ICGEA 2021

2021 5th International Conference on Green Energy and Applications

MARCH 6-8, 2021 | SINGAPORE

CO-ORGANIZED BY

IEEE

IEEE PES Power & Energy Society®

SINGAPORE INSTITUTE OF ELECTRONICS

Content

ICGEA

Welcome

Dear distinguished delegates,

We are pleased to welcome you to 2021 5th International Conference on Green Energy and Applications. Due to the severe impact of COVID-19, we have to hold the conferences online, which is a limited way to support everyone's interaction while avoiding the threat from virus.

The conference brings together researchers looking for opportunities for conversations that cross the traditional discipline boundaries and allows them to resolve multidisciplinary challenging problems. It is the clear intent of the conference to offer excellent mentoring opportunities to participants. Although we cannot meet each other physically, through this online platform, we trust that you will still be able to share the state-of-the-art developments and the cutting-edge technologies in these broad areas.

We'd like to express our sincere gratitude to everyone who has contributed to this conference as its success could have only been achieved through a team effort. A word of special welcome is given to our keynote speakers and Invited speakers who are pleased to make contributions to our conference and share their new research ideas with us. They are Prof. Nikos Hatziargyriou, IEEE fellow, from National Technical University of Athens, Greece, Prof. Alberto Borghetti, IEEE Fellow, from University of Bologna, Italy, Prof. Mohamed Benbouzid, IEEE Fellow, IET Fellow, University of Brest, France, Prof. Vladimiro Miranda, IEEE Fellow, from INESC TEC and University of Porto, Portugal, Prof. Chan Siew Hwa, who is Co-Director, Energy Research Institute @ NTU and Vice-Director, Sino-Singapore International Joint Research Institute @ Guangzhou, Prof. Zhenyuan Zhang from University of Electronic Science and Technology of China, China and Prof. Frank Gunzer from German University in Cairo, Egypt.

Additionally, our special thanks go to all committee members for their excellent work in reviewing the papers and their other academic support efforts.

We believe that by this excellent conference, you can get more opportunity for further communication with researchers and practitioners with the common interest in this field. We are dedicated to higher and better international conference experiences. We will sincerely listen to any suggestion and comment. Wish you will enjoy this conference, contribute effectively toward it and take back with your knowledge, experiences, contacts and happy memories of these days.

We look forward to meeting you again next time!

Yours sincerely,

Prof. Chan Siew Hwa

Nanyang Technological University, Singapore

Committee

Advisory Chairs

Mohamed Benbouzid, IEEE Fellow, University of Brest, France

Nikos Hatziargyriou, IEEE Fellow, National Technical University of Athens, Greece

Alberto Borghetti, IEEE Fellow, University of Bologna, Italy

Conference Chairs

Wang Peng, IEEE Fellow, Nanyang Technological University, Singapore

Siew Hwa Chan, Nanyang Technological University, Singapore

X. Q. Han, Taiyuan University of Technology, China

Program Chairs

Xueshan Han, Shandong University, China

Wenzhi Cui, Chongqing University, China

Steering Committee

Deepak L. Waikar, EduEnergy Consultants LLP, Singapore

Local Chairs

Thaiyal Naayagi Ramasamy, Newcastle University, Singapore

Dhivya Sampath Kumar, National University of Singapore, Singapore

Jiang Fan, Singapore Polytechnic, Singapore

Publication Chair

Jasmine Zhou, Nanyang Technological University, Singapore

Publicity Chairs

Abdul Aziz Abdul Samad, Universiti Tun Hussein Onn Malaysia

Khaled Zehar, University of Bahrain, Bahrain

Sarjiya Sarjiya, Gadjah Mada University, Indonesia

Guideline

Before the conference

Time Zone

Singapore (GMT+8)

You're suggested to set up the time on your computer in advance.

Platform: ZOOM

Download

1）https://zoom.com.cn/download (Chinese author option）

2）https://zoom.us/download

Zoom Guideline

http://icgea.org/Zoom-manual-CN.pdf (Chinese author option）

http://icgea.org/zoom/

Equipment Needed

- A computer with internet connection and camera
- Headphones

Environment Needed

- A quiet place
- Stable internet connection
- Proper lighting and background

Test Your Presentation

Date: March 6-8, 2021

Prior to the formal meeting, presenters shall join the test room to ensure everything is on the right track. Please check your test time on this program.

During the conference

Voice Control Rules

- The host will mute all participants while entering the meeting.
- The host will unmute the speakers' microphone when it is turn for his or her presentation.
- Q&A goes after each speaker, the participant can raise hand for questions, the host will unmute the questioner.
- After Q&A, the host will mute all participants and welcome next speaker.

Oral Presentation

- Timing: a maximum of 15 minutes in total, including 2-3 minutes for Q&A. Please make sure your presentation is well timed.
- It is suggested that the presenter email a backup video/slide to conference secretary in case any technical problem occurs by **March 1st, 2021**.

Conference Recording

The whole conference will be recorded. We appreciate you proper behavior and appearance.

* The recording will be used for conference program and paper publication requirements. The video recording will be destroyed after the conference and it cannot be distributed to or shared with anyone else, and it shall not be used for commercial nor illegal purpose. It will only be recorded by the staff and presenters have no rights to record.

Conference at a Glance

All the schedule will process in Singapore local time (GMT+8) – Greemwhich Mean Time

Room A: 694 7848 2481
https://zoom.com.cn/j/69478482481

Room B: 650 5658 0703
https://zoom.com.cn/j/65056580703

March 6	Event	Duration	Zoom
	Committee member Test	10:30-18:00	Room A
	Author Test	13:00-15:30	Room B

March 7	Event	Duration	Zoom
	Keynote & Invited Speech I	9:00-10:30	Room B
	Session 1	11:00-13:30	Room B
	Session 2	11:00-13:15	Room A
	Keynote Speech II - III	15:00-16:20	Room B
	Session 3	16:30-19:15	Room B
	Session 4	16:30-19:15	Room A

March 8	Event	Duration	Zoom
	Session 5	10:00-12:00	Room B
	Keynote Speech IV Invited Speech II	16:00-17:10	Room B

Detailed Overview

All the schedule will process in Singapore local time (GMT+8) – Greemwhich Mean Time

Day 1—Mar. 6

Room A: 694 7848 2481
https://zoom.com.cn/j/69478482481

Room B: 650 5658 0703
https://zoom.com.cn/j/65056580703

Committee & Speakers' Test Session

Singapore time	Presenter's local time		
10:30-10:45	22:30-22:45	Adjunct Prof. Hamed Aly	**Room A**
10:45-11:00	10:45-11:00	Dr. Deepak Waikar	**Room A**
11:00-11:15	11:00-11:15	Prof. Chan Siew Hwa	**Room A**
11:15-11:30	11:15-11:30	Prof. Zhenyuan Zhang	**Room A**
15:15-15:30	15:15-15:30	Assoc. Prof. Man Pun Wan	**Room A**
15:30-15:45	9:30-9:45	Prof. Frank Gunzer	**Room A**
15:45-16:00	15:45-16:00	Dr. Dhivya Sampath Kumar	**Room A**
16:00-16:15	10:00-10:15	Prof. Nikos Hatziargyriou	**Room A**
16:15-16:30	9:15-9:30	Prof. Alberto Borghetti	**Room A**
17:30-17:45	9:30-9:45	Prof. Vladimiro Miranda	**Room A**
17:45-18:00	10:45-11:00	Prof. Wojciech Czekała	**Room A**

Authors' Test Session

13:00-13:30	Session 1 Electrical Engineering and Automation **NG1-002, NG1-004, NG1-025, NG1-008, NG1-029, NG1-014, NG1-043, NG1-046, NG1-015, NG1-049-A**	**Room B**
14:00-14:30	Session 2 Electronics and Electrical Engineering **E2001, E1001, E12001, E13002, E1012, E1015, E1021, E1026, E1023**	**Room B**
15:00-15:30	Session 3 Electronics and Power System **NG1-005, NG1-010, NG1-020, NG1-021, NG1-027, NG1-030, NG1-031, NG1-038, NG1-044, NG2-803**	**Room B**
16:00-16:30	Session 4 Energy Utilization and Development **NG1-050, NG1-006, NG1-018, NG1-026, NG1-034, NG1-037, NG1-041, NG1-042, NG1-047, NG1-035, NG1-048**	**Room B**
17:00-17:30	Session 5 Energy and Environmental Engineering **E2004, E2005, 13003, E1006, E1022, E1024, E1025-A, E2002**	**Room B**

Detailed Overview

All the schedule will process in Singapore local time (GMT+8) – Greemwhich Mean Time

Day 2—Mar. 7

Room A: 694 7848 2481
https://zoom.com.cn/j/69478482481

Room B: 650 5658 0703
https://zoom.com.cn/j/65056580703

Keynote and Invited Speeches

Dr. Deepak Waikar, EduEnergy Consultants LLP, Singapore

Singapore Time	Presenter's Local Time		
9:00-9:10	**9:00-9:10**	Opening - Prof. Chan Siew Hwa, Nanyang Technological University, Singapore	**Room B**
9:10-9:50	**9:10-9:50**	Keynote Speech I - Prof. Chan Siew Hwa, Nanyang Technological University, Singapore	**Room B**
		Break	
10:00-10:30	**10:00-10:30**	Invited Speech I - Prof. Zhenyuan Zhang, University of Electronic Science and Technology of China, China	**Room B**

Author Parallel Session

March 7 Session 1	Formal Time Singapore time	March 7 Session 2	Formal Time Singapore time
Room B		**Room A**	
Chaired by: Dr. Dhivya Sampath Kumar National University of Singapore, Singapore		**Chaired by: Assoc. Prof. Yiru Dai Tongji University, China**	
NG1-002	11:00-11:15	**E2001**	11:00-11:15
NG1-004	11:15-11:30	**E1001**	11:15-11:30
NG1-025	11:30-11:45	**E12001**	11:30-11:45
NG1-008	11:45-12:00	**E13002**	11:45-12:00
NG1-029	12:00-12:15	**E1012**	12:00-12:15
NG1-014	12:15-12:30	**E1015**	12:15-12:30
NG1-043	12:30-12:45	**E1021**	12:30-12:45
NG1-046	12:45-13:00	**E1026**	12:45-13:00
NG1-015	13:00-13:15	**E1023**	13:00-13:15
NG1-049-A	13:15-13:30		

