/82301781941">https://us02web.zoom.us/j/82301781941</a>

## Day 2 | May 27, 2023, Saturday

Vietnam Time	Activity	Venue	Online
<b>Keynote Speech Host:</b> Assoc. Prof. Minh T. Nguyen, Thai Nguyen University, Vietnam			
08:30-09:00	Opening Remarks Conference Chair	Meeting Room 1 (6F)	Main Room ID: 823 0178 1941
09:00-09:50	Keynote Speech I <b>Prof. Xingjian Jing</b> , City University of Hong Kong, Hong Kong <i>IEEE Senior Member</i>		
<b>Speech: Complex Nonlinear Systems Identification: A Robust Control/Learning Approach</b>			
09:50-10:30	Coffee Break & Group Photo		Corridor (6F)
10:30-11:20	Keynote Speech II <b>Assoc. Prof. Dr. Minh T. Nguyen</b> , Thai Nguyen University of Technology; Thai Nguyen University, Vietnam	Meeting Room 1 (6F)	Main Room ID: 823 0178 1941
<b>Speech: Remote Sensing Networks: Technical Problems, Benefits and Challenges</b>			
11:45-13:45	<b>Lunch Banquet</b>		<b>Danang Petro Hotel</b> Floor 2, 7 Quang Trung (2 minutes walking)
14:00-14:50	Keynote Speech III <b>Prof. Jan Peters</b> , Technische Universitat Darmstadt (TU Darmstadt), Germany <i>IEEE Fellow</i>	Meeting Room 1 (6F)	Main Room ID: 823 0178 1941
<b>Speech: Inductive Biases for Robot Learning</b>			
14:50-15:00	Coffee Break		Corridor (6F)
15:00-18:15	Technical Session <b>Session 1: Modern Information Theory and Image Processing Technology</b> CR11, CR100, CR19, CR16, CR38, SCT005, CR22, SCT002, SCT007, SCT003, SCT006, SCT012, SCT023,	Meeting Room 1 (6F)	OL Room ID: 823 0178 1941
15:00-18:15	Technical Session <b>Session 2: Mechanical Control System Design and Automation</b> SCT004, CR37, CR10, CR02, CR06, CR07, CR13, CR14, CR28, CR30, SCT010, CR36, CR33	Meeting Room 3 (6F)	OL Room ID: 846 5643 8941
18:15-20:00	Closing Session <b>Host: Assoc. Prof. Ha Duc Binh</b> , Duy Tan University, Vietnam	<b>Truc Lam Vien Cafe &amp; Restaurant</b> 10 Ly Tu Trong St, Hai Chau (Conference Shuttle Cars)	
	<b>Dinner Banquet</b>		

## Keynote Speaker

Chair: Assoc. Prof. Nguyen Tuan Minh, Thai Nguyen University, Vietnam

Local Time 09:00-09:50 | 2023.5.27

Onsite Room Meeting Room 1

Main Room ID 823 0178 1941

Link: <https://us02web.zoom.us/j/82301781941>



## Prof. Xingjian Jing

IEEE Senior Member

City University of Hong Kong, Hong Kong

### BIO

Xingjian Jing (M'13, SM'17) received the B.S. degree from Zhejiang University, China, the M.S. degree and PhD degree in Robotics from Shenyang Institute of Automation, Chinese Academy of Sciences, respectively. He also achieved the PhD degree in nonlinear systems and signal processing from University of Sheffield, U.K.. He is now a Professor with the Department of Mechanical Engineering, City University of Hong Kong. Before joining in CityU, he was a Research Fellow with the Institute of Sound and Vibration Research, University of Southampton, followed by assistant professor and associate professor with Hong Kong Polytechnic University. His current research interests include: Nonlinear dynamics, Vibration, Control and Robotics, with a series of 200+ publications of 9400+ citations and H-index 50 (in Google Scholar), with a number of patents filed in China and US. He is one of the top 2% highly cited world scientists and a senior IEEE member. Prof Jing is the recipient of a number of academic and professional awards including 2016 IEEE SMC Andrew P. Sage Best Transactions Paper Award, 2017 TechConnect World Innovation Award in US, 2017 EASD Senior Research Prize in Europe, 2017 the First Prize of HK Construction Industry Council Innovation Award, and 2019 HKIE outstanding paper award etc. He currently serves Associate Editors of Mechanical Systems and Signal Processing, IEEE Transactions on Industrial Electronics, & IEEE Transactions on Systems, Man, Cybernetics -Systems, and served as Technical Editor of IEEE/ASME Trans. on Mechatronics during 2015-2020. He was the lead editor of a special issue on "Exploring nonlinear benefits in engineering" published in Mechanical Systems and Signal Processing during 2017-2018 and is the lead editor of the other special issue on "Next-generation vibration control exploiting nonlinearities" published in MSSP during 2021-2022

### Abstract

#### Complex Nonlinear Systems Identification: A Robust Control/Learning Approach

The training problem of feedforward neural networks (FNNs) and identification of nonlinear systems can all be formulated into a robust control problem of a linear discrete dynamic system in terms of the estimation error. The robust control approach greatly facilitates the analysis and design of robust learning algorithms for multiple-input-multiple-output (MIMO) nonlinear systems using various standard robust control methods for addressing different noisy and disturbance issues in data. The drawbacks of some existing learning/identification algorithms can therefore be avoided, and an optimal robust control/learning algorithm can be established. The optimal learning parameters can also be found by utilizing linear matrix inequality optimization techniques. Theoretical analysis and examples including function approximation, system identification, exclusive-or (XOR) and encoder problems are provided to illustrate the results.

