AOTULE 2019

14th Asia-Oceania Top University League on Engineering Deans', Staff Meetings and Student Conference

25-27 November, 2019
Tokyo Institute of Technology, JAPAN

Participating Universities

CONTENTS

Welcome Message from the Deans

Dear colleagues,

It is our great pleasure to welcome the Asia-Oceania Top University League on Engineering (AOTULE) members to the Tokyo Institute of Technology (Tokyo Tech) for the 14th AOTULE CONFERENCE, which will be held on 25-27 November, 2019. We are proud to be hosting this conference at the birthplace of AOTULE.

The year 2019 is a very important milestone for AOTULE. In 2007, AOTULE was formed, and in that same year, Tokyo Tech hosted its 1st annual Deans' Meeting. In the years since, the AOTULE Conference has been held every year at a different AOTULE member-university, and we have had a very wonderful experience attending them. None of us could have ever imagined in 2007 that AOTULE would grow and become a vibrant league for exchanging information across engineering disciplines, laying the foundation for institutional programs and facilitating student exchanges. At the 2019 conference, we will reflect on the evolution of AOTULE over the previous dozen years and will also set forth some new goals for AOTULE going forward.

We look forward to exchanging ideas with all member-universities and enhancing the foundation of AOTULE for the future. At the same time, November is the most beautiful time of year to visit Japan due to the colorful autumn leaves. We wish you safe travels and a pleasant stay in and around Tokyo.

Nobuyuki IWATSUKI

Dean

School of Engineering

Yuji WADA

Dean

School of Materials and Chemical Technology

Norihiro NAKAI

Dean

School of Environment and Society

Tokyo Tech Engineering Schools

Tokyo Institute of Technology (Tokyo Tech) is Japan's premier university focused on science and engineering education through coursework and advanced research. Tokyo Tech has formulated a new education system, which was launched in April 2016, with the aim of becoming one of the world's top 10 research universities. Located near central Tokyo, our campuses nonetheless offer enjoyment for all four seasons, such as our well renowned cherry blossoms, multi-hued hydrangea, autumn foliage and flowering plum trees in red-and-white.

Tokyo Tech possesses several cutting-edge facilities: these include our giant Supercomputer TSUBAME, the virtually energy self-sufficient EEI (Environmental Energy Innovation Building), and ELSI (Earth-Life Science Institute), while some of our other buildings have been granted Registered Tangible Cultural Property Status. This mixture of modernization and tradition contributes to make Tokyo Tech more attractive. In line with recent University Reforms, the previous School of Engineering has been divided into the three schools (The Engineering Schools), although the Philosophy and Charter of previous school shall be continued in the three newly subdivided Engineering Schools.

In future, Tokyo Tech will place even further importance on globalization in education and research. The Engineering Schools operate a wide variety of research programs for both inbound and outbound students and researchers, and especially summer programs have been well-received now for over ten years. The summer inbound-programs, such as Tokyo Tech AOTULE Summer Program, offer opportunities not only to be involved in researching a topic of the participant’s own choice under faculty supervision, but also to experience Japanese culture and friendship. These programs are conducted by the International Cooperation Office, where full-time coordinators are in charge.

The Asia-Oceania Top University League on Engineering (AOTULE)

The Asia-Oceania Top University League on Engineering (AOTULE) was founded in 2007 by forming strong collaborative relationships through exchanges of information, students, faculty members, and staff among the top ranking engineering universities in the Asia-Oceania region.

AOTULE consists of the following university members:

- ✧ Bandung Institute of Technology, Indonesia
- ✧ Chulalongkorn University, Thailand
- ✧ Hanoi University of Science and Technology, Vietnam
- ✧ Indian Institute of Technology Madras, India
- ✧ Korea Advanced Institute of Science and Technology, Korea
- ✧ Nanyang Technological University, Singapore
- ✧ National Taiwan University, Taiwan
- ✧ The Hong Kong University of Science and Technology, Hong Kong
- ✧ The University of Melbourne, Australia
- ✧ Tokyo Institute of Technology, Japan
- ✧ Tsinghua University, China
- ✧ University of Malaya, Malaysia
- ✧ University of Moratuwa, Sri Lanka

The AOTULE promotes inter-university cooperation through a joint program including an annual Deans' meeting, student workshop and exchanges of students and staff, in order to improve the quality of engineering education and research of the members. It aims to broaden participating students' perspectives through education, research and cross-cultural interactions.

AOTULE 2019 OVERALL PROGRAM

(25th- 27th November 2019)

Venue: Ookayama Campus, Tokyo Institute of Technology

	Time	Deans	Staff	Students
25th November 2019 (Monday)				
Evening	17:30-	**Registration** Centennial Hall, 1F		
	18:00-20:00	**Welcome Reception** Centennial Hall, 1F		
26th November 2019 (Tuesday)				
Morning	8:45-9:15	**Registration** Foyer at West Bldg. 9, 2F		
	9:15-9:45	**Opening Ceremony** **Welcome Address by:** **Dr. Isao Sato** **Prof. Yuji Wada** **Prof. Ashok Kumar Mishra** **Prof. David Shallcross** Multi-Purpose Digital Hall (West Bldg. 9, 2F)		
	9:45-10:00	**Group Photo**		
	10:00-12:15	**Deans' Meeting** Collaboration Room (West Bldg. 9, 2F)	**Staff Meeting Part I & II** Meeting Room 402 (West Bldg. 9, 4F)	**Student Conference** Multi-Purpose Digital Hall, W933, W934, W935 (West Bldg. 9, 2F&3F)
Lunch	12:15-13:45	**Networking Lunch** Centennial Hall, 1F		**Lunch** #1 Cafeteria, 2F
Afternoon	13:45-15:00	**Deans' & Staff Meeting, Part I** Collaboration Room (West Bldg. 9, 2F)		**Student Workshop** W935 (West Bldg. 9, 3F)
	15:00-15:30	**Coffee Break**		
	15:30-16:30	**Invited Presentation** **Dr. Jinichi Igarashi** Collaboration Room (West Bldg. 9, 2F)		
	16:30-17:30	**Deans' & Staff Meeting, Part II** Collaboration Room (West Bldg. 9, 2F)		
Evening	17:30-18:30	**Chartered Bus Ride to Excel Hotel Tokyu**		**Train to Excel Hotel Tokyu**
	18:30-20:30	**GALA DINNER** Venue: FutakoTamagawa Excel Hotel Tokyu		

<table>
<tr><th colspan="4">27th November 2019 (Wednesday)</th></tr>
<tr><td rowspan="3">Morning</td><td>9:00-10:30</td><td>Steering Committee Meeting, Part I
Collaboration Room
(West Bldg. 9, 2F)</td><td>9:00-10:00
Student Workshop
W935
(West Bldg. 9, 3F)</td></tr>
<tr><td>10:30-10:50</td><td>Coffee Break</td><td rowspan="2">10:00-11:40
Group Presentation
Multi-Purpose
Digital Hall
(West Bldg. 9, 2F)</td></tr>
<tr><td>10:50-11:40</td><td>Steering Committee Meeting, Part II
Collaboration Room
(West Bldg. 9, 2F)</td></tr>
<tr><td>Lunch</td><td>11:50-13:00</td><td colspan="2">Farewell Lunch
Presentation Awards in Student Workshop
Centennial Hall, 1F</td></tr>
<tr><td>Afternoon</td><td>13:10-18:00</td><td colspan="2">Tokyo City Tour
Asakusa & teamLab Borderless</td></tr>
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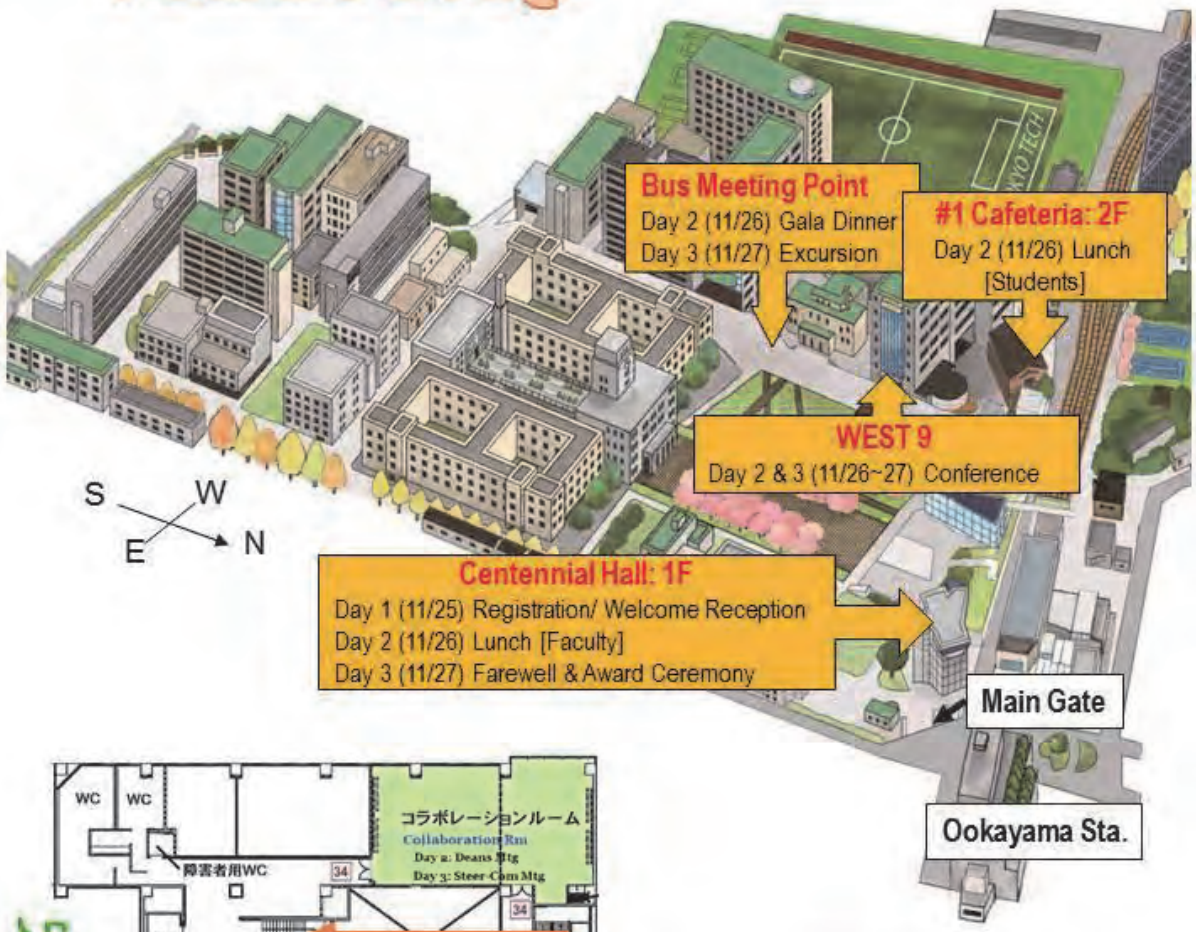
Venue Map


Bus Meeting Point
Day 2 (11/26) Gala Dinner
Day 3 (11/27) Excursion
#1 Cafeteria: 2F
Day 2 (11/26) Lunch
[Students]
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Day 2 & 3 (11/26~27) Conference
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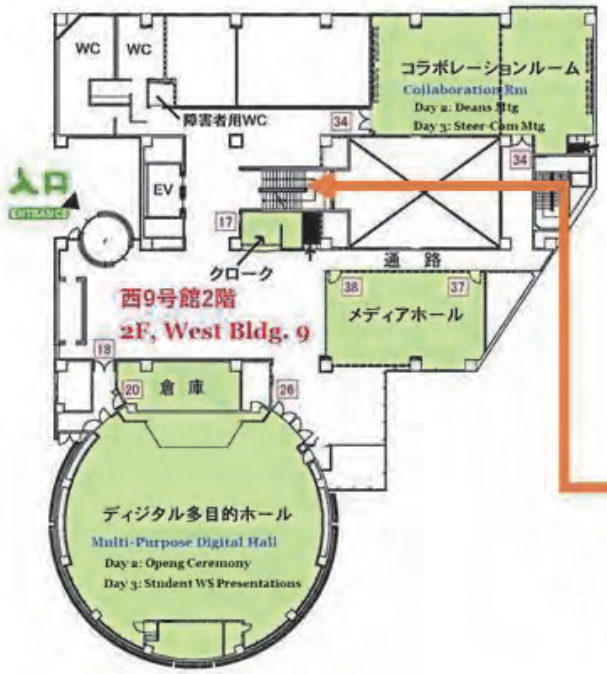
Centennial Hall: 1F
Day 1 (11/25) Registration/ Welcome Reception
Day 2 (11/26) Lunch [Faculty]
Day 3 (11/27) Farewell & Award Ceremony
Main Gate
Ookayama Sta.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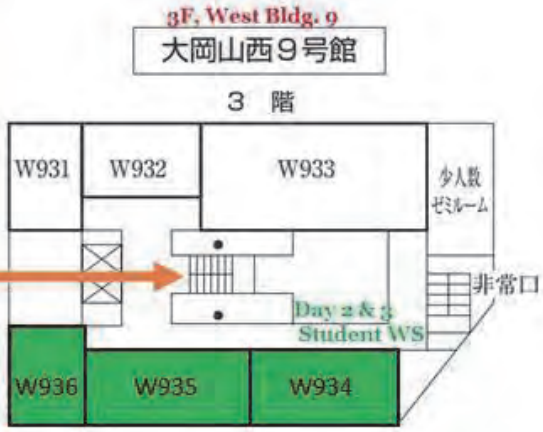
Multi-Purpose Digital Hall
Day 2: Openg Ceremony
Day 3: Student WS Presentations


3F, West Bldg. 9
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W931
W932
W933
少人数
ゼミルーム
非常口
Day 2 & 3
Student WS
W936
W935
W934

AOTULE 2019 DEANS' PROGRAM

25th November 2019 (Monday)	
Welcome Reception Venue: Centennial Hall, Tokyo Tech Ookayama Campus	
17:30-18:00	**Registration** Centennial Hall, 1F
18:00-20:00	**Welcome Reception** Centennial Hall, 1F