Detailed Overview

All the schedule will process in Singapore local time (GMT+8) – Greemwhich Mean Time

Day 2—Mar. 7

Room A: 694 7848 2481
https://zoom.com.cn/j/69478482481

Room B: 650 5658 0703
https://zoom.com.cn/j/65056580703

Keynote Speeches

Dr. Deepak Waikar, EduEnergy Consultants LLP, Singapore

Singapore Time	Presenter's Local Time		
15:00-15:40	**8:00-8:40**	Keynote Speech II - Prof. Alberto Borghetti, University of Bologna, Italy	**Room B**
15:40-16:20	**9:40-10:20**	Keynote Speech III - Prof. Nikos Hatziargyriou, National Technical University of Athens, Greece	**Room B**

Author Parallel Session

March 7 Session 3	**Formal Time Singapore time**	**March 7 Session 4**	**Formal Time Singapore time**
Room B		**Room A**	
Chaired by: Prof. Wojciech Czekała Poznań University of Life Sciences, Poland		**Chaired by: Assoc. Prof. Man Pun Wan Nanyang Technological University, Singapore**	
Prof. Wojciech Czekała	16:30-16:45	**NG1-050**	16:30-16:45
NG1-005	16:45-17:00	**NG1-006**	16:45-17:00
NG1-010	17:00-17:15	**NG1-018**	17:00-17:15
NG1-020	17:15-17:30	**NG1-026**	17:15-17:30
NG1-021	17:30-17:45	**NG1-034**	17:30-17:45
NG1-027	17:45-18:00	**NG1-037**	17:45-18:00
NG1-030	18:00-18:15	**NG1-041**	18:00-18:15
NG1-031	18:15-18:30	**NG1-042**	18:15-18:30
NG1-038	18:30-18:45	**NG1-047**	18:30-18:45
NG1-044	18:45-19:00	**NG1-035**	18:45-19:00
NG2-803	19:00-19:15	**NG1-048**	19:00-19:15

Detailed Overview

All the schedule will process in Singapore local time (GMT+8) – Greemwhich Mean Time

Day 3—Mar. 8

Room B: 650 5658 0703
https://zoom.com.cn/j/65056580703

Author Parallel Session

March 8 Session 5	Formal Time Singapore time
Room B	
Chaired by: Adjunct Prof. Hamed Aly, Dalhousie University, Canada	
E2004	10:00-10:15
E2005	10:15-10:30
E13003	10:30-10:45
E1006	10:45-11:00
E1022	11:00-11:15
E1024	11:15-11:30
E1025-A	11:30-11:45
E2002	11:45-12:00

Keynote and Invited Speeches

Dr. Deepak Waikar, EduEnergy Consultants LLP, Singapore

Singapore Time	Presenter's Local Time		
16:00-16:40	**8:00-8:40**	Keynote Speech IV - Prof. Vladimiro Miranda, INESC TEC and University of Porto, Portugal	**Room B**
16:40-17:10	**10:40-11:10**	Invited Speech II - Prof. Frank Gunzer, German University in Cairo, Egypt	**Room B**

Speakers

Prof. Chan Siew Hwa

Nanyang Technological University

Singapore

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

9:10-9:50, 7th Mar. (GMT+8)

Biography: Prof Chan Siew Hwa is a Fellow of the Academy of Engineering, Singapore. He is also a Professor at the School of Mechanical & Aerospace Engineering and the President's Chair in Energy at Nanyang Technological University (NTU). As a leader in hydrogen and fuel cell research at NTU since 1997, Prof Chan is a Co-Director and a founding member of the Energy Research Institute at NTU and serves as Vice Director of the Sino-Singapore International Joint Research Institute in the China-Singapore Guangzhou Knowledge City. Prof Chan's research has earned him significant recognition, including the George-Stephenson Medal from the UK, Scientific Achievement Award from the International Association of Hydrogen Energy, USA, "World's Most Influential Scientific Minds" Award from Thomson Reuters, Nanyang Award (Research Excellence), Nanyang Award (Innovation and Entrepreneurship), and the "Star of Innovation Talent" award from the Guangzhou Government.

Prof Chan has published 271 refereed journal papers with more than 13,000 citation counts and an h-index of 59. A passionate teacher, Prof Chan has been teaching Thermodynamics since 1991 and was awarded "Teacher of the Year" in 2000.

Title: Turquoise Hydrogen – a bridge towards Hydrogen Economy

Abstract: Building a hydrogen economy is a challenging task especially for a small nation like Singapore where the space is very limited and the renewable energy resources are scarce. In the 12th Singapore International Energy Week held in 2019, Government shared Singapore energy plan for the next 50 years with a clear objective of decarbonizing the economy, i.e., continuing using natural gas in the gencos, increasing the use of solar energy with 2 GWp PV installation by 2030, exploring regional power grid connection and lastly adopting low-carbon alternatives, which include hydrogen and CCUS. Producing hydrogen using limited renewable energy will only contribute a small fraction of CO2 reduction, while importing green hydrogen from overseas will have to pay for a high price before green hydrogen is widely available. This presentation is focused on natural gas pyrolysis (methane cracking), where turquoise hydrogen is produced and the by-product is a high value solid carbon, hence there will be no, or negligible CO2 discharged to the atmosphere.

Speakers

Prof. Zhenyuan Zhang

University of Electronic Science and Technology of China

China

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

10:00-10:30, 7th Mar. (GMT+8)

Biography: Prof. Zhengyuan Zhang graduated from Chang'an University with a bachelor's degree in 2007, and graduated from The University of Texas at Arlington with a doctorate in 2015. Since 2015, he has worked in the School of Energy Science and Engineering, University of Electronic Science and Technology of China. Mainly engaged in smart grid, power system analysis, power system wide-area measurement and control, power market research, power system protection and arc safety research. Participated in a number of scientific research work of IEEE and the United States Department of Energy (DOE), participated in many international and domestic academic conferences and technical exchange activities, and has published more than 10 international academic papers, including the first author SCI searched 7 articles, and the US national invention patent 1 item, participated in the formulation of 1 IEEE standard.

Title: Dynamic Equivalent Modeling of Large-scale Renewable Energy Integrated Power System

Abstract: Due to the unsustainable fossil fuel consumption and its raised environmental concerns, large-scale exploitation and utilization of renewable energy, such as wind power generation, became one of the most prominent features of modern power system. To ensure the system stability and pre-diagnosis the operation risks, an accurate dynamic models of renewable energy resources, such as wind farm is necessary for large-scale power system analysis. However, the detailed wind farm model may contain dozens or even hundreds of wind turbines and bunch of other servicing facilities, which could significantly enlarge the size of model and then lead “curse of dimensionality”. Therefore, the equivalent model, on the basis of reasonable reduction from detailed model, is essential to be developed. This presentation will introduce the current research development on large-scale renewable energy dynamic equivalent modeling, and its corresponding applications on power system stability assessment. The method of time-series based clustering, multi-objective optimization based on-line parameter identification, multi-machine equivalent modeling, and probabilistic stability assessments are also discussed.

Speakers

Prof. Alberto Borghetti, ***IEEE Fellow***

University of Bologna

Italy

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

15:00-15:40, 7th Mar. (GMT+8)

Local time:

8:00-8:40, 7th Mar. (GMT+1)

Biography: Alberto Borghetti was born in Cesena Italy on May 29, 1967. He graduated (with honors) in electrical engineering from the University of Bologna, Italy, in 1992. Since then he has been working with the power system group of the same University, where is now a Professor of Electrical Power Systems. His research and teaching activities are in the areas of power system analysis, power system restoration after blackout, electromagnetic transients, optimal generation scheduling, and distribution system operation. He is the author or coauthor of over 150 scientific papers published in peer-reviewed journals or presented at international conferences. He has served as Technical Program Committee chairperson of the 2010 30th Int. Conf. on Lightning Protection (ICLP), chair of the 2016 Bologna CIGRE Colloquium on Lightning and Power systems, and as a special reporter for CIGRE 2018. IEEE Fellow (class 2015) for contributions to modeling of power distribution systems under transient conditions, he received the ICLP Scientific Committee Award in 2016 and the 2018 CIGRE Technical Council Award for Study Committee C4. From 2010 to 2017 he served as an editor of IEEE Transactions on Smart Grid. Currently he is a member of the editorial board of IEEE Transactions on Power Systems and of Journal of Modern Power Systems and Clean Energy. Since the beginning of 2019, he serves as editor in chief of Electrical Engineering – Archiv fur Elektrotechnik.

Title: Renewable Energy Communities

Abstract:

The talk focuses on renewable energy communities. The community is a set of prosumers, each of them can be equipped with local generation, energy storage systems, and loads. The community is expected to include direct trade between members. Starting from the regulatory framework recently introduced in Europe and from a real experience of a green energy community under development in Bologna, Italy, the presentation will briefly examine different aspects: planning, programming, settling, and service to the networks. The scheduling procedure must distinguish between the energy exchanged with the external network and the power exchanges between the prosumers in order to favor the use of local resources and self-consumption. The procedure should also provide the price of internal transactions and ensure that each member has a benefit from participation. This presentation aims to describe some models that could be useful for the functioning of energy communities and distribution networks where trade between neighbors becomes significant.