## Keynote Speaker

Chair: Assoc. Prof. Nguyen Tuan Minh, Thai Nguyen University, Vietnam

Local Time	10:30-11:20   2023.5.27	Onsite Room	Meeting Room 1
Main Room ID	823 0178 1941	Link:	<a href="https://us02web.zoom.us/j/82301781941">https://us02web.zoom.us/j/82301781941</a>



## Assoc. Prof. Dr. Minh T. Nguyen

Thai Nguyen University of Technology-Thai Nguyen University, Vietnam

### BIO

Minh T. Nguyen received his B.S., M.S. and PhD degrees in Electrical Engineering from Hanoi University of Communication and Transport, Hanoi, Vietnam in 2001, Military Technical Academy, Hanoi, Vietnam in 2007, Oklahoma State University, Stillwater, OK, USA, in 2015, respectively. Assoc. Prof. Dr. Minh T. Nguyen is currently the Director of International training and Cooperation center (ITC) at Thai Nguyen University of Technology (TNUT), Viet Nam, and the director of Advanced Wireless Communication Networks (AWCN) Lab. He has interest and expertise in a variety of research topics in telecommunications, computer networking, and signal processing areas, especially compressive sensing, and wireless/mobile sensor/robotic networks. He serves as technical reviewers for several prestigious journals and international conferences. He also serves as Editors for some journals as, Wireless Communication and Mobile Computing, Transactions on Industrial Networks and Intelligent Systems and Editor in Chief for ICSES Transactions on Computer Networks and Communications.

### Abstract

#### Remote Sensing Networks: Technical Problems, Benefits and Challenges

Remote sensing has proven to be a viable technology for monitoring and collecting data in a variety of sectors and over a wide range of climatic conditions and locales throughout the last few decades. This talk considers sensing networks that include devices and the networking methods to support different applications. For further details, the talk specifies some networks such as wireless sensor networks, robotic networks (mobile robots/sensors), unmanned aerial vehicles (UAVs) networks. Data collection algorithms in the networks are addressed. Some data processing advanced techniques in the networks are also provided. To navigate the mobile devices in such networks, some control algorithms for mobile agents are considered. Finally, the energy efficient problems for the sensing devices are addressed. The talk will provide some potential points for either future developments or research collaborations.

## Keynote Speaker

Chair: Assoc. Prof. Nguyen Tuan Minh, Thai Nguyen University, Vietnam

Local Time	14:00-14:50   2023.5.27	Onsite Room	Meeting Room 1
Main Room ID	823 0178 1941	Link:	<a href="https://us02web.zoom.us/j/82301781941">https://us02web.zoom.us/j/82301781941</a>



## Prof. Jan Peters

IEEE Fellow

Technische Universität Darmstadt (TU Darmstadt), Germany

### BIO

Jan Peters is a full professor (W3) for Intelligent Autonomous Systems at the Computer Science Department of the Technische Universität Darmstadt since 2011, and, at the same time, he is the dept head of the research department on Systems AI for Robot Learning (SAIROL) at the German Research Center for Artificial Intelligence (Deutsches Forschungszentrum für Künstliche Intelligenz, DFKI) since 2022. He is also a founding research faculty member of the Hessian Center for Artificial Intelligence. Jan Peters has received the Dick Volz Best 2007 US PhD Thesis Runner-Up Award, the Robotics: Science & Systems - Early Career Spotlight, the INNS Young Investigator Award, and the IEEE Robotics & Automation Society's Early Career Award as well as numerous best paper awards. In 2015, he received an ERC Starting Grant and in 2019, he was appointed IEEE Fellow, in 2020 ELLIS fellow and in 2021 AAIA fellow. Despite being a faculty member at TU Darmstadt only since 2011, Jan Peters has already nurtured a series of outstanding young researchers into successful careers. These include new faculty members at leading universities in the USA, Japan, Germany, Finland and Holland, postdoctoral scholars at top computer science departments (including MIT, CMU, and Berkeley) and young leaders at top AI companies (including Amazon, Boston Dynamics, Google and Facebook/Meta). Jan Peters has studied Computer Science, Electrical, Mechanical and Control Engineering at TU Munich and FernUni Hagen in Germany, at the National University of Singapore (NUS) and the University of Southern California (USC). He has received four Master's degrees in these disciplines as well as a Computer Science PhD from USC. Jan Peters has performed research in Germany at DLR, TU Munich and the Max Planck Institute for Biological Cybernetics (in addition to the institutions above), in Japan at the Advanced Telecommunication Research Center (ATR), at USC and at both NUS and Siemens Advanced Engineering in Singapore. He has led research groups on Machine Learning for Robotics at the Max Planck Institutes for Biological Cybernetics (2007-2010) and Intelligent Systems (2010-2021).