26th November 2019 (Tuesday)	
8:45-9:15	**Registration** Venue: Foyer at West Bldg. 9, 2F
Opening Ceremony Venue: Multi-Purpose Digital Hall (West Bldg. 9, 2F)	
9:15-9:45	**Welcome Address by:** **Dr. Isao Sato** Provost and Executive Vice President Tokyo Institute of Technology **Prof. Yuji Wada** Dean of the School of Materials and Chemical Technology Tokyo Institute of Technology **Prof. Ashok Kumar Mishra** Executive Chair of AOTULE Professor of Indian Institute of Technology Madras **Prof. David Shallcross** Steering Committee Chair of AOTULE Professor of the University of Melbourne
9:45-10:00	**Group Photo**
Deans' Meeting Venue: Collaboration Room (West Bldg. 9, 2F)	
10:00-12:15	**Deans' Meeting** **Chair: Prof. Jeffrey Cross** Presentation Session by Each University Institution overview for 2 min and reflection over the previous dozen years for 5 min (total 10 min including Q&A) ● Bandung Institute of Technology ● Chulalongkorn University ● Hanoi University of Science and Technology ● Indian Institute of Technology Madras ● Korea Advanced Institute of Science and Technology ● Nanyang Technological University ● National Taiwan University ● The Hong Kong University of Science and Technology ● The University of Melbourne ● Tsinghua University ● University of Malaya ● University of Moratuwa ● Tokyo Institute of Technology

12:15-13:45	**Networking Lunch** Venue: Centennial Hall, 1F
Dean's & Staff Meeting, Part I Venue: Collaboration Room (West Bldg. 9, 2F)	
13:45-14:15	**Deans' & Staff Meeting, Part I** **Chair: Prof. Jeffrey Cross** **AOTULE Questionnaire Results Presentation by Tokyo Tech.** "Reflection on the Evolution of AOTULE over the Previous Dozen Years (2007-2019)"
14:15-15:00	**Discussion about Past AOTULE Activities**
15:00-15:30	**Coffee Break**
Invited Presentation Venue: Collaboration Room (West Bldg. 9, 2F)	
15:30-16:30	**Invited Presentation** **Chair: Prof. Yuji Wada** **Dr. Jinichi Igarashi** Chair, Sub-Committee on Industry-Academia-Government Cooperation Committee on Innovation, Keidanren (Japan Business Federation) Representative Director, President of JX Nippon Research Institute, Ltd. "Society 5.0 - Seeking for the future Industry-Academia cooperation in Japan -"
Dean's & Staff Meeting, Part II Venue: Collaboration Room (West Bldg. 9, 2F)	
16:30-17:30	**Deans' & Staff Meeting, Part II** **Chair: Prof. Jeffrey Cross** Discussion about Future Direction and Collaboration Possibilities ● Consortium-Oriented Exchange ➢ Summer/Winter Program, Joint Research, Joint Technical Conferences, Multi-Party Research Projects, Competition/Challenges for AOTULE Member Schools ● Bilateral Exchange ➢ Summer/Winter Program, Double-Degree Program, Dual-Degree Program, Co-supervisor Joint Research, Faculty Exchange Fellowship ● New Educational Activity ➢ Flipped Learning, Online Learning, Blended e-Learning, University 4.0 ● Faculty Exchange
GALA DINNER Venue: FutakoTamagawa Excel Hotel Tokyu	
17:30-18:30	**Chartered Bus Ride to Excel Hotel Tokyu**
18:30-20:30	**GALA DINNER** FutakoTamagawa Excel Hotel Tokyu

27th November 2019 (Wednesday)	
Steering Committee Meeting Venue: Collaboration Room (West Bldg. 9, 2F)	
9:00-10:30	**Steering Committee Meeting, Part I** **Chair: Prof. David Shallcross** ● Finance ● Memorandum of Understanding ● AOTULE Homepage ● Future AOTULE Conferences in 2020 and 2021 ● Selection of the Next Steering Chair, Co-chair, and Secretary
10:30-10:50	**Coffee Break**
10:50-11:40	**Steering Committee Meeting, Part II** **Chair: Prof. David Shallcross** ● Highlights of Past Deans' Meeting ● Staff Meeting Briefing ● Proposal for 2020 AOTULE Conference ● Closing Remarks
Farewell Lunch **Presentation Awards in Student Conference** Venue: Centennial Hall, 1F	
11:50-13:00	**Farewell Lunch** **Best Presentation Awards from the Student Conference**
Tokyo City Tour	
13:10-	**Bus Boarding**
13:30-18:00	**Tokyo City Tour** Visits to Asakusa & teamLab Borderless

AOTULE 2019 STAFF PROGRAM

25th November 2019 (Monday)	
Welcome Reception Venue: Centennial Hall, Tokyo Tech Ookayama Campus	
17:30-18:00	**Registration** Centennial Hall, 1F
18:00-20:00	**Welcome Reception** Centennial Hall, 1F

26th November 2019 (Tuesday)	
8:45-9:15	**Registration** Venue: Foyer at West Bldg. 9, 2F
Opening Ceremony Venue: Multi-Purpose Digital Hall (West Bldg. 9, 2F)	
9:15-9:45	**Welcome Address by:** **Dr. Isao Sato** Provost and Executive Vice President Tokyo Institute of Technology **Prof. Yuji Wada** Dean of the School of Materials and Chemical Technology Tokyo Institute of Technology **Prof. Ashok Kumar Mishra** Executive Chair of AOTULE Professor of Indian Institute of Technology Madras **Prof. David Shallcross** Steering Committee Chair of AOTULE Professor of the University of Melbourne
9:45-10:00	**Group Photo**
Staff Meeting Venue: Meeting Room 402 (West Bldg. 9, 4F)	
10:00-11:00	**Staff Meeting, Part I** Current status and future perspective of student exchange programs in the viewpoint of coordination procedure Presentations by member universities on "Current status of student exchange programs for coordination procedure and how to enhance students exchange activities by smooth operation and procedure" ● Presentations (7 min) from each university
11:00-11:15	**Break**
11:15-12:15	**Staff Meeting, Part II** ● Discussion to enhance students exchange activities ● Summing-up

12:15-13:45	**Networking Lunch** Venue: Centennial Hall, 1F
Dean's & Staff Meeting, Part I Venue: Collaboration Room (West Bldg. 9, 2F)	
13:45-14:15	**Deans' & Staff Meeting, Part I** **Chair: Prof. Jeffrey Cross** **AOTULE Questionnaire Results Presentation by Tokyo Tech.** "Reflection on the Evolution of AOTULE over the Previous Dozen Years (2007-2019)"
14:15-15:00	**Discussion about Past AOTULE Activities**
15:00-15:30	**Coffee Break**
Invited Presentation Venue: Collaboration Room (West Bldg. 9, 2F)	
15:30-16:30	**Invited Presentation** **Chair: Prof. Yuji Wada** **Dr. Jinichi Igarashi** Chair, Sub-Committee on Industry-Academia-Government Cooperation Committee on Innovation, Keidanren (Japan Business Federation) Representative Director, President of JX Nippon Research Institute, Ltd. "Society 5.0 - Seeking for the future Industry-Academia cooperation in Japan -"
Dean's & Staff Meeting, Part II Venue: Collaboration Room (West Bldg. 9, 2F)	
16:30-17:30	**Deans' & Staff Meeting, Part II** **Chair: Prof. Jeffrey Cross** Discussion about Future Direction and Collaboration Possibilities ● Consortium-Oriented Exchange ➢ Summer/Winter Program, Joint Research, Joint Technical Conferences, Multi-Party Research Projects, Competition/Challenges for AOTULE Member Schools ● Bilateral Exchange ➢ Summer/Winter Program, Double-Degree Program, Dual-Degree Program, Co-supervisor Joint Research, Faculty Exchange Fellowship ● New Educational Activity ➢ Flipped Learning, Online Learning, Blended e-Learning, University 4.0 ● Faculty Exchange
GALA DINNER Venue: FutakoTamagawa Excel Hotel Tokyu	
17:30-18:30	**Chartered Bus Ride to Excel Hotel Tokyu**
18:30-20:30	**GALA DINNER** FutakoTamagawa Excel Hotel Tokyu

27th November 2019 (Wednesday)	
Steering Committee Meeting Venue: Collaboration Room (West Bldg. 9, 2F)	
9:00-10:30	**Steering Committee Meeting, Part I** **Chair: Prof. David Shallcross** ● Finance ● Memorandum of Understanding ● AOTULE Homepage ● Future AOTULE Conferences in 2020 and 2021 ● Selection of the Next Steering Chair, Co-chair, and Secretary
10:30-10:50	**Coffee Break**
10:50-11:40	**Steering Committee Meeting, Part II** **Chair: Prof. David Shallcross** ● Highlights of Past Deans' Meeting ● Staff Meeting Briefing ● Proposal for 2020 AOTULE Conference ● Closing Remarks
Farewell Lunch **Presentation Awards in Student Conference** Venue: Centennial Hall (Museum,1F)	
11:50-13:00	**Farewell Lunch** **Best Presentation Awards from the Student Conference**
Tokyo City Tour	
13:10-	**Bus Boarding**
13:30-18:00	**Tokyo City Tour** Visits to Asakusa & teamLab Borderless

AOTULE 2019 STUDENT PROGRAM

25th November 2019 (Monday)	
Welcome Reception Venue: Centennial Hall, Tokyo Tech Ookayama Campus	
17:30-18:00	**Registration** Centennial Hall, 1F
18:00-20:00	**Welcome Reception** Centennial Hall, 1F

26th November 2019 (Tuesday)	
8:45-9:15	**Registration** Foyer at West Bldg. 9, 2F
Opening Ceremony Venue: Multi-Purpose Digital Hall (West Bldg. 9, 2F)	
9:15-9:45	**Welcome Address by:** **Dr. Isao Sato** Provost and Executive Vice President Tokyo Institute of Technology **Prof. Yuji Wada** Dean of the School of Materials and Chemical Technology Tokyo Institute of Technology **Prof. Ashok Kumar Mishra** Executive Chair of AOTULE Professor of Indian Institute of Technology Madras **Prof. David Shallcross** Steering Committee Chair of AOTULE Professor of the University of Melbourne
9:45-10:00	**Group Photo**
Student Conference Venue: Multi-Purpose Digital Hall, W934, W935, W936 (West Bldg. 9, 2F&3F)	
10:00-12:15	**Student Conference** ● 4 parallel sessions ● Individual presentation on research at home institution ● 5 min talk and 2 min Q&A **[Session A1&A2, Digital Multi-Purpose Hall]** Affordable and Clean Energy Sustainable Cities and Communities **[Session B1&B2, W934]** Clean Water and Sanitation Responsible Consumption and Production Other Related Issues **[Session C, W935]** Industry, Innovation and Infrastructure 1 **[Session D, W936]** Industry, Innovation and Infrastructure 2

12:15-13:45	**Lunch** #1 Cafeteria, 2F
Student Workshop W935 (West Bldg. 9, 3F)	
13:45-17:30	**Student Workshop** Actions towards Achieving the Sustainable Development Goals (SDGs) in Asia and Oceania ● Grouping, Instructions ● Free discussion and brain storming ● Preparation for group presentation
GALA DINNER Venue: FutakoTamagawa Excel Hotel Tokyu	
17:30-18:30	**Train to Excel Hotel Tokyu**
18:30-20:30	**GALA DINNER** FutakoTamagawa Excel Hotel Tokyu

27th November 2019 (Wednesday)	
Student Workshop W935 (West Bldg. 9, 3F)	
9:00-10:00	**Student Workshop** Actions towards Achieving the Sustainable Development Goals (SDGs) in Asia and Oceania ● Preparation for group presentation ● Free discussion
Group Presentation of Student Workshop Multi-Purpose Digital Hall (West Bldg. 9, 2F)	
10:00-11:40	**Group Presentation** Actions towards Achieving the Sustainable Development Goals (SDGs) in Asia and Oceania ● 7 min talk and 5 min Q&A for further discussion
Farewell Lunch **Presentation Awards in Student Conference** Venue: Centennial Hall, 1F	
11:50-13:00	**Farewell Lunch** **Best Presentation Award from the Student Workshop**
Tokyo City Tour	
13:10-	**Bus Boarding**
13:30-18:00	**Tokyo City Tour** Visits to Asakusa & teamLab Borderless

AOTULE 2019 STUDENT CONFERENCE

[Session A1, Multi-Purpose Digital Hall]
Affordable and Clean Energy

Chairpersons: Gaurav Pandey (IITM) and Michino Hashizume (Tokyo Tech)

A01 [10:00-10:07]
Dini Widyani Aghnia, Environmental Engineering, Bandung Institute of Technology
“Treatment of Organic-rich Wastewater and Electricity Generation using Membrane-less Single Chamber Microbial Fuel Cell”

A02 [10:08-10:15]
Edwin Aldrian Santoso, Faculty of Mechanical and Aerospace Engineering, Bandung Institute of Technology
“Software Development for Simulating 1D Ion Movements in Accelerating Grid of Ion Thruster Using Particle In Cell (PIC) Method”

A03 [10:16-10:23]
Vijay Mudgal, Mechanical Engineering Department, Indian Institute of Technology Madras
“Optimal design and integration of hybrid renewable energy system for sustainable and clean energy”

A04 [10:24-10:31]
Somasree Roychowdhury, Mechanical Engineering, Indian Institute of Technology Madras
“Steam reforming of Ethanol in a Micro-channel system”

A05 [10:32-10:39]
Gaurav Pandey, Ocean Engineering Department, Indian Institute of Technology Madras
“Methane Hydrates: A Potential and Future Clean Energy Resource and its Applications”

A06 [10:40-10:47]
Rishav Raj, Ocean Engineering Department, Indian Institute of Technology Madras
“Oscillating Water Column Wave Energy Converter For Extraction Of Wave Energy”

A07 [10:48-10:55]
Dongheon Lee, EE, Korea Advanced Institute of Science and Technology
“Second life application for Lithium-Ion battery by predicting exact battery status via the data-driven method”

A08 [10:56-11:03]
Ernest Pahuyo Delmo, Department of Chemical & Biological Engineering, The Hong Kong University of Science and Technology
“Electrochemical Reduction of Carbon Dioxide to Hydrocarbons Using CuAg, CuRu, and CuZn Nanomaterials”

Break [11:04-11:14]

A09 [11:15-11:22]
Hexin Liu, School of Aerospace Engineering, Tsinghua University
“Study on Thermal and Electrical Transport Properties of conducting p3ht fibers”

A10 [11:23-11:30]
Peng Jin, School of Aerospace Engineering, Tsinghua University
“Ultrasound-based wireless energy transmission and communication wearable implantable device“

A11 [11:31-11:38]
Ai Fujiyama, Materials Science and Engineering, Tokyo Institute of Technology
“Improved performance of triple layer organic photovoltaic devices by inserting Quinacridone layer”

A12 [11:39-11:46]
Koichiro Muto, Chemical Science and Engineering, Tokyo Institute of Technology
“Pressure-Induced Variations in Luminescence Properties of Polyimides Having Fluorescent End-groups”

A13 [11:47-11:54]
Michino Hashizume, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology
“Techno-economic Assessment on Waste from Palm Oil Mill to Electricity in Malaysia”

[Session A2, Multi-Purpose Digital Hall]
Sustainable Cities and Communities

Chairpersons: Gaurav Pandey (IITM) and Michino Hashizume (Tokyo Tech) (Cont.)