Speakers

Prof. Nikos Hatziargyriou, ***IEEE Fellow***

National Technical University of Athens

Greece

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

15:40-16:20, 7th Mar. (GMT+8)

Local time:

9:40-10:20, 7th Mar. (GMT+2)

Biography: Nikos D. Hatziargyriou is professor in Power Systems at the National Technical University of Athens. He has over 10 year industrial experience as Chairman and CEO of the Hellenic Distribution Network Operator and as executive Vice-Chair of the Public Power Corporation. He was chair and currently vice-chair of the EU Technology and Innovation Platform on Smart Networks for Energy Transition (ETIP-SNET) representing E.DSO. He is honorary member of CIGRE and past Chair of CIGRE SC C6 "Distribution Systems and Distributed Generation". He is Life Fellow Member of IEEE, past Chair of the Power System Dynamic Performance Committee (PSDPC) and currently Editor in Chief of the IEEE Trans on Power Systems. He has participated in more than 60 RD&D projects funded by the EU Commission, electric utilities and manufacturers for both fundamental research and practical applications. He is author of the book "Microgrids: Architectures and Control" and of more than 250 journal publications and 500 conference proceedings papers. He is included in the 2016, 2017 and 2019 Thomson Reuters lists of the top 1% most cited researchers.

Title: Microgrids Role in Future Energy Systems

Abstract: An overview of the 2050 Vision of the EU Energy Systems, as formulated by the EU Technology and Innovation Platform on Smart Networks for Energy Transition (ETIP SNET) will be provided. The definitions and main characteristics of Microgrids as building blocks of the future power systems will be introduced and their benefits and technical and commercial challenges will be presented. Emphasis will be given to the capability of Microgrids with enhanced control capabilities to enhance the resilience of the EU Megagrid and provide local supply restoration capabilities by coordinating local distributed resources. The control challenges and hierarchical structures of Microgrids and in particular the shift to distributed control, enhancing further the EU system resilience, will be highlighted.

Speakers

Prof. Vladimiro Miranda, *IEEE Fellow*

INESC TEC and University of Porto

Portugal

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

16:00-16:40, 8th Mar. (GMT+8)

Local time:

8:00-8:40, 8th Mar. (GMT)

Biography: Vladimiro Miranda was born in Porto, Portugal. He graduated in Electrical Engineering in 1977 and received the Ph.D. degree in Electrical Engineering from FEUP, the Faculty of Engineering of the University of Porto, Portugal, in 1982. He joined FEUPin 1981 and joined INESC in 1985, a top R&D institute in Portugal where he came to be coordinator of the area of Power Systems during the 90's.

He was a member of the Board of Directors of INESC TEC, Portugal - an R&D private non-profit organization recognized by the Ministry of Science and with the University of Porto as the main associate - for 18 years until June 2018

- Full Professor (Professor Catedrático) at FEUP.
- Director-President of INESC P&D Brasil, an R&D private non-profit organization with headquarters in São Paulo, Brazil.
- Associate Director at INESC TEC, International Affairs.
- Member of the Doctoral Council of UTAD (University of Trás os Montes e Alto Douro), Portugal,
- Member of the Strategic Council of Forum OCEANO, an Association of Companies devoted to the Blue Economy.
- He is International Scientific Advisor for:
- IRESEN, Agency associated to the Ministry of Energy, Morocco
- Instituto de Investigación Tecnológica (Madrid), Spain
- Instituto de Energía Eléctrica (San Juan), Argentina
- Laboratory for Biologic and Chemical Defense of the Portuguese Army
- Hydrographic Institute, Portuguese Navy

Prof. Miranda has been serving in the Administration Board of spin-off companies created within the INESC system. He has also served as research project evaluator for the governmental science organizations of Portugal, Norway, Croatia, South Africa, Chile, Brazil and Argentina. For the Government of this latter country, he acted as external auditor in the process of evaluation of research institutions.

He has been responsible for many research projects at international level, in the European Union, United States and Brazil, and has authored or co-authored over 200 publications, especially in areas related with the application of Computational Intelligence to Power Systems.

Prof. Miranda is an IEEE Fellow.He is the recipient in 2013 of the IEEE Power Engineering Society Ramakumar Family Renewable Energy Excellence Award. He is a member of the IEEE Distinguished Lecturer Program.

Speakers

Prof. Vladimiro Miranda, *IEEE Fellow*

INESC TEC and University of Porto

Portugal

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

16:00-16:40, 8th Mar. (GMT+8)

Local time:

8:00-8:40, 8th Mar. (GMT)

Title: State awareness and negotiation in the era of power systems 4.0

Abstract: The large scale integration of renewables and storage in large systems is a source of hope, in the context of decarbonisation and fight against global warming, but it has the potential lead to sub-optimal use of resources, if no new approaches are adopted. Furthermore, without new tools, adopting a business-as-traditional attitude, there is the potential to cause high energy costs and to create problems for the secure operation at many levels. However, we are now more equipped than ever to deal with such issues, as like never before the systems are equipped with a diversity of sensors, with extremely different characteristics and data collection rates. This pervasive monitoring goes from high-frequency collection from PMUs to low rate smart meters, to which historical values must be added, to compose the picture. This creates a level and density of monitoring and surveillance of the power system that moves concepts into the 4.0 realm.

This talk will address two connected topics: a) buildind accurate system awareness representations, integrating different types of measurements at distinct levels, dealing with bad data and contributing to a reinforced cybersecurity; and b) departing from state awareness, defining technical conditions to allow system operators at transmission and distribution levels to negotiate, with mutual advantage, a better use of flexibility resources, so that power systems as a whole and their stakeholders may benefit from all resources avalibale in the networks.

Speakers

Prof. Frank Gunzer

German University in Cairo

Egypt

Zoom ID: 650 5658 0703

https://zoom.com.cn/j/65056580703

16:40-17:10, 8th Mar. (GMT+8)

Local time:

10:40-11:10, 8th Mar. (GMT+2)

Biography: 2017 Full Professor, Faculty of Information Engineering and Technology, German University in Cairo, Egypt

2014 Co-founder of the Center for Computational Engineering, German University in Cairo, Egypt

2011 Head of Electronics Engineering Department, German University in Cairo, Egypt

2010 Assoc. Prof., Faculty of Information Engineering and Technology, German University in Cairo, Egypt

2009 Guest Scientist in the research unit of Draeger, Luebeck, Germany (begin of a cooperation including regular research stays for research and development of pulsed ion mobility spectrometry as a tool for environmental monitoring)

Honorary Award:

2013, 2017 Scholarship of the German Academic Exchange Service (DAAD) in the framework of the international scientific exchange program (WAP)

2004 Familie-Schindler-Foerderpreis Award for the doctoral thesis, Christian-Albrecht-University, Kiel, Germany

Prof. Gunzer is a specialist in (laser) mass spectrometry and ion mobility spectrometry. His research activities concentrate on device development/improvement regarding resolving power etc., and the application of theoretic principles such as quantum chemical calculations and theoretic ion mobility calculations as well as simulations for the device development. Currently, he works on a novel high resolving power Cassinian Ion Trap. The analytical focus is on smaller molecular systems typically found in hazardous substances.

Title: Improvement of the Calculated Dimethyl Methyl Phosphonate Dimer Ion Mobility Value with Help of Molecular Dynamics Combined with Density Functional Theory

Abstract: The ability to identify unknown gaseous substances is an important requirement for the success of a great number of scientific disciplines, including environmental sciences. Ion mobility spectrometry is a portable technique that allows the detection of substances with great sensitivity. However, the identification of substances based on mobility measurements alone is difficult due to the limited resolving power of these devices. Especially when detecting unknown substances, being able to use theoretic principles to calculate the mobility in order to compare it to the measured mobilities can then help very much. For these calculations, the molecular structure of the analyte needs to be known, and it is often calculated with help of density functional theory. These calculated structures depend on the initial structure from which a structure in an energy minimum is derived, which does not necessarily have to be the structure the analyte possesses in an experiment. Here we have investigated to which extent molecular dynamics can help to obtain start structures that then with help of density functional theory lead to improved calculated ion mobilities. As a sample analyte the protonated dimer ion of dimethyl methyl phosphonate was used.

Session 1

Time:
Sunday, 7th Mar.
11:00-13:30 (GMT+8)

ZOOM ID:
650 5658 0703
https://zoom.com.cn/j/65056580703

Topic:

Electrical Engineering and Automation

Chaired by:

Dr. Dhivya Sampath Kumar, National University of Singapore, Singapore

Presentations: (15 minutes for each paper, including Q&A)

NG1-002, NG1-004, NG1-025, NG1-008, NG1-029, NG1-014, NG1-043, NG1-046, NG1-015, NG1-049-A

Notes:

- Please arrive at the conference rooms 10 minutes before the session starts.
- Timing: a maximum of 15 minutes in total, including 2-3 minutes for Q&A. Please make sure your presentation is well timed.
- Certificate of Presentation will be sent to each presenter's email box after the conference.
- One Best Presentation will be selected from each parallel session and author of best presentation will be announced at the end of this session.

NG1-002
11:00-11:15

Statistical Uncertainty Modelling and Dispatch Control Systems in Power Systems with High Penetrations of Intermittent Power Sources

Yang Li and Zongjie Wang

Hunan, China

This paper establishes multiple statistical uncertainty models of wind/solar power sources, intermittent power sources (IPSs), and all power sources. Based on that, this paper also adjusts the dispatch control system including how to appropriately select the real-time dispatch timescale. Statistical uncertainty regularity is first concluded over large historical data and a negative exponential function that represents the relationship

between the forecasting error and the time-ahead is further employed. Subsequently, from the perspective of power balancing, the dispatch control hierarchies of traditional power systems and power systems with high penetrations of IPSs are compared and analyzed. Simulation results regarding statistical uncertainty models over different penetrations of IPSs and the corresponding real-time dispatch timescale are demonstrated to show the effectiveness and efficiency of the proposed models and hierarchy.

Novel Virtual Synchronous Generator based on Low-Complexity Model Predictive Control

Zhiwen Xie, Niang Tang, Junqing Qiu, **Lu Chen**, Chang Yuan

North China Electric Power University, China

NG1-004
11:15-11:30

Virtual synchronous generator (VSG) technology can make the grid-connected converter units have the ability to provide inertial support for the system that have received widespread attention, but the existing model predictive control method of VSG needs to repeatedly calculate and compare the control targets under different switching states to obtain the optimal switching state, which leads to a long calculation time. Therefore, a control method that can reduce the calculation time of the control system is proposed in this paper, which can obtain the optimal switching state from the 8 switching modes of the converter by judging the sector where the standard voltage vector located and the time that the instantaneous voltage control vector works. Finally, the comparison of the two control methods in MATLAB verifies the feasibility of the proposed method applied to VSG.