### Abstract

#### Inductive Biases for Robot Learning

The recent success of deep supervised learning in computer vision and deep reinforcement learning in simulations and computer games may make it appear as if intelligent robotics was just around the corner. However, these highly successful approaches require giant data sets only available by massive simulation or data collection over the internet. As "real" robots live in "real" time, millions of robots would need to operate similar tasks with similar bodies in similar environments to generate sufficiently large data sets during their life-time to follow this strategy. In this talk, we therefore focus on the important question how induction biases can be used to accelerate data-driven learning of complex robot action policies in the physical world. We show how structured representations can help advance robot learning and that generic domain knowledge be encoded in robot learning algorithms.

## Technical Session on MAY 27

### Session 1 / Modern Information Theory and Image Processing Technology

Local Time 15:00-18:15 | 2023.5.27      Onsite Room Meeting Room 1  
 Main Room ID 823 0178 1941      Link: <https://us02web.zoom.us/j/82301781941>

**Session Chair: Assoc. Prof. Ha Dac Binh, Duy Tan University, Vietnam**

### Paper Details

Paper ID	Title & Abstract	Type
15:00-15:15 CR11	<p><b>The Application in Texture Surface Inspection with Anomaly Detection Based on Smart Camera and Flexible Vibration Feeders System</b>  <b>Giang Nam Le</b>, Ha Noi University of Science and Technology, Vietnam</p> <p><b>Abstract:</b> This paper introduces a flexible vibration system combined with a machine vision system. The workpiece guide mechanism works powerfully and flexibly with different types of vibrating bowl workpieces. The system collects images of the workpiece with a smart camera and then identifies the features of the defect on the surface of the workpiece. We used unsupervised learning anomaly detection to detect defects. This method is embedded in our designed software called Machine Vision Camera. The defect properties of the product are compared with those of the normally moving workpiece at the outlet of the feed system and the conveyor. Defective workpieces are removed from the line by the system controller. The system of us improves the finished product yield of the vibrating bowl feeding system and reduces the cost and time of product inspection. This study has important implications for providing a solution for defective workpiece detection and removal with a reject system in a flexible manufacturing system that responds rapidly to the challenges of the industrial environment at present.</p>	Onsite
15:15-15:30 CR100	<p><b>LiDAR-based Vehicle Detection by using DBSCAN Unsupervised Clustering approach</b>  <b>Bien Minh Tri</b>, Vietnamese German University, Vietnam</p> <p><b>Abstract:</b> Roadside LiDAR is helping to build intelligent and safe transportation. Object detection is a challenging and fundamental problem in computer vision. Moreover, the vehicle detection system is essential to Intelligent Transportation Systems (ITS). Many researchers in the transportation field spend an enormous amount of money to collect and analyze traffic data to optimize street systems. This research aims to develop a case study for a vehicle detection system in a complex roadway area based on LiDAR through an embedded system. For this purpose, an embedded GPU integrated (Nvidia JetsonTX2) with low power and high performance has been picked, which supports an unsupervised learning algorithm to be run simultaneously and a detection algorithm to be applied for point cloud recognition. We also discuss the structure of the architectures of LiDAR-based roadside systems, and lidar data processing for vehicle detection. In the real-scanned HDL-32E Velodyne 3D LiDAR dataset, our proposed method can achieve vehicle detection accuracy up to 82.7% in several real-scenes datasets. The future research directions to contribute resources beneficially to industry, academia, and government agencies for choosing appropriate LiDAR-based technologies for their vehicle monitoring systems.</p>	Onsite
15:30-15:45 CR19	<p><b>Multi-AUVs Cooperative SLAM under Weak Communication</b>  <b>Fei Chen</b>, Jiangsu University of Science and Technology, China</p> <p><b>Abstract:</b> By Simultaneous Localization And Mapping (SLAM), robots can better localize themselves and the map. However, due to the many shortcomings of acoustic</p>	Virtual