A14 [11:55-12:02]
Kerkritt Sriroongvikrai, Transportation/Civil, Chulalongkorn University
“CRASH ANALYSIS ON NATIONAL HIGHWAY NETWORK WITH MULTI-SOURCE DATA IN THAILAND”

A15 [12:03-12:10]
Raynell Andal Inojosa, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology
“Electromagnetic Properties of RF Signal Under Aquatic Environments for Underwater Wireless Sensor Network Applications”

[Session B1, W934]
Clean Water and Sanitation

Chairpersons: Jiahui Liu (Nanyang Technological University) and Shohei Hara (Tokyo Tech)

B01 [10:00-10:07]
Hoon Cho, Civil and Environmental Engineering, Korea Advanced Institute of Science and Technology
“Membrane fouling alleviation using hydrodynamic orifice system”

B02 [10:08-10:15]
Che-Jung Hsu, Graduate Institute of Environmental Engineering, National Taiwan University
“Synthesis of Cu and S co-impregnated activated carbon to simultaneously adsorb aqueous Hg and prevent gaseous Hg re-emission from SFGD wastewater”

B03 [10:16-10:23]
Zipei Tan, School of Aerospace Engineering, Tsinghua University
“Fast solar-driven evaporation based on nanoporous structure”

B04 [10:24-10:31]
Pengyu Yu, School of Aerospace Engineering, Tsinghua University
“Insulator-based dielectrophoresis for the concentration of bacteria using contactless electrodes”

B05 [10:32-10:39]
Xuejie Xu, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology
“A trial to monitor individual microorganisms in sewage sludge for observational analysis of ultra-sonication impacts”

[Session B2, W934]
Responsible Consumption and Production
Other Related Issues

Chairpersons: Jiahui Liu (Nanyang Technological University) and Shohei Hara (Tokyo Tech)

B06 [10:40-10:47]
Calvin Leonard, Mining Engineering Department, Bandung Institute of Technology
“Stability Analysis of Horizontal Pillar with Analytic Methods”

B07 [10:48-10:55]
Cuong Tuan Le, Information Technology and Communication/Information System, Hanoi University of Science and Technology
“Information Security”

B08 [10:56-11:03]
Huy Quoc Nghiem, Dept. of Aeronautical and Space Engineering, Hanoi University of Science and Technology
“COMPARISON OF DIFFERENT RANS TURBULENCE MODEL IN SIMULATING A DELTA WING”

Break [11:04-11:14]

B09 [11:15-11:22]
Jaehyeon Ryu, College of Engineering / Department of Industrial & Systems Engineering, Korea Advanced Institute of Science and Technology
“Mathematical Optimization and Uncertainty”

B10 [11:23-11:30]
Jiahui Liu, Civil Environmental Engineering, Nanyang Technological University
“Bayesian Projections on the Spectrum of Marine Bunker Fuel: What is the Impact of Fossil Fuels in the Maritime Transportation?”

B11 [11:31-11:38]
Yun Lim, College of Engineering/School of Chemical and Biomedical Engineering, Nanyang Technological University
“Large scale fabrication of Bioinspired Photonic Crystals”

B12 [11:39-11:46]
Sheena Anne Henson Garcia, Department of Chemical & Biological Engineering, The Hong Kong University of Science and Technology
“Investigation of the Nanomaterial Safety”

B13 [11:47-11:54]
May Kristine Jonson Carlon, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology
“Challenges of Developing a Metacognitive Tutor on Open edX”

B14 [11:55-12:02]
Shohei Hara, Chemical Science and Engineering, Tokyo Institute of Technology
“Strategy toward Perpendicularly Aligned Rigid Polyimide: a New Coating Method Based on Liquid Crystal Precursor and Hydrophobic Substrate”

[Session C, W935]
Industry, Innovation and Infrastructure 1

Chairpersons: Yingchao Zhang (Tsinghua University) and Shahriar Kabir (Tokyo Tech)

C01 [10:00-10:07]
Tutla Ayatullah, Faculty of Mechanical and Aerospace Engineering, Bandung Institute of Technology
“Development of a Sensor System for Linear Axis Diagnostic of Machine Tools”

C02 [10:08-10:15]
Jun Hui Lee, Industrial & Systems Engineering Department, Korea Advanced Institute of Science and Technology
“Track Layout Design for Dynamic Routing in AMHS”

C03 [10:16-10:23]
Dorin Harpaz, School of Material Science & Engineering, Nanyang Technological University
“Point-of-Care Surface Plasmon Resonance Biosensor for Stroke Biomarkers NT-proBNP and S100β using a Functionalized Gold Chip with Specific Antibody”

C04 [10:24-10:31]
Simon Goh, EEE, Nanyang Technological University
“Miniaturized infrared spectrometer for the detection of volatile organic compounds in the mid infrared regime”

C05 [10:32-11:39]
Guang Chen, Department of Electronic & Computer Engineering, The Hong Kong University of Science and Technology
“Automatic fracture detection using deep learning”

C06 [10:40-10:47]
Tielin Wu, Aerospace Engineering, Tsinghua University
“Thermal transport at self-assembled monolayer interfaces: Molecular dynamics simulations”

C07 [10:48-10:55]
Hongda Li, School of Aerospace Engineering, Tsinghua University
“Sensitivity of HF-etched multimode fiber on water detection”

C08 [10:56-11:03]
Yingchao Zhang, Department of Engineering Mechanics, Tsinghua University
“Climbing-inspired twining electrodes using shape memory for peripheral nerve stimulation and recording”

Break [11:04-11:14]

C09 [11:15-11:22]
Tuanku Badzlin Hashfi, Department of Electrical Engineering, University of Malaya
"Adaptive Carrier Based PDPWM Modulation Control for Modular Multilevel Converter with Fault-tolerant Capability"

C10 [11:23-11:30]
Britta Hohmann, Department of Mechanical Engineering, Tokyo Institute of Technology
"Usage of Textile Materials for Deployable Membrane Space Structures"

C11 [11:31-11:38]
Wei Hung Chen, Department of Chemical Science and Engineering, Tokyo Institute of Technology
"Platinum-Incorporated TON-Type Zeolite as Catalyst in Dehydrogenation of Straight-Chain Alkanes"

C12 [11:39-11:46]
Luc Gougeon, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology
"Teaching AI and Machine Learning to General Education Students"

C13 [11:47-11:54]
Pengfei Jia, Civil and Environmental Engineering, Tokyo Institute of Technology
"Mechanical Properties of Fiber Reinforced Geopolymer Mortar and Concrete"

C14 [11:55-12:02]
Abraham Castro Garcia, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology
"Kraft lignin depolymerization in super critical alcohol-water mixtures"

C15 [12:03-12:10]
Shahriar Kabir, Department of Electrical and Electronic Engineering, Tokyo Institute of Technology
"Sensitive Near-Infrared Photodetector Based on a Liquid Crystalline Organic Semiconductor Material for Medical Imaging"

[Session D, W936]
Industry, Innovation and Infrastructure 2

Chairpersons: Ahmad Alhilal (HKUST) and Yuta Takahashi (Tokyo Tech)

D01 [10:00-10:07]
Ajith Jogi, Department of Mechanical Engineering, Indian Institute of Technology Madras
“Handling Evaluation of Tractor-semitrailer with Split Fifth Wheel Coupling Maneuvering a J-turn”

D02 [10:08-10:15]
Suttinee Sawadsitang, Computer Science and Engineering, Nanyang Technological University
“Replacing Ground-based Vehicles by Drones in Delivery: System Management and Optimization”

D03 [10:16-10:23]
Yixin Men, Department of Industrial Engineering & Decision Analytics, The Hong Kong University of Science and Technology
“Emotion synesthesia for human”

D04 [10:24-10:31]
Ahmad Alhilal, Department of Computer Science & Engineering, The Hong Kong University of Science and Technology
“Technologies Integration Towards Sustainable Transportation”

D05 [10:32-10:39]
Kai Wu, School of Aerospace Engineering, Tsinghua University
“Topology optimization and its applications”

D06 [10:40-10:47]
Yixiao Sun, School of Aerospace Engineering, Tsinghua University
“Finite Element Method Based on the Willis-form Equations for Geometrically Nonlinear Elasticity Problems”

D07 [10:48-10:55]
Yang Shen, School of Aerospace Engineering, Tsinghua University
“Study of Helicopter Blades Structural Response during Starting Process”

D08 [10:56-11:03]
Wen Chek Leong, Department of Electrical Engineering, Faculty of Engineering, University of Malaya
“High Efficiency, Low Noise Magnetron’s Cathode Sputtering Study using GaN and SiC for Modulated Microwave Power”

Break [11:04-11:14]

D09 [11:15-11:22]
Tabassum Mohsin Chowdhury, Civil and Environmental Engineering, Tokyo Institute of Technology
“Improved Dynamic Increase Factor for Progressive Collapse Analysis of Asymmetric Reinforced Concrete Moment Resisting Frame Buildings”

D10 [11:23-11:30]
Kou Li, Department of Electrical and Electronic Engineering, Tokyo Institute of Technology
“Multifunctional and omnidirectional photo-thermal monitoring robots for ubiquitous safety-net platform”

D11 [11:31-11:38]
Keisuke Omoto, Mechanical Engineering, Tokyo Institute of Technology
“Design and Analysis of 5.8-GHz-band Reflectarray on Nonflat Space Structures”

D12 [11:39-11:46]
Binod Kumar Shrestha, Civil and Environmental Engineering, Tokyo Institute of Technology
“Seismic Improvement of RC Frame Buildings Using Post-Tensioned Hybrid Precast Concrete Walls as Partial Infill Walls”

D13 [11:47-11:54]
Yuta Takahashi, Department of Mechanical Engineering, Tokyo Institute of Technology
“Orbital and Attitude Analysis of Tethered Solar Sail Spacecraft Formation Flying”

D14 [11:55-12:02]
Ryota Kurihara, Department of Civil and Environmental Engineering, Tokyo Institute of Technology
“Analytical evaluation on structural performance change of reinforced concrete structure by long term drying”

D15 [12:03-12:10]
Masaki Kato, Civil Engineering, Tokyo Institute of Technology
“Effects of Web Position on Shear Resistance Mechanism of UFC beams”

EXTENDED ABSTRACTS

[Session A1]
Affordable and Clean Energy

A01
"Treatment of Organic-rich Wastewater and Electricity Generation using Membrane-less Single Chamber Microbial Fuel Cell"
Dini Widyani Aghnia, Environmental Engineering, Bandung Institute of Technology

Energy needs are increasing along with population growth but until now the fulfillment mostly come from fossil sources which are expensive and has negative impact to the environment. Beside that amount of the waste also increasing along with activities of the population and still not processed properly. In this study the use of Microbial fuel cell (MFC) to treat tofu wastewaster as a representative of organic-rich wastewater was investigated to overcome the problems simultaneously. This technology utilizes microorganisms as bio-catalysts to extract energy in organic or inorganic compounds that are easily degraded into electrical energy. The MFC membrane-less single-chamber was used which consisted of a graphite fiber brush as anode and a wet-proofed (30%) carbon cloth as cathode electrodes. This research was conducted on the reactor fed-batch mode with eight external resistance (1000, 800, 600, 400, 200, 100, 50 and 20 Ω) to determine optimum external resistance which yield highest coulombic efficiency (CE) , energy efficiency (EE) and organic removal efficiency. Next experiments was conducted by use continuous flow to the MFC with four different organic loading rates (OLRs) with hydraulic retention time (HRT) (48, 24, 12, and 6 hours) using an optimum external resistance from the previous experiments. The reactor performance was investigated by measuring current density, power density (PD), organic removal efficiency, CE and EE. The fed-batch mode results showed that MFC reactor using tofu waste water can produced maximum voltage 0.487 volts at 1000? , maximum power density 180 mW/m2 and yield an energy recovery 0.357 mW/gCOD removed.

A02
"Software Development for Simulating 1D Ion Movements in Accelerating Grid of Ion Thruster Using Particle In Cell (PIC) Method"
Edwin Aldrian Santoso, Faculty of Mechanical and Aerospace Engineering, Bandung Institute of Technology

Ion thruster has been the revolutionary system nowadays for deep space exploration replacing the conventional chemical thruster. Despite of its small magnitude of force, the efficiency and specific impulse of ion thruster are astonishing. The absence of friction in space makes the satellite in a certain period of time could build up its velocity and perform orbital maneuver effectively. In order to achieve the most optimal design of ion thruster and reduce the production cost, numerical simulation of the system should be conducted. This article will provide the basic software to perform numerical simulation of ion particle inside the accelerating grid. Further development for fully ion thruster simulation could be achieved by expanding from this basic idea of particle simulation. This numerical computation will be validated using theoretical calculation from the basic physics. The phenomenon of ion which is accelerated in accelerating grid is same as the space charge in parallel-plate capacitor, the maximum current density of this phenomenon is given by the Child-Langmuir Law. Each particle will be modelled in 1D and moving independent to each other in the space, accelerated by electric field environment. The space between the positive and negative electric potential will be divided into nodes. Then the particle and magnitude of electric field

will be weighted to the nodes, this method is called particle in cell (PIC) method. The potential in each nodes could be calculated by solving the Poisson equation implicitly. Particles which exceed the boundary will get special treatment to keep the domain within the limits. The computations are performed until the parameters reach steady state values.

A03
"Optimal design and integration of hybrid renewable energy system for sustainable and clean energy"
Vijay Mudgal, Mechanical Engineering Department, Indian Institute of Technology Madras

Hybrid renewable energy system (HRES) is integration of different energy sources to provide uninterrupted and viable solution for electrification especially for areas not connected to main grid due to difficult terrain and economic reasons. HRES has many advantages like non-depleting, non-polluting nature, better load matching and better renewable energy utilization. In the study, mathematical modelling, designing, size optimization and techno-economic analysis of standalone HRES has been carried out. Hybrid system is modelled to have maximum contribution from wind and solar energy with minimum net present cost (NPC) of system to meet electric load demand of CRC building, IIT Madras, India. The results show that most feasible system configuration consists of 12 kW Photovoltaics, 3 kW wind turbine and 15 kW biogas generator with NPC and cost of energy equal to $ 117,098 and $ 0.09 / kWh respectively. The HRES generate 71,826 kWh of energy to meet AC load of 64,396 kWh per year. The capacity factor and percentage contribution of PV, wind turbine and biogas generator are 17.8 %, 6.57 %, 39.1 % and 26 %, 2.4 %, 71.6 % respectively. The analysis also presents sensitivity analysis of hybrid system with variation in capital cost of different components.