Asynchronous startup of the paralleled DC-DC converters in DC microgrid based on the injected frequency

Xuzhou Zhuang, Qinjin Zhang, Yancheng Liu, Pengli Zhu, Yuji Zeng

Dalian Maritime University, China

NG1-025
11:30-11:45

The droop control of DC-DC converters based on injected AC voltage small-signal realizes current sharing control without communication, but DC-DC converter startup fails when AC voltage amplitude, frequency and phase do not meet sufficient conditions. In order to improve the success rate of the DC-DC converter connected to the DC bus, an asynchronous startup strategy based on phase difference is proposed. The AC and DC voltage conditions of the DC-DC converter connected to the microgrid under the injected frequency droop control are analyzed, and the control function of the circuit breaker is designed by using the voltage signals on both sides of the circuit breaker. The small-signal model is used to analyze the frequency convergence characteristics of AC voltage under the asynchronous startup strategy. The hardware in the loop experiment based on Starsim shows that the asynchronous startup method based on phase difference can realize the smooth connection between the DC-DC converter and DC bus, and improve the dynamic performance of the connection process.

An advanced DC voltage control for virtual synchronous generator

NG1-008
11:45-12:00

Zhiwen Xie, Niang Tang, **Lu Chen**, Chang Yuan

North China Electric Power University, China

In order to solve the problem that a large amount of distributed power supply cannot provide enough inertia and damping for the system in microgrid, virtual synchronous generator （VSG） has been widely concerned. However, existing methods combine virtual synchronous generator with classical PI control. When the voltage deviation reaches the margin value set, it still needs a certain "desaturation" time, that is, switching time. At this time, the DC voltage of the system is out of control, resulting in a large voltage fluctuation, which reduces the stability of the system. In order to solve this problem, this paper firstly analyzes the principle of virtual synchronous generator and the traditional PI control method. Then a voltage control method based on virtual synchronous generator is proposed to control the DC voltage and stabilize it in the preset voltage range. Finally, the simulation model built in PSCAD/EMTDC is used to verify the correctness of the theoretical analysis.

Beyond a Green Solution – Enhancement of Power Network with Natural Ester Insulating Fluid

Kin Yu Lam, Alan Sbravati, Janet Tan

Cargill Asia Pacific Holdings Pte Ltd., Singapore

NG1-029
12:00-12:15

With continuous rising demand on power consumption and the increasing needs for integrating distributed energy resources (DERs) due to the deployment of renewable energies, it is becoming more pressing for utility companies and distribution system operators (DSOs) to enhance the loading capability of their power network. Based on recent research and case studies, this paper explains and validates the use of natural ester insulating fluid as an all-rounded solution to enhance the resilience and cost effectiveness of transformers and power network beyond its originally designed benefits as an environmentally ‘green’ less flammable fluid.

A Study of Fault Characteristics of Doubly-fed Wind Power Generation System

Xiangmin Kong, **Jingya Kang**, Zhuopeng Shi, Yachen Wang and Jing Ma

North China Electric Power University, China

NG1-014
12:15-12:30

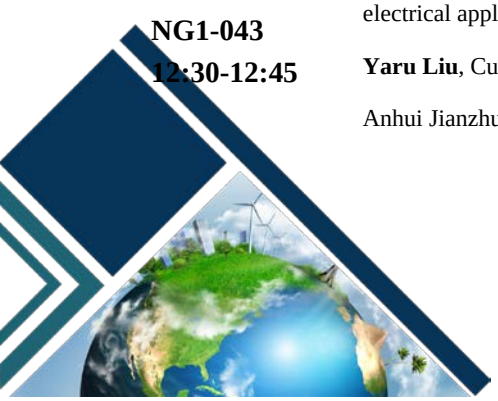
In view of the complex transient characteristics of wind power plants caused by the coupling of electromagnetic transient of motor and converter regulation process after power grid failure, a calculation method of DFIG short circuit current with or without crowbar is proposed. First, the fault equivalent network which takes the rotor converter control into account is established. On this basis, considering the transient regulation of the grid-side and rotor-side converters, the expression of the stator and rotor short-circuit current under the fault of the power grid is derived. RTDS wind farm simulation results verify the correctness of the derived expressions and related theories.

Fine-grained power load modeling based on electricity consumption behavior and minimum working state of electrical appliance’s current

NG1-043
12:30-12:45

Yaru Liu, Cuiyun Gao, Chong Hu, Naiqing Jin, Yukai Huang

Anhui Jianzhu University, China



Accurate load modeling is critical for power system planning and operational decision making especially for new energy power grid. In this paper, we proposed a method of fine-grained power load modeling based on electricity consumption behavior and minimum current states of electrical home appliances. The current waveforms are reconstructed reversely according to a four-layer-model which contains power consumption schedule, the working modes of electric appliance, the sub-states, minimum working states which includes short-time stable state, long-time stable state, and transient state. Using IFFT to rebuild the voltage and the current waveforms of short-time stable state and long-time stable state, and using IWT to rebuild the ones of transient state. The 24-hour-superimposed current and total power of single-phase were calculated for three phases separately, and the 24-hour Peak and Valley values of power of single-phase was also recorded in 4 kinds of different time slots. The experiment shows that: (1) the four-layer-model constructed in this paper has strong operability; (2) The distribution of peak and valley value for different schedules can be fine-grained simulated to realize the optimization for peak reduction.

Comparative Investigation of Lithium-ion Charging Methods Implemented via a Single DC/DC Converter

Rasool M. Imran, Bashar Sakeen Farhan, Yuan-jun Yang, **Habib Ur Rahman Habib**, and Firas M. F. Flaih

Huazhong University of Technology, China

NG1-046
12:45-13:00

Picking an appropriate charging method for a certain implementation depends on several factors, such as charging time, complexity, capacity utilization, and charging effect on the state of health (SOH). A practical-based comparison for the common charging approaches under the same operating conditions is necessary to show the key features of each approach. This paper addresses the mentioned issue and presents a performance comparison between the common waveform-based charging strategies for Lithium-ion batteries. The performance comparison comprises all features mentioned above. A single DC/DC converter is created to implement the different charging strategies and validate the performance of each strategy for the same operating conditions.

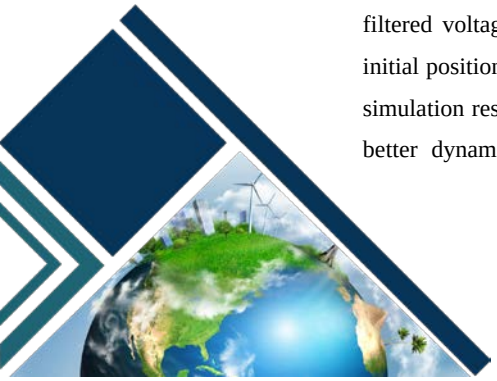
Grid-connection control of doubly fed variable speed pumped storage unit

Guoxian Gong, Jingliang Lv, Xinjian Jiang and Xudong Sun

Tsinghua University, China

NG1-015
13:00-13:15

To avoid the harmonics voltage interfering in the control of the stator voltage amplitude and phase of doubly fed induction machine in the process of grid-connection, and improve the accuracy of voltage synchronization, this paper presents a grid-connection control method based on ButterWorth low-pass filter. The parameter design principles of ButterWorth filter are analyzed based on the filter's responding characteristic and the stator harmonics voltage component. Instead of using the phase of stator voltage, the filtered voltage amplitude is used for phase synchronization. The compensators of rotor current and rotor initial position are designed to control the amplitude and phase of the filtered stator voltage respectively. The simulation results show that compared with the traditional control strategy, the proposed control strategy has better dynamic response performance and higher control accuracy. A 30kW experimental platform is



implemented to verify the effectiveness of the proposed control strategy.

NG1-049-A
13:15-13:30

Harmonics Mitigation in Cascaded Multilevel Inverter Consisting of Four H-Bridge Units Connected to Unequal dc Sources

Tapan Kumar Chakraborty, Ashique Anan Abir, Md. Imran Prodhan

University of Asia Pacific, Dhaka

At present, Electrical Engineers have tremendous interest on multilevel inverters due to many industrial applications in the power sectors. It may be easier to produce high-power, high-voltage inverter structure because of the way in which device stresses are controlled in the structure. Increasing the number of voltage levels in the inverter output without requiring higher ratings on individual devices can increase the power rating. A multilevel inverter which offers several advantages when compared to the conventional bridge inverter in terms of dv/dt stress, lower electromagnetic compatibility, smaller rating and better output features. Different topologies of multilevel inverters have been investigated so far. However, a cascaded multilevel inverter is found simple among them due to its simple network and control strategy. A cascaded multilevel inverter circuit is implemented by connecting several H-bridge units in series to obtain a desired output voltage consisting of several voltage steps. In most of the cascaded multilevel inverters, dc sources with different values are connected to individual H-bridge unit. However, in few cases of the cascaded multilevel inverters, equal independent dc sources are connected to individual H-bridge unit. This paper presents a study of harmonics reduction in output voltages of single-phase multilevel inverter consisting of cascaded four H-bridge units. Four power semiconductor MOSFET switches have been used for each H-bridge unit. Four unequal independent dc sources have been connected to four H-bridge unit. The gate drive signals for sixteen MOSFETs of the four H-bridge units connected in series to control the switching states have been generated using ATmega 2560 microcontroller-based Arduino board. In this work, simple programming codes for the microcontroller has been used to simplify the complication of generating gate drive signals for MOSFETs. Sixteen pins of the Arduino board have been programmed in output mode for generating gate drive signals using simple algorithm. It is observed that less number of power semiconductor devices are used to obtain output voltages of different levels. The proposed system was experimentally tested in the laboratory and total harmonic distortion was estimated. This study also shows that total harmonic distortion of the output voltage of the proposed inverter has been reduced with increasing number of voltage levels at the inverter output. Proper switching angle has been estimated for gate drive signals to reduce harmonic distortion. However, the output voltage of the multilevel inverter consists of switching spikes which may by reduced by selecting proper power switching devices with low turn-off and turn-on times.