	<p>communication, it is very challenging for multi-robot to perform cooperative localization and mapping tasks only through acoustic communication in an underwater environment [1]. This paper proposes a collaborative SLAM framework. Each AUV uses a decentralized graph SLAM algorithm to generate a local map and then reduces the size of the communication data packet by marginalizing the vehicle pose and sparsing the information matrix. This method is suitable for multi-robot cooperative localization and mapping under weak communication environment.</p>	
<p>15:45-16:00 CR16</p>	<p><b>Improved Accuracy of Path System on Creating Intelligence Base</b>  <b>Nguyen Quang Vinh</b>, Academy of military sciences and technology, Vietnam</p> <p><b>Abstract:</b> Artificial Intelligence (AI) is a branch of computer science, created by humans to help computers to automate intelligent behaviors and have human-like intelligence. Currently, AI is a spearhead technology with potential applications in many areas of social life. In particular, in the military, AI is being developed more and more perfectly and started to be applied in practice. This paper proposes a method of applying an artificial neural network to compensate for the lost GNSS signal in the loosely coupled structure to improve the accuracy of the positioning and navigation process for a class of flying devices. The obtained results proved the correctness of the indicated method.</p>	<p>Virtual</p>
<p>16:00-16:15 CR38</p>	<p><b>Automated System for The Classification of Cherimoyas by Neural Network</b>  <b>Jhuliza Jhunely Escalante-Talavera</b>, Universidad Continental, Peru</p> <p><b>Abstract:</b> According to Midagri, cherimoya production in Peru was 20 thousand tons, being one of the most consumed fruits and difficult to meet quality standards in the selection stage due to its rapid ripening. This work develops an automated system for the classification of cherimoyas according to the degree of ripeness and size. For the simulation of cherimoya grading, the bottleneck was determined by direct observation and then the algorithm was programmed using the neural network and trained in YOLO V5 to recognize the external characteristics of cherimoya in green, ripe stage, so a mechanical system was considered for the classification by size, to then obtain the simulation in Factory IO and TIA PORTAL with connection to PLC S7-1200 1214 DC/DC/DC and a HMI TP700. Finally, the classification proposal was implemented in which 100% of the cherimoyas were recognized through the interactive HMI screen, being able to classify them in state, green, ripe, small and then automatically count them in 25 units per box, which has a graphical environment so that the operator can manipulate it.</p>	<p>Virtual</p>
<p>16:15-16:30 SCT005</p>	<p><b>Attack Behavior Approach in Slow HTTP DoS Detection</b>  <b>Tran Cong Manh</b>, Le Quy Don Technical University, Vietnam</p> <p><b>Abstract:</b> Slow HTTP Denial of Service attack (DoS) is unpretentious but impressive effect in knocking down the opponent. The principle of the attack is quite simple however its detection is complicated. A criminal can open lots of connections to the server by initiating HTTP requests and keep them opening. There are many detections analysis and studies; however at slow DoS attack is still threatening and dangerous. In this paper, TCP/IP packet analyzed, and behavior based to detect Slow HTTP DoS attack is proposed.</p>	<p>Onsite</p>
<p>16:30-16:45 CR22</p>	<p><b>Kinematic-Based Nonlinear Control for an Omni-Directional Robot</b>  <b>Hoang Quoc Dong</b>, Institute of Mechanical Engineering- Vietnam Maritime University, Vietnam</p> <p><b>Abstract:</b> In this study, we propose a new control strategy for a robot that utilizes a three Omni wheels for moving. With the construction of the kinematic characteristic equations of the system, it is possible to understand and calculate the correlation between the motions of the motors, the wheels, and the robot. Based on this background, a control strategy for the system is proposed, in which the state variables of the robot corresponding to the desired behavior are calculated and converted to the desired angular velocities of the electric motors. By using the traditional integral sliding controller, the motors are precisely controlled simultaneously with the achievement of the expected displacement of the robot. All simulation results are then given to verify the efficiency of the construction algorithm.</p>	<p>Virtual</p>
<p>16:45-17:00 SCT002</p>	<p><b>An Efficient Approach for Mining Closed High Utility Patterns in the Incremental Database</b>  <b>Po-Chun Chuang</b>, National Sun Yat-Sen University, Taiwan, China</p> <p><b>Abstract:</b> The utility of an itemset is the product of the profit and the frequency of the itemset in the database. If it is larger than the given threshold, it is defined as the high utility pattern. If there is no superset which has the same frequency as the frequency of its subset, the itemset can be considered as the closed itemset. If the itemset satisfies both the high utility and the closed property, the itemset is defined</p>	<p>Virtual</p>