A04
"Steam reforming of Ethanol in a Micro-channel system"
Somasree Roychowdhury, Mechanical Engineering, Indian Institute of Technology Madras

Hydrogen energy being one of the clean forms of energy is gaining popularity for its application to fuel cells. There are various methods to produce hydrogen, but steam reforming of a hydrocarbon is particularly being researched upon due to its low energy requirement. Among all hydrocarbons, bio-ethanol is a form of renewable energy that can be produced by fermentation of bio-wastes. Hence, it has become an enticing option for hydrogen production. In order to meet up with the necessity of power generation for portable devices or automobiles, attention towards the application of micro-scale devices is increasing day by day. However, perceiving an idea to the scale of application requires an in depth understanding of the ethanol steam reforming reaction, the catalyst used for the reaction, the geometrical effects, etc. Although there are various works available in literature addressing the chemical reaction kinetics and catalysts in micro-channel, a very few papers are available that investigate the geometrical effects. As the reforming reaction is endothermic in nature, the heat transfer characteristics of the system are a crucial aspect in determining the thermal efficiency and hence, the ethanol conversion rate or the hydrogen production rate. In a reformer, the reforming mixture (steam and ethanol) acts as the cold fluid (or heat sink) while flue gas flowing through the parallel channels act as the heating channels (or heat source). Hence, the heat transfer between the source and the sink greatly depends upon the geometry, which has been addressed in detail.

A05
"Methane Hydrates: A Potential and Future Clean Energy Resource and its Applications"
Gaurav Pandey, Ocean Engineering Department, Indian Institute of Technology Madras

Over the past century, the population on the earth exceeding 6.2 billion, while the energy consumption grew by over an order of magnitude, from 0.9 × 109 tons of oil equivalent (TOE) to 1.02 × 1010 TOE. The increased energy desires due to rapid industrialization were met initially by using coal and later oil and natural gas. Presently, oil and natural gas are the primary fuels. Conventional fossil fuel resources are limited, and hence an effective search for new sources is underway. One such source is the huge quantity of methane gas hydrate found in the earth. Unlike conventional natural gas, 370 TCM reserves of gas hydrates are distributed evenly around the world. As a result, over 220 gas hydrate deposits have been discovered, more than a hundred wells drilled, and kilometres of hydrated cores studied. Thus, it has attracted significant research interests as an energy source from both academic and industry in countries like, Japan, China, USA, and India. Earlier successful field and production tests have proved about the technical viability of methane gas production from hydrate reservoirs. Methane hydrates is best clean source of energy. However, small amounts of methane have been found in the atmosphere of Mars. At last, gas hydrate has many applications like energy storage, desalination, CO2 capture and sequestration, natural gas transportation and gas separation.

Key words: gas hydrates, clean energy, energy resource, natural gas transport, methane hydrate

A06
“Oscillating Water Column Wave Energy Converter For Extraction Of Wave Energy”
Rishav Raj, Ocean Engineering Department, Indian Institute of Technology Madras

Due to the ever-increasing demand of energy people have started looking towards unconventional sources of energy such as wind, solar, wave, geothermal and biomass energy. Moreover, renewable energy sources have less impact on the environment and are also nonexhaustive. One of the popular yet less explored sources is the ocean waves. The wave energy has benefits such as it has high power density, it is persistent in nature (present all round the year day and night) and is relatively cheap. There are many methods from which wave energy can be extracted but the most popular as well as the common one is by the help of oscillating water column(OWC). In this setup there is a fixed or floating hollow structure which is partially submerged in water. The structure has air trapped inside it. The air present inside the hollow chamber gets compressed or decompressed along with the wave undulations. This air is forced through a turbine coupled with a generator which is used to convert the pneumatic energy into mechanical energy and then finally to electrical energy. As the moving parts in the OWC are kept outside the water, the lifetime of the material increases. The system can be set near the shore making it easy to maintain as well. A lot of current research is focused on the design of OWC as well as improving the performance of the turbines used in the OWC system

A07
“Second life application for Lithium-Ion battery by predicting exact battery status via the data-driven method”
Dongheon Lee, EE, Korea Advanced Institute of Science and Technology

As environmental pollution and energy shortages are emerging worldwide, demand for alternative and electrical energy for sustainable development is surging. Compared to other alternative energy sources, lithium batteries are highly efficient, low-cost, and are mostly used for electric vehicles and energy storage system (ESS). However, these lithium batteries are considered waste batteries because of their stability problems at 80 percent of their initial capacity. Only 50% of these waste batteries are reused, which is because conventional algorithms make it difficult to predict the complex state of the battery. Therefore,

this study allows accurate prediction of the state of an artificial intelligence-based battery and thereby increasing the rate of battery reuse.

A08
"Electrochemical Reduction of Carbon Dioxide to Hydrocarbons Using CuAg, CuRu, and CuZn Nanomaterials"
Ernest Pahuyo Delmo, Department of Chemical & Biological Engineering, The Hong Kong University of Science and Technology

The rise of carbon dioxide concentrations in the Earth's atmosphere due to the excessive burning of fossil fuels has led to the gradual warming of the climate in the past years. Because of the high energy density, ease of storage, and availability of fossil fuels, the global energy mix is still mostly dependent on these energy sources instead of renewable energy resources. Unless an effective energy storage system is coupled with renewable energy sources, its implementation will still remain to be expensive and inefficient. This research aims to synthesize an electrocatalyst that is able to selectively reduce carbon dioxide, an abundant byproduct of combustion, to useful hydrocarbons. If such a technology is successfully implemented, then the energy density of renewable energy storage systems may rival that of crude oil and natural gas. In this study, various bimetallic catalysts were tested for their activity and selectivity for CO2 reduction, namely Cu-ZnO nanoparticles, Cu-Ru nanowires, and Cu-Ag nanoparticles. The nanomaterials were synthesized using various metal salts (Cu(acac)2, Zn(OAc)2, RuCl3xH2O, and AgNO3) as precursors and oleylamine as the reducing agent and surfactant. XRD, SEM, and TEM were used to characterize and confirm the phases and surface morphologies present in the catalysts. The maximum CO FE of 28.6% was obtained at -0.9V using the Cu6Ag NPs. On the other hand, the maximum methane FE of 36.7% and ethylene FE of 20.5% were obtained using the CuZnO NPs (at -1.2V) and CuRu nanowires (at -1.1V), respectively. By utilizing copper alongside another metal, the synergistic effects produced can be shown to modify the selectivity such that only the production of certain hydrocarbons is favored.

A09
"Study on Thermal and Electrical Transport Properties of conducting p3ht fibers"
Hexin Liu, School of Aerospace Engineering, Tsinghua University

Thermoelectric transformation technology can realize direct transformation between heat and electricity without mechanical moving parts. Therefore, it has broad application potential in fields such as deep space exploration, low-grade thermal energy utilization and microscale power supply, etc. Semiconductor thermoelectric materials are developed well, however, the dimensionless quality factor can achieve about 2.0 at most, which cannot meet the requirement of application. With the development of material science, attention has been paid to organic thermoelectric materials for their wide selection region and variety of controllable factor, and they are expected to achieve high thermoelectric transformation efficiency. However, due to the lack of research on the thermal transport properties of organic thermal materials at the micro-nano scale, its evaluation is limited to the power factor and cannot comprehensively characterize the thermoelectric figure of merit. This study introduces the development status of organic thermoelectric materials, as well as the preparation procedure of P3HT via organic small molecule epitaxy. The surface morphology and microscopic physical structure were observed by (SEM) scanning electron microscopy. The comprehensive characterization of thermal conductivity, electrical conductivity and Seebeck coefficient was completed by the integrated T-shaped method and the hidden physical mechanism was discussed. The measurement results show that the physical properties of P3HT are strongly dependent on temperature. In addition, the P3HT with different preparation concentrations are measured. It shows that P3HT fibers with higher

concentration engage higher electrical conductivity, higher thermal conductivity and lower Seebeck coefficient, and there exists an optimal concentration for the thermoelectric figure of merit.

A10
“Ultrasound-based wireless energy transmission and communication wearable implantable device**“**
Peng Jin, School of Aerospace Engineering, Tsinghua University

Through flexible electronic technology, we proposed an ultrathin flexible ultralow power implantable electronic system, which can not only achieve simultaneously wireless charging and communication based on ultrasound, but after integrating specific sensor components also accomplish most implantable medical device’s functions, such as in vivo physiological parameters monitoring, cardiac pacing, nerve stimulation, drug delivery.

A11
“Improved performance of triple layer organic photovoltaic devices by inserting Quinacridone layer”
Ai Fujiyama, Materials Science and Engineering, Tokyo Institute of Technology

Organic materials have advantages in making flexible large-area solar cells at low cost. However, photoconversion efficiency (PCE) and durability of organic photovoltaic (OPV) devices are lower than those of silicon ones. Copper phthalocyanine (CuPc) is one of the standard OPV materials. Though CuPc has excellent durability, the absoraption coefficient in the short visible wavelength region restricts the PCE of CuPc based OPVs. To improve the PCE, we planned to introduce another active layer having complementary absorption spectra. We chose high durability organic pigment Quinacridone (QA) as the third layer material inserting into CuPc/acceptor (C60) OPVs. Triple-layer OPVs (QA/CuPc/C60) were fabricated by vacuum deposition. The PCE of the OPVs increased by 2.6 times compared with the conventional bi-layer OPVs without the QA layer. To reveal the improvement mechanism, QA and CuPc were separately excited using color filters. The results showed that charge separation happened not only at the CuPc/C60 interface but also at the QA/CuPc interface. Both interfaces are series-connected and increase the open-circuit voltage. Though CuPc is a well-known p-type semiconductor, electrons should flow through the CuPc layer, suggesting that CuPc acted as an ambipolar semiconductor. N-type behavior of CuPc was demonstrated by the OPV characteristic of QA/CuPc bilayer OPV device. We also revealed the increase of face-on orientation of CuPc on the QA layer by UV-Vis and X-ray diffraction measurements. In conclusion, the insertion of the QA layer increased the PCE by doubling the charge separation interfaces and controlling the molecular orientation of the CuPc layer.

A12
“Pressure-Induced Variations in Luminescence Properties of Polyimides Having Fluorescent End-groups”
Koichiro Muto, Chemical Science and Engineering, Tokyo Institute of Technology

Organic luminescent materials are applicable to many fields; such as displays, light emitting devices (LEDs), photovoltaic devices, and spectrum convertors for solar cells and crop cultivation. Recently, polyimides (PIs) are increasingly attracting many interests due to the potential applications as novel photoluminescence materials because of their high thermal and chemical stability, and mechanical strength. Our research group has been developing a variety of photoluminescent polyimides which emit visible light in various colors by controlling the primary structure of the polyimides. On the other hand, photoluminescence

properties of PIs strongly depend on not only the primary structure but also the aggregation state. We have reported that the luminescence intensities of fluorescent PIs are reduced under high pressure up to 8 GPa due to the enhancement of nonradiative deactivation caused by intermolecular energy transfer. But, the effect of applying pressure on the fluorescent group at the end of the molecular chain of PIs has not been investigated yet. In this study, the correlations between the aggregation state and the photoluminescent properties were examined for end-capped PIs with fluorescent end-groups based on photoluminescence spectroscopy under high pressure. I used a two types PI as the main chain of end-capped PI. One is fluorescent PI, and other is no fluorescent PI. In addition, same fluorescent molecular was attached to those PIs. In the result, the end-capped PI with no fluorescent PI emitted strong light under high pressure. Such PI can be used to solar spectra converter for solar cell and solve the our energy problem near future.

A13
"Techno-economic Assessment on Waste from Palm Oil Mill to Electricity in Malaysia"
Michino Hashizume, School of Environment & Society/ Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology

In the production process of palm oil, three types of biomass; Empty Fruit Bunch (EFB), Kernel Shell (KS) and Mesocarp Fiber (MF) are produced as wastes. This research forces on these three kinds of biomass and conducts the economic assessment on utilizing each combination of three biomass not only for internal electricity generation but also for selling local area via the grid. This research evaluates seven cases based on each combination: case1 (utilizing all biomass), case2 (utilizing EFB and MF), case3 (utilizing EFB and KS), case4 (utilizing MF and KS), case5 (utilizing only EFB), case6 (utilizing only MF), case7 (utilizing only KS). In this evaluation, unutilized biomass is transferred to nearest palm oil mill simply. As a result, transportation cost accounted for the largest proportion of the cost. About initial cost as construction cost is the lowest in case 6 that is now used generally. However, in the long term, case 6 need the highest cost. About income, the income of selling electricity accounted for the largest proportion. It was also depended strongly from FIT as FIT in Malaysia can be used only for a facility whose capacity is lower than 30MW. This factor made case1 not be the case of making the largest profit because of plant size as it is too big to apply FIT. In these palm oil mills, case3 can make the largest profit. Until FIT can be applied case1 can make the largest profit.

[Session A2]
Sustainable Cities and Communities

A14
"CRASH ANALYSIS ON NATIONAL HIGHWAY NETWORK WITH MULTI-SOURCE DATA IN THAILAND"
Kerkritt Sriroongvikrai, Transportation/Civil, Chulalongkorn University

Road safety is an alarming issue across the world. From the Global Status Report on Road Safety (WHO, 2015), Thailand has the second highest road traffic fatality rate in the world at 36.2 per 100,000 population, with an annual estimate of over 24,000 deaths or approximately 50 to 60 cases per day. While 1 million people were wounded and sought hospital treatments each year, 60,000 of whom were permanently disabled. Fatality rate in Thailand from year 2000 to 2016 shows that traumatic situation in Thailand has been unchanged for last 7 years (2010-2016) and trend to be increasing from last couple year (2015-2016). The main objective of this topic is to explain the factors contributing to traffic accidents in Thailand using meta-source data.