Session 2

Time: **Sunday, 7th Mar.** **11:00-13:15 (GMT+8)**	**ZOOM ID:** **694 7848 2481** **https://zoom.com.cn/j/69478482481**

Topic:

Electronics and Electrical Engineering

Chaired by:

Assoc. Prof. Yiru Dai, Tongji University, China

Presentations: (15 minutes for each paper, including Q&A)

E2001, E1001, E12001, E13002, E1012, E1015, E1021, E1026, E1023

Notes:

- Please arrive at the conference rooms 10 minutes before the session starts.
- Timing: a maximum of 15 minutes in total, including 2-3 minutes for Q&A. Please make sure your presentation is well timed.
- Certificate of Presentation will be sent to each presenter's email box after the conference.
- One Best Presentation will be selected from each parallel session and author of best presentation will be announced at the end of this session.

E2001
11:00-11:15

Thermo-hydro-mechanical Responses of Unsaturated Media Under Temperature Loading

Zhi-guang Guo, Chang-jiang Ao, Yong-Fu Liu
China Construction and Civil Engineering CO., LTD, China

An analytical method is developed for the coupling control equations of heat transfer, moisture transfer and deformation in unsaturated porous media, basing on the linear theory of wet and thermal elasticity. The coupling effect of thermo-hydro-mechanical in axial symmetrical porous media with a central heat source is analyzed. The results show that the saturation response characteristics is mainly affected by the gravity effect resulting on the same horizontal line is mostly consistent, and the vertical difference is related to the initial saturation also. At the beginning, the pore water flows from the upper to the lower part of the porous medium, as the temperature changes, the flow of the clockwise rotation is generated. The settlement of porous media increases first and then decreases, because of

gravity, wet expansion and thermal expansion. When the porous medium is in the saturation state, the heat flow rate is faster than that of the unsaturated state, while the vertical inhomogeneity is opposite with the state. In the unsaturated state, heat flow in the lower part of the porous medium is faster than that of the upper part.

Experimental investigation on the seismic response of composite lining tunnel with buffer layer

Fan Kaixiang, Yusheng Shen
Southwest Jiaotong University, China

E1001
11:15-11:30

Based on the wave function expansion method, the analytical solution of dynamic stress concentration coefficient of lining tunnel with buffer layer in elastic half space subjected to the planar SV wave incidence is derived. The influence of incident angle, elastic modulus and thickness of buffer layer on the dynamic stress concentration coefficient is analyzed, then the shaking table test is adopted to study the damping mechanism of buffer layer. The results show that applying buffer layer does not significantly change the spatial distribution of dynamic stress concentration coefficient, but it does change the amplitude of that. With the decrease of the stiffness of the buffer layer, the dynamic stress of the lining decreases first and then increases. It is suggested that the elastic modulus ratio between the buffer layer and surrounding rock should not be less than 1/100. With the increase of the thickness of buffer layer, the dynamic stress of lining decreases first and then increases. It is suggested that the ratio of the thickness of buffer layer to the radius of tunnel is 1/40~1/20. The results of shaking table tests are consistent with the analytical solution. After applying buffer layer, the dynamic strain amplitude of lining tunnel decreases significantly, and the number of cracks in lining decreases, the arch springing and side wall of lining tunnel are the weak parts in the seismic fortification of the tunnel.

Structural Optimization of Main Beam of Ultra-Low Clearance Hoisting System for EHV Cables

Zisen Li, Yi Gao
Guangdong Power Grid Co., Ltd., China

E12001
11:30-11:45

Aiming at the special engineering environment of laying extra-high voltage power grid underground, a combined cable ultra-low headroom lifting system is used to make alignment adjustments for the cable. In order to meet the requirements of light weight, small structure and high strength of the lifting system, aluminum alloy is used as material of main beam. Three cross-sectional shapes of aluminum alloy beam are designed. Taking the height and cross-sectional area of the beam as the research object, optimize structure of beam by improved particle swarm algorithm and determine the optimal main beam track section. By comparing the optimization results of three sections, it can be concluded that the section area of II section girder is reduced by 85.96% compared with the initial setting value, and the optimization effect is the best.Perform finite element simulation on the optimal main beam track section to verify its mechanical performance. Making a physical prototype to verify the performance of the improved system.

Comprehensive Analysis and Visualization Method of Online and Offline Operation Modes of Power System

Dongyu Shi, Lulu Zhang
China Electric Power Research Institute, China

E13002
11:45-12:00

The AC / DC hybrid power grid has already been built in China using Ultra-High Voltage (UHV) grid as its backbone. Operation modes of power grid become more complex and diverse. With the development of online and offline analysis of the power system, more and more operation mode data have been accumulated. However, it is difficult to study the offline and online data together because of their different distributions. Offline data are distributed on the

boundary of security region, while online data are concentrated in some parts for a period of time. Therefore, a comprehensive analysis and visualization method should be proposed to demonstrate the relationship between them. Firstly, a simulation sample database is constructed including both online and offline data. Then, the research of sample distribution is carried out based on an introduced similarity degree index that calculated by designated features. Finally, a new method is proposed to represent the closeness degree of simulation samples, which maps the high-dimensional and complicated relations into 2D images by using t-distribution stochastic neighbor embedding algorithm (t-SNE) to give dispatcher more intuitive impressions. The method is verified by taking the actual data of regional power grid.

E1012
12:00-12:15

Influence of PWM Current Harmonics on Electromagnetic Noise of External-Rotor In-Wheel Permanent Magnet Synchronous Motor for Electric Vehicle

Jiaxin Qin, Hongliang Ying, Surong Huang, Fei Quan, Qi Zhang
Shanghai University, China

In this paper, the speed-frequency law of the radial electromagnetic force of external-rotor in-wheel permanent magnet synchronous motor (PMSM) for electric vehicle was summarized, a co-simulation model of "PWM Current-Electromagnetic Field-Structure Field" considering the influence of cross-coupling and magnetic saturation on inductance parameters was proposed. The electromagnetic noise of 36-slot 48-pole external-rotor in-wheel PMSM as the prototype was simulated and analyzed. The results show that the new noise harmonics generated by PWM current harmonics appear as scattering curve families, and each scattering curve family takes kfc (k=1,2,3,...) as its axis of symmetry in noise spectrum diagram. Properly increasing the switching frequency can reduce the noise and make the noise harmonic scattering curve families shift to the right and increase the interval in the spectrum diagram, which is an effective measure to suppress the electromagnetic noise generated by PWM current harmonics. The results of the prototype test verify the above conclusions. The theoretical basis and analysis method were provided for the prediction, evaluation and optimization of the noise of the external-rotor in-wheel PMSM powered by PWM current.

E1015
12:15-12:30

An electromagnetic immunity test scheme for vehicle audio system

Ke Tang, Jing Xu Ding, Mei Jian Lei, Zhen Zeng, Jun Di Guo, Qiu Ling Zeng
China Automotive Engineering Research Institute Co., Ltd, China

With the emergence of in-vehicle electronic products and the rapid development of Telematics, the electromagnetic environment faced by vehicles has become more complex than ever, and the electromagnetic immunity of in-vehicle electronic products has a crucial impact on the driver's user experience and even road safety. So electromagnetic susceptibility (EMS) testing has become an urgent issue for the industry to face and solve. Besides EMS test, acoustic measurement should be paid attention to in-vehicle multimedia equipment audio performance. In this paper, an electromagnetic compatibility (EMC) test scheme for vehicle level audio quality is proposed. The EMC test platform is verified, the audio anti-interference test system is placed in an AF shielding box to test the different reverberation effects of the information received by human ear, and the Perceptual Objective Hearing Quality Assessment (POLQA) is introduced. The EMS test results show that it is feasible to use the MOS values of POLQA to evaluate the whole vehicle audio electromagnetic immunity.

E1021
12:30-12:45

Thailand's EV Taxi Situation and Charging Station Location for EV Taxi

Pichamon Keawthong, Veera Muangsin

Chulalongkorn University, Thailand

Thailand has targeted having 1.2 million electric vehicles (EVs) on the road by 2036. In accordance with this government policy, the Department of Land Transport has partnered with the business sector to provide 100% EV taxis to encourage greater use of EVs. Ensuring there are sufficient charging stations is one of the critical factors for the adoption of EVs. Utilizing qualitative research, this paper studies the EV situation in Thailand, the expansion of EV taxis in Thailand, and the optimal site selection criteria for the installation of EV taxi charging stations. Regarding the EV taxi situation in Thailand, it was found that the expansion of EV taxis in Thailand can be divided into 2 cases: by the private sector without government promotion or support and by the private sector with government promotions and support. EV Society is the first and only company to run an EV taxi service with 100 units, mainly operating out of Suvarnabhumi Airport. According to interviews with key stakeholders, the optimal locations for the installation of charging stations are airports, main roads, tourist routes, normal taxi routes, taxi garages or nearby areas, and LPG/NGV/gas stations. These locations require enough parking space, easy access, sufficient power supply, and appropriate facilities, while they should also be scattered throughout the city at strategic locations within optimal distances of each other. Moreover, this study found that the key success factor for optimal site selection involves location analysis of the busiest taxi commuter routes to identify the routes that are in highest demand. Previous installation programs have involved large-scale investment but the stations were inefficient and had little usage in return. The investment efficiency can be improved by conducting applicable site selection analysis before installing charging stations.