	<p>as the closed high utility itemset/pattern (CHUI). Among those algorithms based on the utility-list structure, the HMiner- Closed algorithm is the most efficient algorithm. However, if the value of the threshold decreases, the number of candidate CHUIs increases and decreases the efficiency of the algorithm. Therefore, in this paper, we propose an efficient algorithm based on a closed-set lattice structure. Our algorithm first finds the closed itemsets and then finds CHUIs in those itemsets. By checking the set relationship between the transactions, we first insert transactions into the closed-set lattice structure. Our algorithm also considers data insertion/deletion in the incremental database. From our simulation results, we show that our proposed approach is more efficient than the HMiner-Closed algorithm.</p>	
<p>17:00-17:15 SCT007</p>	<p><b>Application of Apriori Algorithm in One State University's Library Book Borrower Records for Efficient Library Shelving</b> <b>Jerson D. Cecilio</b>, Laguna State Polytechnic University, Philippines</p> <p><b>Abstract:</b> Association rule mining is a technique for discovering patterns, associations, and relationships in large data sets or in a variety of databases such as relational, transactional, and other archives or repositories. It is significantly used in libraries to provide a data-driven approach in management of books, reports, theses, manuscripts, and other literature. This article was conducted to examine book borrowing patterns using the Apriori algorithm for efficient book shelving to assist Laguna State Polytechnic University's library in effectively managing resources, and services. The three year book borrower records of Laguna State Polytechnic University was used as the dataset in this article. Hence, rapidminer was used as a data mining tool in implementing apriori algorithm in the latter and for association discovery. Through the use of apriori algorithm, it was discovered that histories, and consumer preferences books give a high relationship rating therefore, the library may consider rearranging the shelves and place the latter closer with each other. Moreover, all the combinations of two item sets or books with a confidence value greater than 60% as shown in this article were strongly advised to be placed or grouped together for a more effective shelving and efficient searching of books.</p>	<p>Virtual</p>
<p>17:15-17:30 SCT003</p>	<p><b>Malware Classification Using Low-level Characteristics</b> <b>Tuan Van Dao</b>, National Defense Academy of Japan, Japan</p> <p><b>Abstract:</b> Malware is growing at breakneck speed and has become a global problem. Malware detection has reached a high accuracy level of nearly 100%; however, malware classification is still challenging. Distinguishing and classifying different types of malware from each other is essential to better understanding how they can infect computers and devices, their threat level, and how to protect against them. Traditional malware classification works based on signature and behavior approaches. This approach is fragile in address with polymorphic and metamorphic malware. Moreover, because of the rapid development of several automatic malware creation tools, these methods cannot catch up to the speed of malware generation. Machine learning has handled most of today's problems with models ranging from simple to complex. Current studies focus on high-level characteristics of malware, which require high computational costs to detect and classify malware via complex neural network architectures, but the performance is still not groundbreaking. On the contrary, low-level characteristics still have much potential but are still not fully exploited. This study takes the advance of ensembling two low-level characteristic sets, including registers and opcodes, and selecting the appropriate features through the selection feature algorithm to increase performance and reduce computational costs. Proposed method outperformed previous works on two different malware data. This paper shows that extraction and selection features are no less critical than it is for architecture development.</p>	<p>Onsite</p>
<p>17:30-17:45 SCT006</p>	<p><b>Spatial Epidemiological Analysis of Early COVID-19 in the Municipality of Los Baños, Laguna, Philippines using K-means Clustering</b> <b>Jonardo R. Asor</b>, Laguna State Polytechnic University, Philippines</p> <p><b>Abstract:</b> This paper aims to analyze the spread of COVID- 19 in the municipality of Los Baños, Laguna in the Philippines through the use of clustering algorithms. The record of the COVID-19 cases in Los Baños from March 2020 up-to March 2021 was used as dataset which includes susceptible, probable, confirmed, recovered and death cases. Following the clustering technique in data mining, a model was created to further analyzed the patterns of COVID-19. Three famous clustering algorithms were used in this study namely; K-means, K-medoids and mean shift. Furthermore, GeoPandas was used in this study for spatial analysis using cluster data while evaluation metrics for clustering such as Dunn index and Euclidean distance dendrogram were used to inspect clustering capability. Through the use of Dunn index, the study had identified K-Means as an efficient clustering method for COVID-19 cases. Hence, shown in this paper that barangay Tuntungin Putho, Mayondon, San Antonio, and Batong Malake formed a relationship.</p>	<p>Virtual</p>



<p>17:45-18:00 SCT012</p>	<p><b>Time-and-Energy consumption offloading for mobile devices in Mobile Cloud Computing</b>  <b>Van-Viet Nguyen</b>, Thai Nguyen University of Information and Communication Technology, Vietnam</p> <p><b>Abstract:</b> Concurrent processing of sophisticated tasks on mobile devices could consume a lot of energy and processing time because of their limited resources. In order to offload mobile devices, some tasks are uploaded to the cloud server for execution. However, it is very difficult to choose which tasks to upload to the cloud because it needs to ensure two requirements: Optimizing energy costs and optimizing execution time costs. In this paper, we introduce a method to offload mobile devices when it processes multiple tasks concurrently. By applying the proposed energy automata from previous studies, our method allows for the identification of factors influencing the energy consumption and execution time of tasks, while also proposing an objective function and algorithms to make the offloading decision. When we applied the proposed method to an actual image processing application to process 1000 photos on a mobile device, it could save a maximum of 24.1% of energy, 37.6% of processing time, and an average of 18% of energy, 21% of processing time compared to non-offloading.</p>	<p>Onsite</p>
<p>18:00-18:15 SCT023</p>	<p><b>Using an integrated model to determine the factor impact of using super apps behaviors in Taiwan, Vietnam and Indonesia in COVID -19 pandemic context</b>  <b>Le Thi Phuong Thanh</b>, Chang Gung University, Taiwan, China</p> <p><b>Abstract:</b> Due to extensive and prolonged lockdown regulations, the COVID-19 pandemic of 2020 had a significant impact on the global economy (UNCTAD, 2020). In this context, super apps, applications provide a single point of access to a variety of virtual goods and services, have become a phenomenon. AIDA, TAM, and TPB are all well-known theories that are frequently applied to the study of consumer behavior, particularly in adopt to technology. Can a straightforward model be utilized to describe customer behavior? It has been contested that the AIDA model is inadequate for defining an individual's behavior (Bendixen, 1993). Similarly, both TAM and TPB are criticized by researchers. While TAM has been criticized for failing to adequately address the nature of consumer acceptance (Min et al., 2019), TPB may partially explain customer behavior, but it may not be sufficient in isolation (Kroschus et al., 2014). When customers interact with a product, brand, service, or technology over a series of steps, they navigate a complex journey that defines their overall consumption experience, according to Varnali (2019). And will the pandemic context have an impact on the acceptance of technology, particularly the super app, or not? This paper uses an integrated model based on AIDA, TAM, TPB, and a portion of PMT theory to explain the adoption of technology by various nations, such as Taiwan, Vietnam, and Indonesia, in a pandemic context. Theoretically, we anticipate providing a broader perspective on customer behavior in various countries in the context of a hypothetical global pandemic. For implication, we provide application developers with a better understanding of the app adoption journey, from initial advertisement exposure to behavioral intention with the element "health-influenced" (disease). This laid the groundwork for the creation of the application. In addition, business can also achieve and implement a customer-centric strategy in multiple countries.</p>	<p>Onsite</p>