A15
"Electromagnetic Properties of RF Signal Under Aquatic Environments for Underwater Wireless Sensor Network Applications"
Raynell Andal Inojosa, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology

Electromagnetic (EM) waves in the radio frequency (RF) range have been identified in this report to severely attenuate due to the conductivity σ of water. The complex propagation constant γ, which is defined by Maxwell's equation, has been utilized to derive the attenuation factor α and model the propagation of RF waves according to the σ value-purewater (σ=0.01 S/m), lakewater (σ=0.05 S/m), and seawater (σ=4 S/m). RF signal attenuation is expected to be lower in freshwater because its conductivity is extremely smaller than seawater; hence, it has shown promising feasibility in the freshwater aquatic environment specifically for short or shallow distance real-time scenario. In underwater wireless communications, acoustic and optical signals have been commonly employed as communication links for underwater wireless sensor networks (UWSNs). To remedy the acoustic and optical signals' shortcomings within a specified depth, a method of utilizing EM waves is proposed. The electromagnetic properties (i.e., loss tangent, attenuation, and velocity) will be investigated to evaluate the impact of utilizing RF signal for UWSNs. The recent advances in technology have made it possible to create small, powerful, energy-efficient, cost-effective UWSNs for general underwater applications such as disaster management, marine transportation, ocean exploration, water quality monitoring, and even fish farming (aquaculture), which is commonly done in freshwater. From this report's findings of using EM waves, UWSN technologies could pave the way for more specific applications to support the aquaculture sector thereby promote a sustainable community, whose source of living is highly dependent on aquatic environments (e.g., fish farming).

[Session B1]
Clean Water and Sanitation

B01
"Membrane fouling alleviation using hydrodynamic orifice system"
Hoon Cho, Civil and Environmental Engineering, Korea Advanced Institute of Science and Technology

In pursuance of clean water in the modern world, water contaminants are treated in the wastewater treatment. Among many conventional techniques, membrane technology is considered promising due to its high separation quality. In this field, with its high screening effect throughout the operation, membrane may suffer from contaminants stacking on the membrane during filtration, also known as fouling. Various techniques via physical and chemical ways are implemented and studied to resolve such issue. Several examples are backwashing, air scouring, chemical disinfectant, baffle, etc. However, it is inevitable for the current techniques to face additional energy input or secondary pollution due to usage of devices or chemicals. This may lead to increase in maintenance cost. In this research, fouling alleviation using turbulence on the membrane surface was studied. Orifice system used in hydrodynamics is applied in the membrane technology to generate maximum turbulence that will lead to wall shear stress to remove any contaminants fouled on the membrane. Model foulants used to mimic wastewater condition were experimented and the membrane flux of orifice system increased significantly, indicating that the applied system is beneficial especially in removing cake layers, thick contaminant layer formed on the

membrane surface due to its larger aggregate size than membrane pores. Without additional device nor chemicals, simple application of orifice can definitely resolve such issue.

B02
"Synthesis of Cu and S co-impregnated activated carbon to simultaneously adsorb aqueous Hg and prevent gaseous Hg re-emission from SFGD wastewater"
Che-Jung Hsu, Graduate Institute of Environmental Engineering, National Taiwan University

The environmental impacts of the seawater flue gas desulfurization (SFGD) of coal-fired power plants (CFPPs) including the discharge of Hg-containing seawater to ocean and the re-emission of Hg0 from aeration tank to ambient air have been of global concerns. In this article, a series of bench experiments were conducted to obtain the optimal adsorption conditions for removing the aqueous Hg from SFGD system by using Cu and S co-impregnated activated carbon (Cu-S-AC). The total surface area, copper content, and sulfur content of Cu-S-AC was 500 m2/g, 2.11 wt%, and 2.67 wt%, respectively. At low initial Hg concentration, a significant difference between the removal efficiency of SAC and AC was not observed. When the initial concentration reached 4104 ng/L, the Hg removal of Cu-S-AC increased with increasing initial Hg concentration whereas that of AC decreased. Hg removal efficiency was also shown to be slightly higher at pH 7 and 8 than that in an acid seawater condition. Thermodynamic parameter calculation concluded that $\triangle H°$= 34.63 kJ/mole, $\triangle S°$= 0.146 kJ/mole, and $\triangle G$ was almost negative, indicating that Hg adsorption by SAC is endothermic and spontaneous.

B03
"Fast solar-driven evaporation based on nanoporous structure"
Zipei Tan, School of Aerospace Engineering, Tsinghua University

Solar water evaporation is a promising method for acquiring clean water. However, due to the relatively high heat resistance between the bulk water and the vapor, the evaporation rate is low. Based on the thin film evaporation theory, we cover a nanoporous alumina membrane (pore radius ranging from 20nm to 200nm) on the surface of the water, and report a 30% higher evaporation rate than the evaporation rate of the bare water under 1 sun illumination. It is found that the temperature of the nanoporous membrane is not significantly higher than the surface of the bare water, indicating the evaporation rate rise by the unique structure of the nanoporous membrane. The nanoporous structure divides the whole water surface into many small surfaces on nanoscale, and each surface has a thin film region which allows higher heat flux toward, and therefore allows higher evaporation rate. The nanoporous membrane shows a promising approach to achieving fast solar-driven evaporation.

B04
"Insulator-based dielectrophoresis for the concentration of bacteria using contactless electrodes"
Pengyu Yu, School of Aerospace Engineering, Tsinghua University

Dielectrophoresis (DEP) has become a promising technique to separate and identify cells and microparticles suspended in a medium based on their size or electrical properties. Presented herein is a new technique to provide the non-uniform electric field required for DEP based on insulator that does not require electrodes to contact the sample fluid. In our method, electrodes are capacitively-coupled to a fluidic channel through dielectric barriers; the application of a high-frequency electric field to these electrodes then induces a non-uniform electric field in the channel. This technique combines the cell manipulation

abilities of traditional DEP with the ease of fabrication found in insulator-based technologies. A microfluidic device was fabricated based on this principle to determine the feasibility of cell manipulations through contactless DEP. We were able to demonstrate that insulator-based dielectrophoresis microfluidic device can achieve the capture of bacteria with high efficiency and shows the potential to separate the live and dead bacteria. These results illustrate the potential for this technique application in water analysis.

B05
"A trial to monitor individual microorganisms in sewage sludge for observational analysis of ultra-sonication impacts"
Xuejie Xu, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology

The high water content in the sewage sludge is one of global environmental considerations which related to the secondary environmental pollution including hazardous liquid leakage in the landfill process and gas exhaust gas and CO2 emission via incineration. Moreover, the treatment and disposal cost of sewage sludge takes almost 50% to 70% of the total operation cost of wastewater treatment plant. At present, many researchers have found that ultra-sonication can break the sludge structure and destroy cells to release the intracellular water and facilitate the sludge dewatering performance, which shows the potential advantage of ultra-sonication on sludge dewatering application and controlling the operational cost. However, the transformation of individual microorganisms via ultra-sonication treatment and the mechanism of ultra-sonication at micro-scale are not fully studied. Thus, this study starts from monitoring each microorganism body before and after ultra-sonication to investigate ultra-sonication effect at micro-scale. The sewage sludge takes directly from the Naruse Clean Center located in Yokohama. Morphological properties of individual microorganisms in sewage sludge before and after ultra-sonication are characterized using Digital Microscope (3-6300-01 M-100FLD corded), Ultrasonic Homogenizer (THU-80) used in sonication with different ultrasonic energy input. The target microorganism cell and flocs in the sewage sludge show change tendency via different experimental mode. Thus, ultra-sonication is effective on injuring or breaking the single microorganism cell and flocs structure which facilitates release the intracellular matters into the outside aqueous phase.

[Session B2]
Responsible Consumption and Production
Other Related Issues

B06
"Stability Analysis of Horizontal Pillar with Analytic Methods"
Calvin Leonard, Mining Engineering Department, Bandung Institute of Technology

Horizontal pillar (sill pillar) is an important element in underground mining that uses stoping. The stability of the pillar is very influential on the overall stability of the mine, company profits, and natural resource needs, so it is necessary to extract as much ore as possible safely. This study aims to produce an equation to calculate the effective horizontal pillar thickness which can be used as a preliminary study in mining activities. A parametric study has been conducted to verify the equation. The parameters in the equation include the dip, depth, and geometry of the ore body, friction force, density, thickness, and mechanical properties of the horizontal pillar and backfill material. The horizontal pillar thickness and safety factors generated from the analytical calculations from this study will be compared with empirical

equations and with 2D numerical analysis, Finite Element Methods (FEM). A study has been carried out on a sublevel mine with a 200 meters depth, steeply dipping ore bodies, with a 40 meters long stope above the pillar that has been filled and stope with the same length below the pillar has not been filled. The results obtained are the difference in the value of the safety factor from the analytical equation from this study with empirical and numerical analysis respectively for pillars with a thickness of 5 meters is 1% and 11%, for pillars with a thickness of 10 meters is 13% and 2%, and for a pillar with a thickness of 15 meters is 7% and 7%.

B07

"Information Security"

Coung Tuan Le, Information Technology and Communication/Information System, Hanoi University of Science and Technology

- Information security is the protection of personal and organizational data in order to avoid thefts by bad guys or hackers. The good security of data and information will avoid unnecessary risks for yourself and your business.
- There are 4 aspects of information security:
1. Confidentiality: Ensuring that information is unique, those who want to access must be granted access rights.
2. Integrity. Complete comprehensive protection for information systems.
3. Accuracy. The information given must be accurate, complete, must not be misleading or infringe content copyrights.
4. Ready. The security of information must always be available, can be done anywhere, anytime.
- Why is information security necessary?
1. Information which is relevant to you, your company and your business is very important. Currently, the situation of hackers is increasingly dangerous and unpredictable. If you are exposed or insecured, it is easy for hackers to steal your data.
2. Moreover, there are many types of malware such as Virus, Trojan
- The main causes of security risks:
1. Poor Authorization and Authentication
2. Insecure Direct Object Reference
3. Missing Function Level Access Control
4. Using Component with Known Vulnerabilities
- Advanced solutions to information security:
1. 2-layer authentication.
2. Upgrade passwords.
3. Strict inspection of decentralization (if any).
4. Check the input and output devices to ensure the best safety for information.

B08

"COMPARISON OF DIFFERENT RANS TURBULENCE MODEL IN SIMULATING A DELTA WING"

Huy Quoc Nghiem, Dept. of Aeronautical and Space Engineering, Hanoi University of Science and Technology

Computational Fluid Dynamics or CFD has been used in HUST to observe and analyze the two vortices that form above the delta wing. The usage of RANS turbulence models is common due to the accuracy and low cost of computer resources. Choosing the right turbulence model to perform a CFD simulation is always a problem at the beginning. The main objective of this study is to compare the effectiveness of the three most popular models based on RANS: Realizable k-epsilon, SST k-omega and Spalart-Allmaras in the simulation

of the delta wing. The simulated model is a simple 41-degree conventional sweep delta wing with a flat cross-section at different angles of attack ranging from 5 to 45-degree. The aspect ratio is 1.5. The ANSYS ICEM software package is used to obtain HEXA mesh. In general, HEXA mesh reduces the number of elements, has better quality, and wastes less CPU time than TETRA mesh. The fluid at the inlet is air whose density is 1.225 kg/m3 and viscosity is 1.802e-5 kg/ms. The flow is incompressible which has a very small Mach number and is at steady-state. The wing boundaries are no-slip walls. The main results include the lift coefficient, the vortex formation, pressure distribution on wing surfaces. They will be validated against theory calculation and experimental data that were carried out in HUST and by other scientists in different methods. They will show the most suitable turbulence model for simulating a delta wing in different situations.

B09

"Mathematical Optimization and Uncertainty"

Jaehyeon Ryu, College of Engineering / Department of Industrial & Systems Engineering, Korea Advanced Institute of Science and Technology

Mathematical optimization is a branch of applied mathematics that concerns solutions of optimization problems for the best decision-making in real-world problems. A solution of each optimization problem maximizes (or minimizes) its objective function of decision variables under some specific equality and inequality constraints. Also, parameters are needed to describe quantitative information such as cost, price, duration, and demand into the objective function and constraints. They are usually generated from prior information and real-world data and are exposed to uncertainty coming from prediction error and/or observational error. Therefore, the optimization problems need to reflect the uncertainty to obtain a robust solution against the variation of parameters. It is difficult to solve the optimization problems with uncertainty except for some specific types of convex optimization problems. That is especially true for discrete optimization problems whose decision variables are restricted to only binary or integer values. These problems include many difficult problems such as the traveling salesman problem which cannot be solvable in polynomial time unless P=NP. Moreover, some polynomially solvable problems, including the shortest path problem, become NP-hard problems after reflecting the uncertainty of parameters. They explain why research on discrete optimization with uncertainty is generally hard. In this presentation, some kinds of mathematical optimization models with uncertainty such as stochastic programming and robust optimization are introduced. Difficulties in solving the optimization problem under noisy and incomplete data are also discussed. Moreover, risk-averse discrete optimization problems and their solutions which are major part of my research topics are presented.

B10

"Bayesian Projections on the Spectrum of Marine Bunker Fuel: What is the Impact of Fossil Fuels in the Maritime Transportation?"

Jiahui Liu, Civil Environmental Engineering, Nanyang Technological University

Due to the increasingly stringent regulations on air pollution, marine fuel oils (particularly heavy fuel oil) that are commonly used today for powering ships may not be applicable in the future. Hence, this paper develops a Bayesian probabilistic testbed for policy implementation and fuel choice of users to illustrate the volume of ship emissions in regard to the spectrum of fossil fuel type and estimates ship emissions to understand their efficiency in meeting legislations. A novel Bayesian probabilistic forecasting algorithm has been proposed to project long-term ship emission prediction based on probabilities extracted from current ship movements, sailing configurations and ship particulars. The empirical study reflects the case of the Port of Singapore and the forecasting horizon for years of 2018, 2020, 2030 and 2050.

Three major scenarios have been illustrated in projections with Heavy Fuel Oil (HFO), Marine Diesel Oil (MDO), Marine Gas Oil (MGO), Low Sulphur Fuel Oil (LSFO, treated by refineries) as well as Liquified Natural Gas (LNG). The proposed simulation testbed calculates ship movements in the port area based on a Bayesian ship traffic generator estimated from existing actual ship movement data. Various features of the testbed can be manipulated to reflect changes on terminal location, ship technology or fuel type. So, it is expected to support policy makers as an apparatus to visualize future projections of current policy considerations.