Study of Fault Detection of Bridge Crane Wheel based on Fourier Transform

Pengwei Guo, Xiaoping Ma, Wenmin Zhang, Fang Gao, Meng Liang, **Hengliang Shi**
Henan University of Science and Technology, China

E1026
12:45-13:00

The track condition of a bridge crane directly affects the production efficiency and life safety. Due to the limitation of harsh environment, the traditional detection methods include high altitude danger, difficult operation and low efficiency. In this paper, according to the on-line inspection of wheel track wear, the acoustic signal of electric converter is used to collect the sound signal. The method of failure detection based on power spectrum is proposed, and the BIF feature selection combined with Fisher criterion is used to select the best special collection, and the problem of many characteristics is solved. Finally, we use the two classification logic regression to achieve the mathematical modeling between the feature set and the wear volume, and use the H function as the basis of failure judgement. The results show that the failure probability value of the system is more than 0.8 when the wheel wear is serious and close to failure, which is approximately equal to the real value. It can provide a reliable basis for the detection of wheel track.

3D Simulation of Cluster Binary Breakup Model

Xianglin Ye, Nongdie Tan, Lei Chen, Wandi Wu, HaiLing Xiong
Southwest University, China

E1023
13:00-13:15

To simplify and further study the properties of fractal dispersion in different fields, a program to implement the cluster binary breakup(CBB) model is proposed in this paper. In the simulation program, there are three methods of breaking

here: ero-sion, rupture and uniform. These methods represent different choices of split positions and correspond to different scenari-os. By using the program, the cluster breakup can be displayed dynamically in the form of three-dimensional(3D) figure. Meanwhile, the related kinetics data of cluster can be also recorded dynamically. Compared to the previous program, the program is not only more universal in different areas but also has better real-time performance and is more helpful to ob-serve the cluster breakup process, which contributes to the scientific study in cluster dynamics.

Session 3

Time: **Sunday, 7th Mar.** **16:30-19:15 (GMT+8)**	**ZOOM ID:** **650 5658 0703** **https://zoom.com.cn/j/65056580703**

Topic:

Electronics and Power System

Chaired by:

Prof. Wojciech Czekała, Poznań University of Life Sciences, Poland

Presentations: (15 minutes for each paper, including Q&A)

NG1-005, NG1-010, NG1-020, NG1-021, NG1-027, NG1-030, NG1-031, NG1-038, NG1-044, NG2-803

Notes:

- Please arrive at the conference rooms 10 minutes before the session starts.
- Timing: a maximum of 15 minutes in total, including 2-3 minutes for Q&A. Please make sure your presentation is well timed.
- Certificate of Presentation will be sent to each presenter's email box after the conference.
- One Best Presentation will be selected from each parallel session and author of best presentation will be announced at the end of this session.

Session Chair **16:30-16:45**	Waste to fertilizer - choice or necessity? Prof. Wojciech Czekała Poznań University of Life Sciences, Poland
NG1-005 **16:45-17:00**	A Comparative Study on Machine Learning Algorithms for Hourly Univariate Wind Power Forecasting in Arctic Regions Hao Chen and Yngve Birkelund The Arctic University of Norway, Norway

Wind power forecasting is crucial for wind power systems, grid load balance, maintenance, and grid operation optimization. The utilization of wind energy in the Arctic regions helps reduce greenhouse gas emissions in this environmentally vulnerable area. In the present study, eight various models, seven of which are representative machine learning algorithms, are used to make 1, 2 and 3 step hourly wind power predictions for five wind parks inside the Norwegian Arctic regions and their performance is compared. Consequently, we recommend persistence model, multilayer perceptron, and support vector regression can be used for univariate time-series wind power forecasting within the time horizon of 3 hours.

Power Profiling

Vindya Wijesinghe, Manoj Perera, Praveen Vidyaratne, Chamod Peiris, Dasuni Nawinna and Janaka Wijekoon

Sri Lanka Institute of Information Technology, Sri Lanka

NG1-010
17:00-17:15

Reduced energy footprint is considered an indicator of efficiency around the world. Having insights into electricity consumption behavior of individuals or families across the day is very useful in efficient management of electricity. In this paper, we present s study that focused on identifying patterns in the monthly electricity consumption profiles of a single household with the K-means clustering algorithm. The data required for this study was collected through a survey in the Sri Lankan context. The survey mainly captured the factors affecting electricity consumption. After proving the demand of electricity is dependable on the data that has been collected, they will be keyed into data models/ profiles that will be built using clustering algorithms. A load profile will be designed using K-means to identify usage patterns of a household on a monthly basis. The parameters that affect the electricity consumption were tested and trained using the SVM algorithm.

The outcomes of this study include; identifying the factors contributing to the electricity consumption, identifying electricity consumption patterns, identifying the energy footprint of individuals or families and predicting the future electricity requirements. The results of this study provide many advantages for both consumers and suppliers in efficient management of electricity. It also provides significant impacts in both micro and macro levels through enabling efficient decision-making regarding management of electricity.

Implementation of vehicle-to-grid scheme in hydro-dominant grid subjected to ultra-low frequency oscillations

Mouhamed Niasse, Qi Zheng, Ai Xin, Federico Alexander Flamenco Quan

North China Electric Power University, China

NG1-020
17:15-17:30

This paper aims to improve the frequency stability in electric vehicles (EVs) penetrated hydro-dominant power grids. Such an environment is subjected to two significant technical challenges. On the one side, the occurrence of ultra-low frequency oscillations (ULFOs) has been frequently noticed in the last two decades. They are intrinsically caused by the hydropower plants and can lead to the hydro-dominant power systems' collapse. On the other side, EVs have demonstrated the ability to participate in the power system's frequency regulation by injecting stored power back in the grid. However, this contribution from vehicle-to-grid (V2G) has to match EV users' convenience. In this paper, the ability of a V2G system to participate in the damping of hydro-dominant grid ultra-low frequency oscillations is investigated. The occurrence of ultra-low frequency oscillations is successfully reproduced in the chosen test system. A comparison between the system with and without proposed V2G schemes is carried out, showing V2G schemes' positive

effect on the grid frequency stability. The results are then shown and discussed to validate the effectiveness of the proposition in terms of damping the ULFOs while still satisfying EV users' convenience.

Developing a Cost Optimization Model for Electricity Generation from Agricultural Biomass

Busamas Dangprok, Korrakot Y. Tippayawong and Nakorn Tippayawong

Chiang Mai University, Thailand

NG1-021
17:30-17:45

Open burning of agricultural residues as a means of disposal causes massive atmospheric air pollution in northern Thailand. Converting this agricultural residual biomass to green energy can help reduce this problem. They may be utilized as solid fuel for electricity generation, where cost is one of the major factors that affect long-term success in the use of biomass energy. In this work, cost optimization model for Thailand was developed by considering two parts of total cost; biomass and transportation costs. Ten potential biomass materials which were the most abundant in Thailand were taken into account. For transportation cost, K-means clustering was applied to group a number of supplies and demands and to identify centroids of each cluster to use them as representatives in calculating transportation cost from a supply to a demand. Each kind of biomass was gathered into six different types of power plant. It was transported by 10 wheel-trucks. A wide range of input data (biomass and transportation costs) from a supply to demand was also evaluated. From the findings, it was found that reduction of the total cost by > 50% can be achieved. These results were calculated from only biomass and transportation costs without taking other factors such as seasonal conditions or process limitations into consideration. Different input parameters can change the total cost.

Demand Response Strategy for the Smart Home with the Distributed Photovoltaic Generation

Miao Guangyao, Tian Jingchao, Cao Lingguo and Zhang Yuyong

Ningxia State Grid Corporation, China

NG1-027
17:45-18:00

With the gradual development of the power grid in the direction of intelligence, the rigid demand for auxiliary resources included in the dispatch and control range of the power system in the past is increasing. The intelligent power utilization system is the key to solve the problem of distribute individual user in the unified dispatch of the grid center. In this paper, a smart electricity consumption algorithm based on user-side demand is proposed. This method can ensure the user's right of independent choice on the basis of satisfying demand response constraints, realizing the interaction of multiple sources and loads to a certain extent. The main task of this paper is to consider the influence of distributed photovoltaic power on the algorithm and put user selection the first under the constraints of satisfying demand response. Firstly, the model of the intelligent power consumption system is introduced, and the classification of different loads under system control and its power supply model are given. Then, the paper proposes the concept of user choice, considering the calculation method of the priority of household appliances from multiple angles, which is the core of the control system algorithm. The control algorithm not only considers the influence of distributed photovoltaic power sources connected to the power consumption system, but also considers that user can independently select the working mode of distributed photovoltaic power sources. Finally, in the process of designing the control algorithm, the concept of user interruption is put forward, which is that the user has the right to first execute his own decision and jump out of the algorithm under the condition of demand response. In the subsequent simulation verification, the paper carried out the demand response power conflict experiment with and without the distributed photovoltaic power sources. The

simulation results verify that distributed photovoltaic power sources can improve the comfort of user under demand response conditions. When there is no distributed photovoltaic power, the strategy with user interruption algorithm and the strategy without user interruption algorithm are respectively implemented. This comparative experiment verifies that the interruption algorithm improves the user's right to choose.

A Hybrid Evolutionary Algorithm for Strategic Bidding in Day-Ahead Market with Flexible Demand

Haoyang Zhang

China Southern Power Grid, China

NG1-030
18:00-18:15

Bi-level optimization is a widely used tool for modelling the strategic bidding problems in electricity markets. Traditionally, bi-level optimization problems can be solved after converting them to single-level Mathematical Problems with Equilibrium Constraints (MPEC) by Karush-Kuhn-Tucker (KKT) conditions. However, the non-convex and non-linear operating variables of the generators render KKT conditions and MPEC unavailable in strategic bidding optimization problems. To address this problem, this paper proposes a hybrid evolutionary algorithm to solve the bi-level optimization strategic bidding problem in a day-ahead electricity market with flexible demand by transforming the original lower level mixed-integer non-linear problem (MINLP) into mixed-integer linear problem (MILP). The case study result demonstrates the ability of the proposed method to solve the bi-level optimization problem and find a more profitable bidding strategy compared to the benchmark case with a competitive behaviour.