## Technical Session on MAY 27

### Session 2 / Mechanical Control System Design and Automation

Local Time	15:00-18:15   2023.5.27	Onsite Room	Meeting Room 3
Main Room ID	846 5643 8941	Link:	<a href="https://us02web.zoom.us/j/84656438941">https://us02web.zoom.us/j/84656438941</a>

**Chair: Dr. Hoang Thang, University of Science and Technology, The University of Danang, Vietnam**

### Paper Details

Paper ID	Title & Abstract	Type
15:00-15:15 SCT004	<p><b>A Stacking-based Hybrid Model with Random Forest as Meta-learner for Diabetes Mellitus Prediction</b> Rajender Singh Chhillar, MDU Rohtak, India</p> <p>Diabetes Mellitus (DM) is a condition in which the pancreas is incapable of producing enough insulin for glucose metabolism. Risk factors such as age, hectic schedules, inactivity, patient weight, high blood pressure, and blood sugar level are considered to be the primary cause of type 2 diabetes. Due to misinformation and bad eating habits, the pace of increase in diabetes individuals is problematic. Therefore, a framework employing clinical criteria to diagnose thousands of patients accurately is required. For predicting DM at an early stage based on the risk-based characteristics of a person's health, stacking-based classifier is developed that combines five classifiers, namely Logistic Regression (LR), AdaBoost + Support Vector Machine (SVM), Nave Bayes (NB), Artificial Neural Network (ANN), and k-Nearest Neighbors (k-NN), into a single model and uses Random Forest (RF) as a meta-learner. In addition, the performance of these six classifiers was compared to that of the stacked model using the PIMA Indians Diabetes Database (PIDD) dataset. The outcome of the performance analysis revealed that the proposed model obtained ~85.36% accuracy, which is much higher than the six classifiers.</p>	Onsite
15:15-15:30 CR37	<p><b>A Novel Framework of Visual Detection, Tracking and Landing for UAVs utilizing AR Markers</b> Cuong. V. Nguyen, Thai Nguyen University- University of information and communication of technology, Vietnam</p> <p><b>Abstract:</b> An Unmanned Aerial Vehicle (UAV) visual landing is an example of a robot visual navigation application scenario. State estimate is a crucial component of landing missions. The advancement of computer technology and algorithms has dramatically enhanced the speed and precision of visual processing techniques. We present an approach to predict the states (attitude, location, and velocity) of unmanned aerial vehicles (UAVs) based on an onboard camera during the landing phase, with the goal of improving the autonomy of intelligent multi-rotor UAVs. First, the control points of a visual landing target are derived by detecting an ARUco marker in vision. The attitude and position of UAVs, also known as their pose, are then determined. To calculate dense optical flow, a solution based on corner point interpolation of the Lucas-Kanade algorithm is presented due to mission speed and precision requirements. The integral of optical flow is then derived from the optical flow field and certain UAV attitude limitations. Lastly, the UAV's velocity is computed based on the optical flow integral and the UAV's estimated pose. This estimate approach has apparent advantages because it just uses the visual sensor. Integrating optical flow may eliminate the influence of noise spots in the optical flow field.</p>	Onsite