B11
"Large scale fabrication of Bioinspired Photonic Crystals"
Yun Lim, College of Engineering/School of Chemical and Biomedical Engineering, Nanyang Technological University

Non-iridescent structural colors arise from coherent light scattering of amorphous photonic structures (APSs) have gained tremendous interest as an emerging class of photonic ink in the last decade. Such amorphous or quasi-amorphous arrangement provide structural materials with unique characteristics such as angle-independent, nonfading and eco-friendly, all of which are superior attributes to that of conventional toxic organic dyes and heavy metal pigments. However, attempts to mimic APS via colloidal self-assembly approaches so far have resulted in structural colors which are pale or whitish due to the strong incoherent light scattering. Recent incorporation of black dopants has been reported to be useful in suppressing incoherent light scattering by absorption and thereby enhancing the color contrast. Herein, inspired by melanin - a naturally occurring light absorbing pigment found in avian feathers, biomimetic melanin-like polydopamine coated polystyrene nanoparticles (PS@PDA) were fabricated and subsequently evaluated in different thermodynamic equilibrium states. In addition, driven by the demand for large scale manufacturing, structural color printing of photonic colloidal films with tailored packing geometries and optical properties by colloidal self-assembly were then explored using infiltrated assisted and common inkjet printing methods. Compared to pristine PS particles, it was found that PS@PDA particles offer superior color contrast while allowing for controllable angle-dependency and color brightness of the fabricated photonic films. We envisage that our proposed PDA-based platform may be readily extended for facilitating practical applications ranging from next generation of photonic devices, structural color displays to even dynamic anticounterfeit and wide-viewing angle sensors.

B12
"Investigation of the Nanomaterial Safety"
Sheena Anne Henson Garcia, Department of Chemical & Biological Engineering, The Hong Kong University of Science and Technology

Nanomaterials have been gaining attention and investments, with a projected ?100 billion global market by the year 2020. They are very essential as they are promising in numerous applications such as advanced therapy medicinal products and medical devices. However, there are bottlenecks that negatively affect the market; restraints include side reactions on immunological, inflammatory and regulatory systems of people. Many studies lack the study about the safety of metal organic frameworks. This study will focus on metal-organic framework (MOF). MOFs have been gaining attention during the past decade because their structure can be tailored easily by changing the metal and/or the organic linker. They are gaining attraction due to their easy chemistry, modification and functionalization. This study will investigate the behavior of these particular type of nanomaterials and evaluate its effects and risks in human health and environment through the collection of transport data particularly transpiration and translocation study of nanomaterials in plants. By knowing the

fate of these nanomaterials in the environment, its availability on the living organisms will be known. Existing methods will be evaluated and modified; new test methods could be developed to support these investigations. Once the safety of the nanomaterial is guaranteed, then the development of nanotechnology could be promoted. Nanotechnology can help solve in global issues namely Clean Water and Sanitation (e.g. water purification), Affordable and Clean Energy (e.g. clean energy technology), Industry, Innovation and Infrastructure (e.g. green manufacturing and chemistry), Responsible Consumption and Production (e.g. materials supply and utilization), Climate Action (e.g. greenhouse gases management).

B13
"Challenges of Developing a Metacognitive Tutor on Open edX"
May Kristine Jonson Carlon, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology

Metacognition, or the awareness of knowledge level and ability to regulate it, is important to a learner since it is a good predictor of academic performance and success in lifelong learning. In this research, we developed the Personalized Online Adaptive Learning System (POALS), a metacognitive tutor that can be embedded in Learning Management Systems (LMS) such as Open edX. Aside from the complexity of creating a system that interacts with an external system and ensuring security of learner information, another challenge is validating whether POALS is effective in raising metacognitive skills. Metacognitive development can be measured through online (real-time in-activity measurement) and offline (independently gathered measurement) methods. A pilot study was conducted during the first quarter of the academic year 2019 in an Educational Technology class with 17 learners to give us an idea on POALS' effectiveness using the data collected by the Learner Profile, a measuring tool that uses the online method built into POALS, and to select appropriate offline method for succeeding experiments. The results indicate that POALS dramatically increased students' knowledge awareness with no conclusive effect on reducing bias (i.e. being too optimistic or pessimistic about their knowledge), thus the overall result is moderate. We also learned that for succeeding experiments, the Metacognitive Awareness Inventory (MAI) is preferable to Goal-oriented studying, Active studying, Meaningful and memorable studying, Explain to understand, and Self-monitor (GAMES) survey as the offline method since MAI better corroborates with the results of the offline method.

B14
"Strategy toward Perpendicularly Aligned Rigid Polyimide: a New Coating Method Based on Liquid Crystal Precursor and Hydrophobic Substrate"
Shohei Hara, Chemical Science and Engineering, Tokyo Institute of Technology

Polyimides (PIs) have been widely used in industrial fields due to their high mechanical strength, thermal and chemical stabilities. Highly oriented PIs can provide further useful applications, for example vertically aligned PI film can be used for the high thermal conductive layer in the thickness direction. In this study, we focused on one of the precursors of PIs, poly (amic ester)s (PAEs), which have remarkable rigidity to exhibit smectic liquid crystal in the concentrated NMP solution. Smectic layer structure can form vertical orientation (VO) structure by growing in layer by layer mechanism (epitaxial growth) from the air interface. Therefore, the PAE solutions are potential precursors for VO PI films. In addition, to enhance the epitaxial growth, we introduced hydrophobic perfluoro-alkyl (Rf) end groups, which facilitates segregation at the interface. However, PI chains strongly tend to align parallel to the substrate. To reduce the parallel orientation, we used hydrophobic Si substrates modified with Rf group having low surface free energy. To evaluate moleculer

orientation of the precursor and PI, uniaxial orientation order parameter S was evaluated by pMAIRS FT-IR measurement. The S values were calculated from dichroic ratio of absorbance peak at 1490 cm-1 which was assigned to aromatic C=C stretching vibration transition moment parallel to the main chain. The PAE films exihibit VO behavior in the thinner film region, which indicates that PAE chains grew epitaxially from the interface because Rf end groups strongly segregate at the interface, and the thinner films have larger specific surface area to enhance the epitaxial growing.

[Session C]
Industry, Innovation and Infrastructure 1

C01
"Development of a Sensor System for Linear Axis Diagnostic of Machine Tools"
Tutla Ayatullah, Faculty of Mechanical and Aerospace Engineering, Bandung Institute of Technology

In this research a multi-sensor system has been developed that can be used to quickly predict the decrease in linear axis performance. The sensor developed can be used to measure changes in straightness and angle errors due to degradation. In addition, this sensor can be used to monitor machining conditions. The type of sensor used in this multi sensor system consists of an accelerometer, an inclinometer and a gyroscope. This sensor system is expected to save costs due to product failure. The sensor box is installed fixed on the machine tool and data is collected regularly, so that the degradation of the linear axis can be determined and used for diagnostics and prognostics to help optimize maintenance, production schedules, and quality control parts.

C02
"Track Layout Design for Dynamic Routing in AMHS"
Jun Hui Lee, Industrial & Systems Engineering Department, Korea Advanced Institute of Science and Technology

An automated material handling system (AMHS) in semiconductor manufacturing operates overhead hoist transport (OHT) that carries wafers. For unified AMHS which support direct tool-to-tool transfers between different bays, dynamic routing has been studied to improve traffic conditions. We propose a design approach to place Shortcuts and Highways under the situation of dynamic routing in AMHS.

C03
"Point-of-Care Surface Plasmon Resonance Biosensor for Stroke Biomarkers NT-proBNP and S100β using a Functionalized Gold Chip with Specific Antibody"
Dorin Harpaz, School of Material Science & Engineering, Nanyang Technological University

Surface-plasmon-resonance (SPR) is a quantum-electromagnetic phenomenon arising from the interaction of light with free electrons at a metal-dielectric interface. At a specific angle/wavelength of light, the photon's energy is transferred to excite the oscillation of the free electrons on the surface. A change in the refractive-index (RI) may occur, which is influenced by the analyte concentration in the medium in close contact with the metal surface. SPR has been widely used for the detection of gaseous, liquid, or solid samples. In this study, a functionalized specific SPR chip was designed and used in a novel point-of-care SPR module (PhotonicSys SPR H5) for the detection of the stroke biomarkers NT-proBNP and S100β. These biomarkers have proven to be good for stroke diagnosis, with sensitivity and specificity of >85%. Specific detection was done by binding a

biomolecular-recognizing antibody onto the Au SPR-chip. Detection was tested in water and plasma samples. NT-proBNP and S100β were detected in a range of concentrations for stroke, from 0.1ng/mL to 10ng/mL. The RI of the blank plasma samples was 1.362412, and the lowest concentration tested for both biomarkers showed a prominent shift in the RI signal (0.25 ng/mL NT-proBNP (1.364215) and S100β (1.364024)). The sensor demonstrated a clinically relevant limit-of-detection of less than ng/mL.

C04
"Miniaturized infrared spectrometer for the detection of volatile organic compounds in the mid infrared regime"
Simon Goh, EEE, Nanyang Technological University

Poor air quality is a massive issue for many cities around the world. This is largely due to the insatiable demand for energy. The current situation is exacerbated by weak environmental enforcement and in particularly, the lack of appropriate monitoring tools to quantify and qualify the presence of atmospheric contaminants. Hitherto, the gold standard for molecular detection is by mass spectrometry. Although it offers high resolution measurement, the cost of ownership is exorbitantly high impeding widespread field use. An alternative to mass spectrometry is the use of infrared spectrometers (IRS). Many IRS such as Michelson interferometer and Fabry-Perot interferometer have been developed so far. However, these tunable IRS are prone to mechanical vibrations leading to signal distortion. On the contrary, linear variable filter (LVF), without moving parts, is suitable for measurement even under adverse conditions. Thus, LVFs with operating ranges between 3.00 - 4.25 m were fabricated and characterized. To demonstrate its ability for volatile organic contaminants (VOCs) measurement, LVFs were subjected to various -CH containing chemicals such as ethanol, isopropanol and butane. The fabricated sensor can be three-dimensionally packaged with a linear array detector, broadband light source and other optical peripherals for the construction of a micro-spectrometer. The robust spectrometers could be mounted on drones, buildings and other public places for monitoring and reporting of indoor and outdoor air quality. It is expected that the air quality sensors network to provide comprehensive umbrella monitoring coverage yet to be attained by today's technology and standard.

C05
"Automatic fracture detection using deep learning"
Guang Chen, Department of Electronic & Computer Engineering, The Hong Kong University of Science and Technology

Bone fractures represent a significant clinical and public health problem worldwide. They are among the most common causes of hospitalization, morbidity, and mortality in the elderly. Diagnosis of a fracture is usually made with pelvic x-ray imaging, where systems with the ability to provide a highly accurate diagnosis using little resources are highly desirable. Recent advances in medical image analysis using deep learning have produced automated systems that can perform as well as human experts in some medical tasks. We investigate the application of deep learning using convolutional neural networks for the task of fracture detection, and present a large scale study where a deep learning system achieves human-level performance on a common and important radiological task.

C06
"Thermal transport at self-assembled monolayer interfaces: Molecular dynamics simulations"
Tielin Wu, Aerospace Engineering, Tsinghua University

Using molecular dynamics simulations, we expose the thermal transports across a self-assembled monolayer(SAM) of alkanethiol molecules covalently bonded to PbS substrate.With four differnet types of ligands(C5S2,C10S2,C15S2,C8S4) which form the SAM ,we explored the influence of the length ,density and categories of ligands on the thermal boundary conductivity between the PbS and SAM.And we can get the thermal boundary conductivity of four different ligands.Through the data obtained from the MD simulation in simple structure, we can predict the thermal conductivity of the structure in three-dimensional complex structure.With self-assembled monolayer material, we can adjust the thermodynamic properties of the material by adjusting the length,density and type of the ligands.These materials with special thermoelectric properties can be used in the design of advanced electronic components.

C07
"Sensitivity of HF-etched multimode fiber on water detection"
Hongda Li, School of Aerospace Engineering, Tsinghua University

With the development of the optical transmission, optical sensors have developed rapidly during the last thirty years. Here we provide the test result of the sensitivity of HF-etched multimode fiber on water detection and introduce some potential areas where optical sensors can be used extensively. My experiment has tested the sensitivity of etched fiber on water detection. The result shows that the intensity of the output in air is different from that in water. The result will change with the etched shape and the distribution of the water. There are two main factors causing the result, the refractive index and the absorption spectrum of the environmental substance. With suitable fiber and light source, we can detect the environmental substance quickly and efficiently. Many relevant researches have been done to enhance the sensitivity and explore the future prospect. Optical fiber sensors can be used in many fields. The distributed optical fiber sensor has been used extensively in industry and civil engineering structures. It has allowed for a better understanding of structures' conditions and increasingly leads to a more cost-effective management of those infrastructures. In the environmental protection field, optical fiber sensors can also play a significant role. It can be used in environmental detection, health protection and many other potential areas.

C08
"Climbing-inspired twining electrodes using shape memory for peripheral nerve stimulation and recording"
Yingchao Zhang, Department of Engineering Mechanics, Tsinghua University

Peripheral neuromodulation has been widely used throughout clinical practices and basic neuroscience research. However, the mechanical and geometrical mismatches at current electrode-nerve interfaces and complicated surgical implantation often induce irreversible neural damage, such as axonal degradation. Here, compatible with traditional 2D planar processing, we propose a 3D twining electrode by integrating stretchable mesh-serpentine wires onto a flexible shape memory substrate, which possesses permanent shape reconfigurability (from 2D to 3D), distinct elastic modulus controllability (from ~100 MPa to ~300 kPa) and shape memory recoverability at body temperature. Similar to the climbing process of twining plants, the temporarily flattened 2D stiff twining electrode can naturally self-climb onto nerves driven by 37 degrees Celsius normal saline, and form 3D flexible

neural interfaces with minimal constraint on the deforming nerves. In vivo animal experiments including right vagus nerve stimulation for reducing the heart rate and action potential recording of the sciatic nerve demonstrate the potential clinical utility.

C09
"Adaptive Carrier Based PDPWM Modulation Control for Modular Multilevel Converter with Fault-tolerant Capability"
Tuanku Badzlin Hashfi, Department of Electrical Engineering, University of Malaya

Modular multilevel converters (MMCs) can be considered very promising converter which have modularity structure and reliability from fault-tolerant. A fault can occur internally within a submodule (SM), which is one of the essential issues of half-bridge MMCs with substantial switching devices. In this paper, an adaptive carrier based phase disposition pulse width modulation (PDPWM) technique for MMCs, which uses only one carrier having flexibility with fault-tolerant capability, is presented. The energy-based control is also used in this study to regulate the balancing of SMs during and after a fault. In order to investigate the performance of the proposed method, a laboratory single-phase MMC prototype has been built by using 4 (four) SMs to generate nine-level. The single-phase MMC prototype is tested by assuming one of the SMs in failure condition. The result revealed that the proposed method had been successfully applied on the MMC prototype to control the upper and lower arm during the failure. In addition, the reference command will correct the fault according to the adaptive carrier and the computational burden is lesser since it only uses one single carrier.