Application of Improved Cluster Division Method in Active Distribution Network

Meng Wang, Fang Li, Fu Hong, Shichuan Wang

Shandong University, China

NG1-031
18:15-18:30

A large number of distributed power sources based on photovoltaics are connected to the distribution network, which makes the power system require various components to actively participate in the management of the grid, which constitutes the basic principle of the active distribution network. Active management is one of the main characteristics of the active distribution network. This paper adopts the strategy of cluster division, divides the active distribution network into multiple relatively independent clusters, and establishes a distribution network partition index based on the load absorption index. A zoning strategy aimed at reducing source and load collaborative complementary scenarios. Considering the uncertainty of load and photovoltaic at the same time, the effectiveness of the proposed method is verified in the 60-node distribution network example.

Numerical Simulation Study of the Water Entry Slamming on Oscillating Buoys with Different Shapes

Xuejian Li, Xing Luo, Ruohong Wang, Yanjun Liu

Shandong University, China

NG1-038
18:30-18:45

Heaving buoys device is a commonly used form of wave energy utilization. When encountering extreme wind and waves, the float will rise away from the waves, and then fall back to the normal working position will be impacted by

water. In this paper, numerical simulation studies are carried out on the slamming characteristics of three types of floats of cone, truncated cone and hemispherical shapes, and the influence of the bottom lift angle of the floating body on the peak acceleration and the peak slamming pressure is analyzed. The CFD method was used to simulate the slamming process of different shapes of floating bodies, and the velocity, pressure and flow field changes during the process of entering the water were obtained, resulting in the main conclusions as follows : The truncated cone-shaped floating body is subject to greater slamming pressure, and the bottom rise angle has little effect on the slamming pressure and speed changes; The slamming pressure on the conical floating body is smaller, and the larger the bottom lift angle, the smaller the slamming pressure; The slamming pressure of the hemispherical floating body is stronger than that of the conical shape, but its speed after entering the water is greater than that of the conical shape, and the kinetic energy loss is minimal.

NG1-044
18:45-19:00

IoT Based Smart Home Automation Using Solar Photovoltaic System and Online Time Server

Chiradeep Ghosh, Somdeb Chanda, Kashmira Sil

Calcutta Institute Of Technology, India

In the global scenario comfortable living conditions with domestic automation has become an essential part of our daily life. Our standard of domestic comfort is directly related to consumption of limited resources. By making our house smart to lift up our comfort zone, we're also managing our necessity of water and electricity in a smart way to minimize wastage and reduce environmental pollution by using alternative source of energy for electricity like solar panels. Automation can be accomplished by incorporating the Internet of Things (IoT). This paper presents the complete design of an IoT based solar power control system and water level control system for smart home automation. The proposed design uses the flexible and user-friendly Blynk platform for measurement and control the required parameters. The sensing of different variables like water level and ambient light conditions are conducted using the NodeMCU-ESP8266 microcontroller board, which allows real time data sensing, processing and controlling final control elements in a smarter way.

NG2-803
19:00-19:15

Analysis on Application of GaN in 5G Communication Technology

Dahe Pan

Xidian University, Xi'an, Shaanxi, China

Because of its important strategic position and economic status, 5G communication has become a hot point in information fields. According to its main core technology Massive MIMO(multiple input multiple output), RF devices which work in it should be smaller and could work in higher frequency and voltage, the traditional material silicon can not continue to serve for 5G communication, GaAs is the main material of 2nd semiconductor and GaN is a kind of new material which is a really good one to fit the request of 5G. Because of the microscope property of GaAs and GaN, they have better performance in communication technology, although silicon is still the mainstream because of its low cost and mature processing, because of merits about bandgap, mobility, and so on, in next ten years, these two better materials will gradually take the place of silicon. This passage will focus on the property of GaAs and GaN and explain how these two materials do benefit to 5th generation communication technology.

Session 4

Time: **Sunday, 7th Mar.** **16:30-19:15 (GMT+8)**	**ZOOM ID:** **694 7848 2481** **https://zoom.com.cn/j/69478482481**

Topic:

Energy Utilization and Development

Chaired by:

Assoc. Prof. Man Pun Wan, Nanyang Technological University, Singapore

Presentations: (15 minutes for each paper, including Q&A)

NG1-050, NG1-006, NG1-018, NG1-026, NG1-034, NG1-037, NG1-041, NG1-042, NG1-047, NG1-035, NG1-048

Notes:

- Please arrive at the conference rooms 10 minutes before the session starts.
- Timing: a maximum of 15 minutes in total, including 2-3 minutes for Q&A. Please make sure your presentation is well timed.
- Certificate of Presentation will be sent to each presenter's email box after the conference.
- One Best Presentation will be selected from each parallel session and author of best presentation will be announced at the end of this session.

Research and Application of Zero Discharge Technology for Desulfurization Wastewater of 660MW Coal-fired Unit

ZHANG Shanshan, WU Qiaoling, JI Haihong, LI Tinghao

Huadian Electric Power Research Institute Co., LTD, China

NG1-050

16:30-16:45

In this paper, the pretreatment, concentration reduction and evaporation crystallization stages of desulfurization wastewater in zero discharge technology were studied and engineering applications were carried out, and the performance of 660MW coal-fired unit zero discharge desulfurization wastewater was evaluated. The results showed that for desulphurization wastewater with a total dissolved solid of about 48768.9 mg/L and a Cl content of about 12507.2mg/L, the pass flue gas evaporation process could realize zero discharge treatment of desulphurization wastewater. The hot smoke content introduced into the drying tower was about

52351.0m3/h, the inlet and outlet smoke temperatures of the drying tower were 374℃ and 130℃ respectively, the influence on boiler efficiency was about 0.0676%, and the moisture content of drying products was only 0.15%. The content of HCl in the flue gas at the inlet and outlet of the drying tower was 53mg/L and 165mg/L, the mass fraction of Cl removal and volatilization of desulfurized wastewater were 93.10% and 6.90%, the average content of chlorine in fly ash was about 0.225%, which meet the requirements of relevant standards for the comprehensive utilization of fly ash.

Data-based analysis of the optimal direction of a photovoltaic system for remote sensor nodes for a case study in Germany

Na Shen, Jian Wu, Gabriela Molinar and Wilhelm Stork

Karlsruhe Institute of Technology, Germany

NG1-006
16:45-17:00

Solar based self-sufficient smart sensor nodes are broadly used for remote monitoring purpose especially for applications, where the assessment for human is hostile. For the power supply of these smart sensor nodes, solar panels and battery are usually used. In order to collect the solar energy more efficiently, the solar penal of the sensor node should be directed optimal. In this paper a study at Schnarrenberg with the coordinate [□□. □ , □. □] in Germany has been done, to determine the optimal tilt and orientation angle, which maximize the received solar energy at an inclination in the worse months, nevertheless without weakening of the solar energy of other months. Finally, with the calculated average monthly solar energy on this inclination, the minimum value was taken to determine the peak sun hours to size of the solar panel. Our approach is evaluated by applying the hourly solar global and diffuse irradiance on the horizontal surface from the open metadata of the German Weather Service, between 2013 and 2017. The evaluation results can be used for distributing sensor nodes along high voltage overhead lines in the framework of PrognoNetz research project.

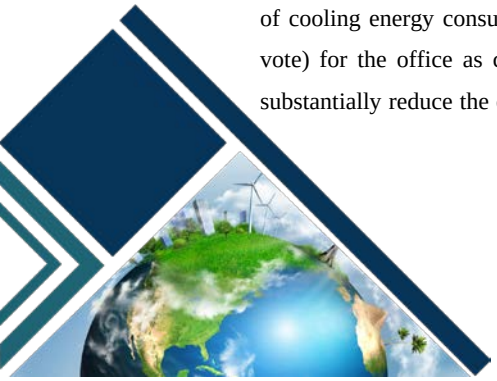
Machine-Learning-based Model Predictive Control with Instantaneous Linearization for Building Energy Management

Shiyu Yang, Nithiakuhan Uthayakumar, Wei Jie Yeo and Man Pun Wan

Nanyang Technological University, Singapore

NG1-018
17:00-17:15

Machine learning (ML)-based building modelling can cut down the model construction time in developing model predictive control (MPC) for building energy management applications as compared to conventional physics-based modelling approach. However, ML-based building models are usually nonlinear, leading to computationally inefficient nonlinear optimization problems that are prohibitive to real-time building control and optimization applications. This study proposes a ML-based MPC with an instantaneous linearization (IL) scheme that employs online building operation data to continuously linearize the nonlinear ML-based building model to construct a fast linear MPC at each control interval. The proposed ML-based MPC with IL is implemented to control an air-conditioning system in an office located in Singapore for experimental evaluation of its control performance. The proposed ML-based MPC with IL is compared to a conventional ML-based MPC that directly uses the nonlinear ML-based model and the original reactive-control-based thermostat of the office. The ML-based MPC with IL significantly reduced the computation time (by more than 100 times) as compared to the ML-based MPC while retaining most of the benefits of the ML-based MPC. The ML-based MPC and the ML-based MPC with IL achieve 31.85% and 28.16% reductions of cooling energy consumption, respectively, while significantly improve indoor thermal comfort (measured by predicted mean vote) for the office as compared to the original thermostat. The study demonstrated that using IL for ML-based MPC could substantially reduce the computation load with no obvious performance degradation in terms of both thermal comfort and energy



efficiency.