<p>15:30-15:45 <b>CR10</b></p>	<p><b>Early Detection of Rolling Bearing Faults using Long Short-term Memory</b> <b>Nam Du Nguyen Hoang</b>, University of Agder, Norway</p> <p><b>Abstract:</b> Bearings are the vital components of rotating machines in wind turbines and industrial productions. Any bearing fault might result in system failures, interruptions in industry process and huge losses of productivity. Therefore, detecting bearing faults in early stages is essential to prevent system outages and reduce maintenance costs. This paper presents a data driven fault detection method, based on long short-term memory (LSTM) and fault characteristic frequencies. Within the framework, both time series data and frequency domain features are fed to the LSTM model-based autoencoder to train the model, aiming to detect early abnormal bearing states through the learning method. Further, supervised learning methods of classifying the bearing faults are compared based on accuracy. The proposed method can detect incipient bearing faults, allowing the operators to have right actions to prevent a large-scale failure in energy systems. The suggested scheme is validated through experimental data, being able to discriminate anomalies from the observed multivariate data.</p>	<p>Virtual</p>
<p>15:45-16:00 <b>CR02</b></p>	<p><b>Active in-wheel suspension performance analysis using Linear Quadratic controllers</b> <b>Do Trong Tu</b>, Next Generation Vehicle Laboratory, Vietnam</p> <p><b>Abstract:</b> Along with the explosion of electric vehicles, and environmentally friendly vehicles, researchers gradually shift the trend to focus more on electric and hybrid electric systems to replace purely mechanical systems. A controllable suspension system with an integrated traction motor is one of the topics on electric vehicles that attract many research groups and modern equipment manufacturing companies. In this study, we refer to the model of a traction motor linked to an active suspension system on an electric vehicle. The suspension controls are designed not only to ensure smoothness and safety on conventional systems but also to ensure durability and reliability for a complex system. This study concerned different types of controllers for the active suspension system which combines the in-wheel traction motor that is referred to as the electric vehicle. The results of this examination show that, compared with the unguided system, the proposed models significantly reduce the undesirable factors of the tractive motor and enhance the comfort and safety of passengers as well as vehicles.</p>	<p>Virtual</p>
<p>16:00-16:15 <b>CR06</b></p>	<p><b>Smart Irrigation Framework Using Arduino for an Improved Abaca Farming System</b> <b>Erickson T. Salazar</b>, Catanduanes State University, Philippines</p> <p><b>Abstract:</b> Being newly renowned as the Abaca Capital of the Philippines, Catanduanes must ensure the sustainability of producing quality abaca fibers for the province's economic growth. Farming factors hold immense weight in the end production of any plant and with the great unpredictability brought by the province's uncontrolled abaca plantation environments and onslaught of typhoons, producing quality abaca yields pose quite a challenge to its farmers. This paper presents a framework to integrate a smart farming irrigation system using Arduino and sensors to detect the soil moisture, soil pH, and temperature levels for conducive farming of abaca in Catanduanes. The framework also includes a system-level architecture of a web-based system that would allow the abaca farmers to view the sensor and event trigger logs of the irrigation system. This study likewise presents results of the developed framework's evaluation by pre-determined stakeholders and technical experts to identify the level of feasibility, viability, and desirability of its development and implementation in Virac, Catanduanes.</p>	<p>Virtual</p>
<p>16:15-16:30 <b>CR07</b></p>	<p><b>Application of Mixed Reality in Industrial and Collaborative Robot Control</b> <b>Thien Tran</b>, Engineering and Technology (SSET) - Royal Melbourne Institute of Technology University, Vietnam</p> <p><b>Abstract:</b> With the advent of the fourth industrial revolution, the creation of robots and their support software for organized industrial settings to the autonomous and collaborative creation of hybrid environments are the top priorities. The proliferation of collaborative robots has led to various issues, including the inability of hybrid teams to utilize them effectively and the programming requires high technical skill. Easier, more effective, and more user-friendly human-robot interaction may be achieved by combining several new technologies, including augmented and mixed reality, digital twins, the internet of things, and 3D simulation. In this paper, we propose a solution to demonstrate the new approach for human-robot interaction and easy programming with MR technology on both industrial and collaborative robots.</p>	<p>Onsite</p>