C10
"Usage of Textile Materials for Deployable Membrane Space Structures"
Britta Hohmann, Department of Mechanical Engineering, Tokyo Institute of Technology

Deployable membrane structures are used to create large surfaces in space. Compared to other structures they are very light weight and have a small storage volume. Meaning that through their usage we can save fuel during the launch phase. The created surface can be used as solar sail, drag sail or as support structure for devices, such as antennas or solar panels. Traditionally the membrane of these structures is made from thin plastic films, for example the IKAROS mission used a 25 µm thick aluminized polyimide film as a solar sail. However, this material is easily plasticly deformed and therefore it is impossible to avoid creases in the material during the production and folding process. These creases lead to local out-of-plane deformation which reduce the efficiency as solar sail or the efficiency and precision of attached devices. For this reason, we propose the usage of textiles as the material for the membrane structure. Textiles have in general a higher elasticity than plastic films and thus they are less prone to get creased during the production and storage process. Furthermore, textiles have a higher tear resistance, meaning the membrane is less likely to fail after for example a collision with space debris. The exact behavior of textile materials is highly depending on the fabric structure. The authors have the goal to optimize the textile behavior to fit the on orbit needs by mixing different structures types.

C11
"Platinum-Incorporated TON-Type Zeolite as Catalyst in Dehydrogenation of Straight-Chain Alkanes"
Wei Hung Chen, Department of Chemical Science and Engineering, Tokyo Institute of Technology

Alpha-olefins are alkenes distinguished by having a double bond at the primary (alpha) position. Alpha-olefins are important raw materials in the production of polyolefins. One way

to synthesize alpha-olefin is dehydrogenation of straight-chain alkanes. But the low catalytic activity and low selectivity are challenging. In this research, our target is to enhance alpha-olefin selectivity by using TON-type zeolite as catalyst in dehydrogenation reaction. TON-type zeolite is a variety of zeolite with one-dimensional pore structure, and the pore size is 0.46 x 0.57 nm. Platinum as active site for dehydrogenation is expected to be incorporated in TON-type zeolite containing aluminum atoms through ion exchange. Because the aluminum atoms for ion exchange are located both in the pore and on the outer surface of zeolite, platinum particles as active sites for dehydrogenation are predicted to exist both in the pore and on the outer surface after ion exchange. Therefore, dehydrogenation may occur both in the pore and on the outer surface that leads to a low selectivity for alpha-olefin. To tackle this problem, in this work, we synthesized a core-shell structured TON-type zeolite whose outer surface consists of only silica and core consists of silica and alumina. Platinum only exists in the core of zeolite after ion exchange so that dehydrogenation on the outer surface is expected to be restrained. Therefore, a highly pure alpha-olefin synthesis process is estimated by using TON-type zeolite with a core-shell structure as a catalyst.

C12

“Teaching AI and Machine Learning to General Education Students”

Luc Gougeon, Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology

INTRODUCTION

Japan needs to scale up its AI and data science classes in higher education.The Abe government has proposed training 250,000 AI specialist a year in order to meet the goal of establishing Society 5.0. This ambitious plan calls for a massive change in the educational curriculum. This presentation will describe an approach to teach AI and machine learning to the general education students at the university level.

TEACHING AI

Results presented will be based upon media literacy classes taught at two Japanese universities. Understanding AI can help students with their critical thinking skills and prepare them for facing the challenges of the Society 5.0 workplace. The author will survey a number of students and teachers and plans to include questions on AI and machine learning in the survey. In these model lessons, the possible implications of the developments of AI were explained to the students. The students were then shown two videos and given a very short lecture. After that, the students were asked to write short essays about AI or were asked to make a small oral presentation about AI and machine learning.

CONCLUSION

By reading the students essays, we realize that topic of AI and Machine Learning pushes most non-technical students to think outside the box. The students, in the span of two weeks were able to internalize the concept, understand the buzzword of “AI” and see how AI would affect their own life.

https://asia.nikkei.com/Business/Technology/Asia-s-AI-talent-pool-broadens-except-in-Japan

C13

“Mechanical Properties of Fiber Reinforced Geopolymer Mortar and Concrete”

Pengfei Jia, Civil and Environmental Engineering, Tokyo Institute of Technology

According to the effect of global warming, scientists and engineers have been continuously paying attention to finding eco-friendlier construction materials. A new kind of concrete: geopolymer concrete is quite suitable to meet the demand. It will not leak much carbon

dioxide during the fabrication procedure compared to the ordinary cement concrete. Therefore, the objective of my research is to investigate the mechanical properties of a specific kind of geopolymer mortar and concrete using the fiber-reinforced geopolymer binder as the original material. Experimental methods were conducted according to the Japanese standard and specifications, and they were compressive cylinder tests, splitting cylinder tests and three-point bending tests using notched beams. Ordinary cement concrete of which W/B is 57% was chosen as the reference series. And geopolymer mortar and concrete of different W/B ratio (15%, 20%, 30%, and 57%) was tested. The curing conditions of ordinary cement concrete were 20 degrees centigrade and being covered by wet clothes which are the same as the geopolymer concrete. Conclusions are as follow. Firstly, compared with cement concrete, geopolymer concrete of which W/B is 20% has better mechanical properties including compressive strength, tensile strength and fracture energy. Secondly, at W/B 20%, the relationship between Young's Modulus and compressive strength of the geopolymer concrete is very close to that of ordinary cement concrete. Finally, further research on the structural performance is needed to get full use of the geopolymer concrete.

C14
"Kraft lignin depolymerization in super critical alcohol-water mixtures"
Abraham Castro Garcia, Department of Transdiciplinary Science and Engineering, Tokyo Institute of Technology

Lignocellulose such as wood and crop residue are abundant sources of renewable of biomass and is composed of 15-30% lignin by weight. Cellulose and hemicellulose fractions are used for making paper in the Kraft process, but lignin is seen as a low-value waste product that is burnt as fuel to power the paper making process. Lignin is a complex polymer made of phenolic units and as such is a potential source of aromatic chemicals which are currently obtained only from oil, these chemicals are used for fuels, plastics and medicines. In this work hydrogenolysis reaction is used to transform lignin into aromatic chemicals by using only alcohols and water as a source of hydrogen together with a nickel catalyst on supercritical conditions. Experiments are carried out in a bomb type reactor with different types of alcohols, temperatures, reaction times and solvent-lignin-catalyst ratios, the products consist mainly of a brown bio oil and is analyzed by gas chromatography-mass spectrometry (GC-MS) to find its product distribution. The research objectives are to find a combination of reaction conditions that maximize the quantity and quality of the bio oil and see how the reaction variables impact the performance of the reaction.

C15
"Sensitive Near-Infrared Photodetector Based on a Liquid Crystalline Organic Semiconductor Material for Medical Imaging"
Shahriar Kabir, Department of Electrical and Electronic Engineering, Tokyo Institute of Technology

Phthalocyanine derivatives are suitable active material for near-infrared (NIR) organic photodetectros (OPDs) because of their high absorption in the spectral window of 700nm to 900nm. This region is called the "Medical Spectral Window" because we can take images of human blood vessels and veins easily using this NIR window. In this work, we tested 3 phthalocyanine derivatives for their suitability as active material of the OPDs and selected Octaoctyl-phthalocyanine (8H2Pc) for its good solubility in organic solvents, impressive semiconducting properties and liquid crystalline characteristics. We also demonstrated the fabrication of sensitive NIR OPDs with a blend of 8H2Pc and Phenyl-C61-butyric acid methyl ester (PCBM) for the purpose of medical imaging. We fabricated bottom illuminated OPDs with the blend of 8H2Pc:PCBM (1:1 ratio by weight) with an active area of 4mm2 and

characterized them using a light source of 740nm. The OPDs showed good linear dynamic range over a wide range of light intensities (from 12μW/cm2 to at least 5mW/cm2). We also tested the effect of annealing the samples at crystalline temperature (85°C and lower) and liquid crystalline temperature (86°C to 150°C) of 8H2Pc. We noticed that the dynamic performance of the NIR OPDs improved in the case of the samples annealed at 100℃, the liquid crystalline phase temperature of 8H2Pc. The annealing process improved the fall time of the dynamic photoresponse from 480μsec to 58μsec. In conclusion, we believe these NIR OPDs have significant future prospect in the field of medical imaging for their impressive static and dynamic performance.

[Session D]
Industry, Innovation and Infrastructure 2

D01
“Handling Evaluation of Tractor-semitrailer with Split Fifth Wheel Coupling Maneuvering a J-turn”
Ajith Jogi, Department of Mechanical Engineering, Indian Institute of Technology Madras

In recent years, the demand for the accessibility of heavy commercial vehicles in remote locations has been increasing rapidly, giving rise to the need for more methods to reduce off-tracking. Off-tracking of a vehicle is the radial distance between the paths traced by its frontmost and the rearmost axle when it maneuvers a turn. One of the innovative and passive methods to reduce off-tracking in tractor-semitrailers is to implement Split fifth wheel coupling (SFWC). The studies show that the off-tracking is reduced by up to 21% for a circular turning maneuver. The handling performance of the tractor-semitrailer with SFWC is not evaluated yet and hence needs to be addressed. In the current work, multi-body simulation models of the tractor-semitrailer with Conventional fifth wheel coupling (CFWC) as well as SFWC are developed. The tractor-semitrailer with SFWC is simulated for a J-turn maneuver to evaluate the handling performance. The results are compared with the CFWC model to study the relative performance. Preliminary studies show that comparatively the SFWC model is little unstable and finds it difficult to trace the J-turn path at higher speeds. This explains that even though the off-tracking is reduced one has to do little compromise on the stability and handling of the vehicle. However, with the use of modern technologies like Electronic stability control, one can effectively control the tractor-semitrailer with SFWC. The results are further analyzed and useful conclusions are drawn in the final paper.

D02
“Replacing Ground-based Vehicles by Drones in Delivery: System Management and Optimization”
Suttinee Sawadsitang, Computer Science and Engineering, Nanyang Technological University

Guardian UK reported that Asian and Africa are the major continents facing air pollution problems. The air quality in Singapore, which many people call it a green city, is nearly double the world health organization (WHO) recommended level in term of PM2.5. Moreover, one of the major sources of air pollution is ground-based vehicular emission. Usually, vehicles on the road are personal vehicles and industry vehicles, i.e., logistics. The demand of logistics industry has been rapidly increased because of the booming e-commerce. As such, a parcel delivery service will become a significant business function in logistics, and the massive number of vehicles will be used to deliver a parcel for e-commerce customers. As a result, more vehicles will be on the road and more vehicular emission will be created, which will adversely affect the quality of air. To improve the quality of air, we focus on a

study that reduces the number of vehicles on roads by (i) helping a shipper to plan its delivery with the minimum number of trucks and (ii) replacing potential trucks by unmanned aerial vehicles (UAVs). UAVs, as known as drones, are aerial vehicles that can fly autonomously or be piloted remotely from outside. Drone delivery is not only more environment friendly than conventional ground-based vehicle, but also offers faster speed, lower cost, and requires less manpower.

D03
"Emotion synesthesia for human"
Yixin Men, Department of Industrial Engineering & Decision Analytics, The Hong Kong University of Science and Technology

The emotions of human come from a lot of sources. There is a certain amount of people who have synaesthesia to perceive different stimuli jointly, such as letters, shapes, smell, colour and music. From this reference, a lot of researchers designed experiments and generalized principles on how emotion can be the mediation to match between each of them. My focus is to link characters in music, such as timbre, pitch, dynamics, tempo, mode, duration, with characters in colour, such as hue, lightness, saturation, transparency, intensity mediated by emotion, such as scary, angry, happy, calm, sad, heroic, mysterious, romantic and comic. Existed research already dig out some basic connections like lightness to mode and saturation to tempo. There are still a lot of further details can be tapped into, especially complex sense like illusion. And surely the way experiments designed, subjects selected and data analysed can be refined to improve our conclusions. Since human's perception and the ability to associate can be trained up and reinforced. My research is not only helpful for product design and performance, but also can be used in therapy, perception training and behaviour training.

D04
"Technologies Integration Towards Sustainable Transportation"
Ahmad Alhilal, Department of Computer Science & Engineering, The Hong Kong University of Science and Technology

With growing population, economic and cities populations, vehicles are increasing tremendously leading to increasing congestion, accidents rate, and greenhouse gas emissions into the atmosphere. These consequences have attracted industry and academia to carry our researches, develop frameworks, and design infrastructure to address these challenges. In my research, I'm trying to characterize the emerging technologies, integrate them, and employ them towards sustainable city. I aim to pinpoint the sources of fuel consumption inefficiency, which is involved in GHG emissions, develop a framework to relieve the congestion, promote the efficiency of transportation via smart transportation, target environment friendly development, and address the requirements zero-accident transportation.
Research 1: It highlights the fuel efficiency and its impact on greenhouse gas emissions in Chinese cities. Here we synthesize the fuel consumption of (millions) of private car trips with the road networks of (twelve) diverse Chinese cities. We analyse the factors affecting the fuel consumption which increases greenhouse gas emissions. We show the impact of traffic flow between the city's regions, inter-district interactions, on the fuel efficiency.
Research 2: The new era of vehicles' applications requires 1) Ingestion of massive data that best describe the ambient environment. 2) Transmission of this data through ultra-reliable and low-latency communications. 3) Processing and making decisions in time. We will investigate the requirements and challenges of these applications, explore the promising technologies for vehicular communications and the computation technologies that help to

address these requirements, employ these technologies to develop a frameworks for efficient, greener and safer transportation.

D05
“Topology optimization and its applications”
Kai Wu, School of Aerospace Engineering, Tsinghua University

Structural Optimization tries to find out suitable material distributions or topological configurations in the design domain to optimize the objective functions (e.g. compliance, stress, displacement, electromagnetic performances) on the condition of specific constraints (e.g. material usage, manufacturing conditions). Compared with sizing and shape optimization, topology optimization does not adhere to a fixed topological relationship, which greatly broaden the design space. In my previous study, I proposed a set of integrated schemes as a complete design flow from the conceptual design to engineering geometry scheme, including multi-objective dynamic topology optimization, transformation from the optimal topological conceptual design to engineering geometry model, CAE analysis and 3D printing. The structure of Aircraft rudder and cabin are optimized accordingly to cut down structural weight under the premise of ensuring mechanical performances. Additionally, negative poisson’s ratio structures, force inverters are also obtained by means of density-based topology optimization. Topology optimization has strong portability and broad application prospects in aerospace engineering, wind turbines design, compliant mechanisms design and some multi-physics settings. Topology optimization is a great preprocessing tool for structure design, but its configurations are often too complex to fabricate. However, with the rapid development of additive manufacturing, manufacturing of intricate topological configurations are now much easier to implement. In the future, topology optimization together with additive manufacturing, will greatly change the way of manufacturing, help to improve material utilization efficiency, reduce production costs and pollution in industry, which certainly correspond with SDGs.