<p>16:30-16:45 <b>CR13</b></p>	<p><b>Observer based Descriptor Approach for Model Reference Tracking Control of Quadrotor</b> <b>Souad BEZZAOUCHA REBAI</b>, EIGSI-La Rochelle, France</p> <p><b>Abstract:</b> In this paper, an algorithm based on a polytopic - fuzzy-TS Takagi-Sugeno PDC (Parallel Distributed Control) control to ensure the stability and model reference tracking of a quadrotor is considered. After giving the nonlinear model of the UAV, its representation by a polytopic model is first discussed. Next, an observer and PDC controller are synthesized which guarantee desired control performances (stability and L2 reference tracking performance). The given observer and controller gains are designed using numerical tools (Linear Matrix Inequalities-LMI). The simulation results show effectiveness and robustness of the proposed method.</p>	<p>Virtual</p>
<p>16:45-17:00 <b>CR14</b></p>	<p><b>Linear Quadratic Regulators Optimal Control of Rotary Double Parallel Inverted Pendulum</b> <b>Minh-Duy Vo</b>, Ho Chi Minh City University of Technology and Education (HCMUTE), Vietnam</p> <p><b>Abstract:</b> In this research, a new kind of first-order rotary inverted pendulum system is proposed. This new model, which is not popularly considered, is rotary double parallel inverted pendulum (RDPIP). This model is constructed by adding one more link parallel to the old link, which is placed at the ends of the arm. The RDPIP is not only rarely considered in reality but also in simulation. Due to the complexity of RDPIP, it is a far less researched subject than other pendulum models such as RIP, RDSIP, etc., and it is also difficult to find documents about RDPIP. So, this research will focus on studying the mathematical equations of RDPIP and applying the LQR controller to balance this model in Matlab/Simulink toolbox.</p>	<p>Virtual</p>
<p>17:00-17:15 <b>CR28</b></p>	<p><b>The research design calculations and optimization of control arms in Mac Pherson suspensions in car</b> <b>Vu Hai Quan</b>, HaNoi university of industry (HaUI), VietNam</p> <p><b>Abstract:</b> The suspension is a soft link system between the wheels and the chassis. The suspension link of the car is an elastic bond whose function is to facilitate the wheel to perform relatively vertical movement towards the chassis according to the requirement of "mellow" oscillation, limiting to the point where other unwanted movements of the wheel are acceptable. In which the control arm is the detail that binds the above components. With the function of anti-vibration, it is maintaining tilt angles, and pinching angles save space under the car in front and ensures the stable operation of the car when moving on all roads. In this study, NX Siemens software is used to design the shape of control arms. Application of HyperWorks software to analyze finite elements in detail and optimize the structure of parts. The result is to design the shape of the control arm in accordance with the calculated load conditions. The part's design is optimized in shape to be smaller while ensuring operation when equipped on the vehicle.</p>	<p>Virtual</p>
<p>17:15-17:30 <b>CR30</b></p>	<p><b>Automated system for sorting blueberries by size and degree of ripeness</b> <b>Eduardo Parraga Arotinco</b>, Universidad Continental, Peru</p> <p><b>Abstract:</b> According to the National Institute of Statistics and Informatics in the period of 2022, the production of blueberries was 42 thousand 40 tons, in which Peru has an export share of 59% destined for the United States. This work develops an automated system for the classification of blueberries by size and degree of maturity. For the simulation of the classification of blueberries by size from 10 mm to 14 mm and above, the bottleneck was determined by direct observation and then the mechanical system was programmed for the classification by size and then the colour detection was performed by HSV to classify blueberries over 10 mm by maturity, and then obtain the simulation in Factory IO and TIA PORTAL with connection to PLC S7-1200 1214 DC/DC/DC and a HMI TP700. Finally, the sorting proposal was implemented in which 100% of the blueberries were recognised by means of the interactive HMI screen, being able to automatically sort and count them, which has a graphic environment for the operator to manipulate.</p>	<p>Virtual</p>
<p>17:30-17:45 <b>SCT010</b></p>	<p><b>RML++: Development of Calibration Management System for Regional Metrology Laboratory DOST- CALABARZON, Philippines</b> <b>Jefferson Lerios</b>, Laguna State Polytechnic University; Regional Metrology Laboratory, Philippines</p> <p><b>Abstract:</b> The Regional Metrology Laboratory is the lone government institution that provides calibration services in Region IV-A or in CALABARZON. RML's objective is to guarantee the safety and fair trade of both local and international markets by calibrating measuring devices and instruments used by industry and the general public. RML is also ISO/IEC 17025 certified, demonstrating that its</p>	<p>Virtual</p>

	<p>calibration services meet the international standard for testing and calibration laboratories. However, the complexity of the preparation of calibration certificates with the increasing number of clientele become the bottleneck and cause of delay in the release of certificates. RML ++ is a system which is a management software solution that optimizes the processing of documentary requirements, from the receipt of customers' measuring devices and instruments to the issuance of calibration certificates. The system was developed using the Model-Driven Architecture (MDA) that is built on the principle of abstraction, modelling reuse, and patterns to help understand standard referencing and all the mathematical calculations of the three (3) calibration certificates namely the Single Range Electronic Balance, Thermohyrometer, and Test Weights. RML ++ was able to reduce the processing time of the calibration certificates from encoding to releasing with a systematic process of the mathematical calculation of uncertainty and selection of standards.</p>	
<p>17:45-18:00 CR36</p>	<p><b>Collision-free Formation Control of Multi-agent Systems Based on Formation Graphs</b>  <b>Hoa TT. Nguyen</b>, Thai Nguyen University of Technology, Vietnam</p> <p><b>Abstract:</b> In recent decades, distributed formation control for multiple agent systems (MAS) is becoming an increasingly attractive topic in many fields. This paper introduces the collision-free formation tracking control problem for MAS based on the formation graph. A formation control protocol for MAS composed of multiple quadrotors is designed to form the desired formation aiming to track and encircle a dynamic target. This target is considered a dynamic leader and the control input commands of the leader are unknown to the followers. In addition, the possibility of collision between quadrotors is very easy in forming the formation. Hence, a collision avoidance mechanism is also designed so that the distance of quadrotors in formation tracking is greater than the safety threshold. By using the Lyapunov theory-based stability analysis, it is proved that multiple quadrotors can track the dynamic target in a desired formation using the proposed method. Finally, several digital simulations are carried out to verify the effectiveness of the proposed protocol.</p>	<p>Onsite</p>
<p>18:00-18:15 CR33</p>	<p><b>Performance Optimization of Double Intelligent Reflecting Surfaces Aided Mobile Edge Computing Networks with NOMA Scheme</b>  <b>Truong Van Truong</b>, Duy Tan University, Vietnam</p> <p><b>Abstract:</b> In this paper, the analytical performance of double intelligent reflecting surfaces (IRSs) aided mobile edge computing (MEC) networks based on non-orthogonal multiple access (NOMA) is studied. Two IRSs are deployed to assist two users in offloading their tasks to an access point (AP). The closed form expressions of successful computation probability (SCP) and energy consumption probability (ECP) are derived to illustrate system performance. Furthermore, a multiple-objective (MO) optimization problem is formulated and solved based on MO Particle Swarm Optimization (PSO). Finally, numerical results are provided to investigate the performance and verify the correctness of our analysis.</p>	<p>Onsite</p>