D06
“Finite Element Method Based on the Willis-form Equations for Geometrically Nonlinear Elasticity Problems”
Yixiao Sun, School of Aerospace Engineering, Tsinghua University

Buckling is a vital problem with long-lasting difficulties in solid mechanics, in which structural stiffness is a crucial factor. It is well-known that the gradually accumulated pre-stresses during the deformation process have great impact on the structural stiffness. However, the inhomogeneity of the pre-stresses is usually ignored. In order to investigate the effect of pre-stress gradients, this paper establishes a new updated Lagrangian finite element formulation based on the Willis-form equations with displacement coupling terms. These equations can be naturally obtained by considering the inhomogeneity of strain energy density and explicitly contain the pre-stress gradients. Compared with the classical finite element method (FEM), the proposed new method has an additional stiffness matrix that is contributed by the pre-stress gradients. A preliminary calculation for an axially compression bar gives the same buckling load as the classical solution, because it is free of pre-stress gradients. However, other calculations for cantilever beams under tip loading give much lower buckling loads than those from the classical FEM. For this case, it is verified that the energy conservation can be guaranteed and numerical results agree with theoretical predictions. Finally, extensive analyses are conducted for a classical but pending buckling problem: perfect cylindrical shells under axial compression. Compared with existing experimental results, it is interesting to find that the results from this new FEM give an approximate upper bound of knockdown factors (KDF). This implies that there is a critical buckling state with lower energy, which is governed by the pre-stress gradients. Thus, it

could give a new explanation to the discrepancy between the experimental and analytical buckling loads of axially compressed cylindrical shells.

D07
"Study of Helicopter Blades Structural Response during Starting Process"
Yang Shen, School of Aerospace Engineering, Tsinghua University

The Starting process is the most important but dangerous part of entire helicopter flight because of its non-periodic aerodynamic load and ground resonance etc. This study mainly focuses on the structural response during starting process using a comprehensive homemade code. Geometric precision beam model and free wake analysis was adopted when analyze the structural and fluid domain to provide a nearly real-time simulation. UH-60 model was analyzed and the results corresponded well with the experiment. As well as the stability analysis was conducted.

D08
"High Efficiency, Low Noise Magnetron's Cathode Sputtering Study using GaN and SiC for Modulated Microwave Power"
Wen Chek Leong, Department of Electrical Engineering, Faculty of Engineering, University of Malaya

Plasma sputtering on magnetron's cathode surface using semiconductors such as GaN and SiC performed for microwave power generation enhancement intended for modulated microwave power transmission. This process includes plasma grown on magnetron's cathode surface using GaN and SiC through a semiconductor deposition process. Several parameters examined to produce the best quality of sputtering, such as deposition period and temperature. Generally sputtering is used to grow semiconductor into a wafer ingot for integrated circuits fabrication. However, sputtering on magnetron's cathode surface is the first for industrial low power microwave generation purpose. Magnetron commonly used to generate high-power microwave with low frequency for energy transfer and heating purpose, compared to other types of microwave power generators due to its reliability. Magnetron efficiency dropped significantly when it used to generate low power microwave using high frequency due to power losses during generation. The primary purpose of plasma sputtering on magnetron's cathode is to enhance the efficiency of the magnetron to generate low power microwave with high frequency. Enhancement of magnetron through cathode sputtering has reduced the losses of microwave power significantly and exhibits a better power quality as proven experimentally.

D09
"Improved Dynamic Increase Factor for Progressive Collapse Analysis of Asymmetric Reinforced Concrete Moment Resisting Frame Buildings"
Tabassum Mohsin Chowdhury, Civil and Environmental Engineering, Tokyo Institute of Technology

Nonlinear dynamic analysis (NDA) is performed to assess the structural vulnerability against progressive collapse by predicting the force amplification due to the removal of columns. Although NDA has greater accuracy compared to other methods (linear static, linear dynamic, and nonlinear static), it is computationally expensive; thus, dynamic increase factor (DIF) which is used to amplify the gravity loads on affected bays is adopted as an alternative. Because of experimental constraints and facilities, the most suitable, reasonable and fastest method to study the behavior of structures due to such effect is numerical approach. To approximately account for the dynamic effects due to sudden element removal, DIF is used to amplify the gravity load in the nonlinear static analysis (NLS) method. Meanwhile, studies

concerning the behavior of structures with geometric irregularities and mass eccentricities due to progressive collapse are limited. In this study, progressive collapse of structures due to column removal are investigated in asymmetric reinforced concrete moment resisting frame (RC-MRF) buildings and a modified DIF formula is proposed as a function of max (Mu/My) and eccentricities, (where the Mu and My are the moment demand and moment capacity of the affected bays directly adjacent and above the removed column). Several three dimensional RC-MRF structures with different configurations are designed for high seismicity and analyzed to propose the DIF formula. This proposed DIF is verified by predicting deformation and stress (max (Mu/My)) in affected bays using nonlinear dynamic analysis results, which is adopted as a benchmark of the structural member after column removal.

D10
“Multifunctional and omnidirectional photo-thermal monitoring robots for ubiquitous safety-net platform”
Kou Li, Department of Electrical and Electronic Engineering, Tokyo Institute of Technology

Recent development of fexible electronics including bendbale solar cells and bio scanner have been indispensable for sustainable social system. In addition, visualizing techniquies based on terahertz (THz) wave are attrachting attention for various applications such as nondestructive inspection. Althoug we previously pioneered flexible THz imaging device with single-walled carbon nanotube (CNT) films that enables us to examine freely regardless the shape / size of inspection objects, whole scheme is still bulky and cannot be applied to the real usages. Here, we then report on novel laser-imager integrated type multifunctional around-view THz monitoring robots, and ubiquitous / sustainable social safetynet system. The present scheme can be highly adoptable for social implementation with further integration with wireless communication and AI-assisted graphical processing, and will shed light on the way for realizing universal social safety net platform in the upcoming IoT era.

D11
“Design and Analysis of 5.8-GHz-band Reflectarray on Nonflat Space Structures”
Keisuke Omoto, Mechanical Engineering, Tokyo Institute of Technology

For high data rate and long distance communication of satellite, a large aperture antenna on satellite is required. Because of volume restriction of satellite, a deployable antenna is used for a large aperture antenna of satellite. However it is difficult to make high flatness and large surface in deployable structures. For example, JAXA launched satellite IKAROS which deployed 14m square membrane with thin device but out-of-plane deformation was occurred on orbit. So current study on large antennas for satellites makes the high flatness surface by using relativity low storage rate and high stiffness structures such as rigid panel. For example, NASA launched satellite Mars Cube One in 2018 which have reflectarray made of aluminum to make the high flatness surface. If we allow the out-of-plane deformation of deployable antenna on orbit, storage rate will greatly improve by using membrane structures like IKAROS. In this study, we propose the active reflectarray which actively adjusts the reflection phase of elements by varactor diodes and reconfigure its low flatness surface. This active reflectarray correct the phase difference because of the radio wave path difference caused by the out-of-plane deformation of deployable reflectarray antenna. To correct this phase difference we use varactor diodes which adjust the reflection phase of elements on the active reflectarray antenna. We do the numerical analysis of the active reflectarray and confirm our proposal method.

D12
“Seismic Improvement of RC Frame Buildings Using Post-Tensioned Hybrid Precast Concrete Walls as Partial Infill Walls”
Binod Kumar Shrestha, Civil and Environmental Engineering, Tokyo Institute of Technology

Lightly reinforced concrete (RC) infill walls with openings (spandrels, wall piers, and wing walls) that were monolithically constructed inside RC frames were damaged in the past major earthquakes. The damage of these walls can be mitigated by installing seismic slits between the wall segments and the primary frames. However, in this study, partially infilled post-tensioned hybrid (PH) precast concrete shear walls are introduced inside the RC frame buildings to reduce damage and residual deformation, and to show better seismic performance. For this purpose, seismic performance of four-story partially infilled PH precast concrete wall (PHW) frame buildings and conventional RC wall (RCW) frame buildings with different frame shear ratios (0, 0.25, and 0.5) subjected to spectrum-matched far-fault earthquake ground motions are investigated. Results indicated the superior seismic performance of partially infilled PHW frame buildings compared to RCW frame buildings.

D13
“Orbital and Attitude Analysis of Tethered Solar Sail Spacecraft Formation Flying”
Yuta Takahashi, Department of Mechanical Engineering, Tokyo Institute of Technology

In this study, it was investigated using a simple model 'Dual Sail' that two solar sails connected by tethers can be controlled by a simple control law using only light pressure. The 'Dual Sail' concept stabilizes the system by rotating it around the center of the model.This concept makes it easier to manufacture membrane surfaces and experiment on the ground compared to making a single large solar sail. Dividing the mass into multiple satellites can increase the sail's own acceleration and diversify its mission.In the simulation, the 'Dual Sail' that applied the characteristic values ??of the IKAROS satellite, which was the first in the world to demonstrate photon propulsion technology, was used to examine the feasibility of the system and the validity of distributed control.Compared to the conventional use of solar sail for observation on non-Kepler orbits, it was investigated that structural requirements for orbital realization were reduced, and the conditions for use of non-Kepler orbits around the earth were shown. The concept of Tethered Solar Sail Spacecraft Formation Flying not only divides sail, but also solves the problems of maintaining high-accuracy inter-satellite distance, preventing collision between satellites, and delaying information transmission, which the Formation Flying Mission has. Finally, in view of further diversification and enlargement of sails, the sail arrangement method suggested by this study and the conditions for dispersion control in the nonlinear range were presented.

D14
“Analytical evaluation on structural performance change of reinforced concrete structure by long term drying”
Ryota Kurihara, Department of Civil and Environmental Engineering, Tokyo Institute of Technology

The natural frequency of reinforced concrete (RC) structures such as nuclear power plants or multi-story buildings has been reported to gradually decrease decades. The decrease in natural frequency means the reduction of structural stiffness. Authors applied the thermo-hygral analysis by full-scale model of structures in service. The natural frequency reduction with aging was numerically reproduced, and it is found that drying shrinkage cracks reduces structural stiffness. However, RC structures have complex junctions by

various members. To clarify the impact of drying shrinkage quantitatively on RC member itself is needed. The objective of this research is to investigate the drying effect on the structural performance of RC shear wall, especially the long-term gradual reduction of structural stiffness and scale effects. In this research, shear cyclic loading test on a shea wall is numerically reproduced by the multi-scale analytical system and parametric study on drying effects on concrete structure such as scale effects was carried out by using reproduction model. The analytical results reproduce the experimental results properly. For investigating scale effects 15 times larger model than reproduction analysis model was analyzed. This scale is the same order as nuclear power plant member. The speed of drying effect progress may change by scale because drying proceeds from the surface to inside. Each model was exposed to the dried environment for 50 years. Authors concluded that he drying shrinkage cracks reduced the initial stiffness of RC shear wall and scale of the member is key factor on moisture loss. The rate of stiffness reduction by drying effects is slower in large scale member, and scaled down specimen is sensitive to drying effects.

D15
“Effects of Web Position on Shear Resistance Mechanism of UFC beams“
Masaki Kato, Civil Engineering, Tokyo Institute of Technology

Ultra high strength fiber reinforced concrete (UFC) is an advanced cementitious material with excellent mechanical properties and high flowability. Because of these high performances, the efficient cross-section of bridge girders using UFC are T-shape or hollow-shape for weight saving by thin webs and flanges with various web positions. In this study, the objective is to clarify the effects of web position on the shear resistance mechanism of UFC beams. Four-point bending tests of total 3 beams with different web position were conducted, whose structural performances were prospected same. The results revealed that the web position greatly affected the shear capacity, the flexural rigidity, the displacement at the shear failure and the post peak behavior. Especially about the shear capacity, the differences were explained to be caused by the differences of the area resisting the shear force. In the case that the only one web was arranged at the center of the flange, the only partial area of the web resisted the shear force at the maximum load. Then the shear capacity was the smallest. In the case that two webs were arranged at the edge of the flange, the partial area of the web and the compressive and tensile flanges resisted. Then the shear capacity was the second largest. In the case that two webs were arranged at the quarter of the flange, the almost whole area of the web and the compressive flange resisted, which provided the largest shear capacity.

About Japan (and Recent Events)

Territory: 378,000 km²
Population: 126,230,000 (August 2019)
Capital: Tokyo
Language: Japanese

Japan is an island nation located in East Asia. It lies off the eastern coast of the Asian Continent in the Pacific Ocean and the Japanese Archipelago consists of four main islands and more than 6,800 small islands. The country has four distinct seasons with a climate ranging from subarctic in the north to subtropical in the south. The weather and climate conditions also vary somewhat between the Pacific Ocean facing side and the Sea of Japan or eastern side.

Recent news

1) Crown Prince Naruhito became the latest emperor after his father and former emperor abdicated. This new imperial era of " Reiwa 令和 ", meaning "order and harmony", started in May 2019, where the first year in the Japanese new Reiwa period is the 0th year.
2) Ancient Osaka tomb clusters were added to the World Heritage list in July 2019.
3) iPS transplant was for the first time conducted for corneal disease in September 2019 based upon research at Kyoto university.
4) This year (2019) the Rugby World Cup is being held, while the Olympics and Paralympic Games Tokyo 2020 will be held next year around the country but primarily in Tokyo and the Kanto region.
5) The 2019 Nobel Prize in chemistry was awarded to Akira Yoshino for the development of lithium-ion batteries. The 71-year-old honorary fellow with Asahi Kasei Corp. is credited as one of the pioneers in developing the power source indispensable for cellphones and other electronic devices today.

Japan National Tourism Organization
https://www.jnto.go.jp/


Asakusa


Mt. Fuji & Momiji leaves


teamLab★Borderless

Wi-Fi

Wireless Network Name (ESSID): aotule2019
PASS: 2019aotuleTOKYO

Money

The Japanese currency is the YEN (JPY). Bills usually come in 1,000 yen, 5,000 yen and 10,000 yen. Coins come in 1 yen, 5 yen, 10 yen, 50 yen, 100 yen and 500 yen.

JPY1,000≒USD9.24 (18 Sep 2019)

It is advisable to carry some cash in Japanese yen as some small retailers do not accept credit cards.

Emergency

Police: 110
Fire & Emergency Medical Ambulance: 119
Narita Airport (+81)-476-34-8000
Haneda Airport (+81)-3-6428-0888
Tokyo Tourist Information Center (+81)-3-5321-3077
Tokyo Tech: (+81)-3-5734-3859

http://www.eng3.e.titech.ac.jp/event/aotule2019/index.html