Solar Radiation Forecasting in Saudi Arabia Using Machine Learning

Budoor Alwated and Tayeb Brahimi

Effat University, Saudi Arabia

NG1-026
17:15-17:30

Solar energy is a promising renewable energy source due to its availability and environmentally friendliness. The capability to maximize the utilization and efficiency of solar energy remains a difficult task because of the challenges in collecting and analyzing the solar radiation data. Therefore, there is a great need to forecast the solar radiation in order to predict the output power. This paper aims to use machine learning methods to forecast the solar radiation in Saudi Arabia in Riyadh city. The study compares the forecasted solar radiation using different machine leaning models such as Artificial Neural Networks (ANN), Random Forest, and linear regression. The weather dataset obtained from KACARE,2017. The proposed models evaluated using root mean square error, and direction accuracy. Random forest has the highest accuracy and the lowest RMSE with an accuracy of 92.8571, and RMSE of 10.3157 compared to ANN (91.3043, 18.4656), linear regression (78.5714, 30.4098)

An Attention-Based Photovoltaic Forecasting Scheme Combined with LSTM Model

Wei Huang, Mi Wen and **Chen Xing**

Shanghai University of Electric Power, China

NG1-034
17:30-17:45

With the development of new energy around the world, the proportion of photovoltaic energy used as a clean energy in the distribution network is gradually rising. The forecast of photovoltaic power plants is vital to many energy providers for their marketing analysis. Thus, photovoltaic forecasting has become an important research direction at present. However, owing to the high volatility and intermittent characteristics of photovoltaic power generation, it is still a challenge to predict photovoltaic power accurately. As far as traditional photovoltaic forecasting methods are concerned, SVM and ARIMA, as machine learning methods can solve the timing prediction problem of certain scenarios, but they are often not appropriate for some time series closely related to features. To address this problem, this paper proposes a short-term photovoltaic load forecasting model based on the Attention mechanism and LSTM model. Firstly, the correlation coefficient and LASSO regression are used for feature selection to filter out redundant features. Secondly, a long short-term memory network (LSTM) is used to make predictions to solve the problem of gradient disappearance during model training. Finally, the Attention mechanism is added to better capture feature weights and further improve the prediction accuracy of the training model. The proposed method can predict the change trend well. Comparative results confirm that the proposed method with feature selection can has better effect than ARIMA,SVM, and ELM.

Energy Management Scheme for Renewable Energy Source based DC Microgrid with Energy Storage

Chandrakant L. Bhattar and **Madhuri A. Chaudhari**

Visvesvaraya National Institute of Technology, India

NG1-037
17:45-18:00

Renewable Energies such as solar, wind, fuel cell etc. need to be utilized effectively and efficiently to reduce the carbon foot prints to fulfil the energy demand deficit. The intermittence nature of these energy resources affects energy balance and power quality significantly. Renewable energy resources throw the challenge on the system operator for utilizing the available energy to fulfil the energy demand requirement. However, this paper investigates the power flow management in DC Micro-Grid. The

proposed scheme effectively regulates the dc bus voltage and balancing the power flow in the system under all operating scenario and curtail load during the deficit of power. The scheme considers the load category i.e. essential and non-essential load. In support to the energy management scheme, the test condition considers Maximum Power Point Tracking (MPPT) condition and battery State of Charge (SoC) and converter control strategies to regulate the DC bus voltage. The test system of 48V, 300W DC Microgrid system is simulated in MATLAB/Simulink environment and results are studied considering different various conditions.

Unit Commitment with Integrated Energy System Considering Primary and Secondary Frequency Regulation

Xuan Zhang, Xingquan Ji, Ying Zang*, Yumin Zhang, Qing Hao, Yundong Xiao

Shandong University of Science and Technology, China

NG1-041
18:00-18:15

With the development of renewable energy generation such as wind power, the economic operation of power system is greatly challenged by the phenomenon of wind curtailment. In order to reduce the operation cost of power system and improve the accommodation capacity of renewable energy, this paper proposes a unit commitment (UC) model with integrated energy system (IES) considering primary frequency regulation (PFR) and secondary frequency regulation (SFR). Firstly, establishing the model to co-optimize the electric system, gas system and thermal system. Then, for the nonlinear problem of natural gas pipeline flow, an incremental piece-wise method is proposed for linearization, from which the nonlinear non-convex programming problem can be transformed into a mixed integer linear programming problem (MILP). Finally, 24-bus electric system, 20-bus natural gas system and 16-bus thermal system are used to simulate and verify the proposed model in this paper. Numerical results illustrate that the unit commitment considering integrated energy system is beneficial to improve the energy efficiency and the economy of the system operation.

Optimal Deployment Capacity of District Multi-energy System Considering Cost Evolution

Yiru DAI and Yipu ZENG

Tongji University, China

NG1-042
18:15-18:30

For the purpose of coping with the severe climate change challenge arising by greenhouse gas emission, a novel energy system paradigm, generally so-called District Multi-Energy System (DMES), has turned out to be the most influential solution for exiting energy system to transit to a higher efficient, lower-carbon, safer and more sustainable energy environment. Hence, a large number of researches has already contributed to address optimal problems relevant to planning, deployment, operation, management issues in DMES area. In the context of these efforts, energy technological cost, a significantly important parameter in optimization target, is often assumed as a given value being irrelevant to optimal decision-making. Such an approach clearly neglects the evolutional characteristic of energy technology and consequently leads to less accurate optimization results. In this respect, integrating multiple types of energy carriers, in particular renewables, a kind of District Multi-Energy System (DMES) model is proposed which intends to obtain the optimal deployment capacity of different power units involved in the energy system. Moreover, learning curve model that depicts the evolution trajectory of energy-technological cost is also incorporated to DMES model to investigate the impact of cost evolution on optimal results.

NG1-047
18:30-18:45

BEMS with On-line Learning Mechanism on Microservice Architecture

Yusuke Fujiwara, Toshihiro Mega, Kodai Murakami, Noriyuki Kushiro

Kyushu Institute of Technology, Japan

There is a growing interest to introduce energy saving algorithms, which balance energy saving with comfort, into building energy management system (BEMS). Development of the algorithm is accomplished through cooperative work among various kinds of agents (researchers and engineers), and introduction of new energy saving algorithms requires long-term field tests for tuning. Difficulties that integrating each agent's fruits and performing long-term field tests hinder penetration of new energy saving algorithms into BEMS. We proposed a new architecture for BEMS based on microservice architecture. In the proposed BEMS, fruits of each agents are easily combined directly without engineering and cooperate with each other. As a result, the proposed system realizes on-line learning mechanism inherently and succeeded in reducing terms required for parameters' tuning. The proposed BEMS was implemented and was evaluated validity in a real office building.

Simulating the Key Design Parameters of Oil Field Development

Muhammad Usman Tahir, Hongtao Zhou, Asadullah Memon, Wei David Liu, Shahid Ali and Ubedullah Ansari

China university of Petroleum, China

NG1-035
18:45-19:00

The Southwest Betara (SWB) field is located in the western area of the Jabung Block, South Sumatra Basin. The reservoir simulation study was done in this field to predict the reservoir performance, generate production forecast, and finally generate the optimum field of the development plan. To achieve these goals, integrated seismic interpretation, geological model, and reservoir engineering study has been conducted to create dynamic reservoir models. Several reservoir model realizations have been created according to the geological models. The model is validated with the available production history and reservoir pressure data. The PVT data have also been validated with more accurate oil and gas production data. To define optimum field development, sensitivities of the number of producing wells, and pressure maintenance to cumulative oil recovery were done. A total of three cases, base case-11 wells, case-1-18 wells, and case-2-18 wells plus 2 injectors, were run to optimize the future development of the SWB field. Results revealed that gas production rate in case-1 higher than the other cases. Because of in case-1 the reservoir pressure drops significantly under bubble point pressure. While the cumulative oil production from case-2 is higher than others. On average, the reservoir pressure drops by 800psia after 5 years of production in case-1. In water injection case (case-2), the reservoir pressure drop by 1200psia, it means that water injection can be used to maintain reservoir pressure in the SWB field. An estimated 14.56% Oil Recovery factor is generated from a reservoir simulation model in base case, 17.8 % from case-1, and 20.69 % from case-2.

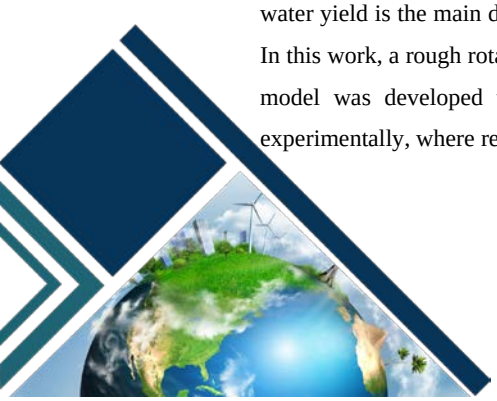
Experimental validation of an enhanced solar still with a rough rotating drum

Manar Younis, Carine Habchi, George Ayoub, Mohammad N. Ahmad and Kamel Ghali

American University of Beirut, Lebanon

NG1-048
19:00-19:15

Solar stills are considered a promising option for obtaining fresh water when needed, especially in rural areas. However, the low water yield is the main drawback of these systems. Therefore, several studies have been dine to increase the system's water yield. In this work, a rough rotating drum was integrated with the system to enhance the obtained water yield. A predictive mathematical model was developed to account for the obtained water yield under the effect of roughness. The model was validated experimentally, where results showed a good agreement between modelled and experimental results.



Session 5

Time: **Sunday, 8th Mar.** **10:00-12:00 (GMT+8)**	**ZOOM ID:** **650 5658 0703** **https://zoom.com.cn/j/65056580703**

Topic:

Energy and Environmental Engineering

Chaired by:

Adjunct Prof. Hamed Aly, Dalhousie University, Canada

Presentations: (15 minutes for each paper, including Q&A)

E2004, E2005, E13003, E1006, E1022, E1024, E1025-A, E2002

Notes:

- Please arrive at the conference rooms 10 minutes before the session starts.
- Timing: a maximum of 15 minutes in total, including 2-3 minutes for Q&A. Please make sure your presentation is well timed.
- Certificate of Presentation will be sent to each presenter's email box after the conference.
- One Best Presentation will be selected from each parallel session and author of best presentation will be announced at the end of this session.

E2004

10:00-10:15

Collection channel selection in a closed-loop supply chain considering recycling price for used product

Yaling Yan, Qingguo Tang

Nanjing University of Science and Technology, China

This paper constructs a closed-loop supply chain (CLSC) with price and effort dependent demand to study the impact of the relationship between recycling prices of retailer and third party on the optimal recovery strategy. Taking the recycling price as the endogenous variable, the effort, pricing and collection decision of supply chain members under the dual channel recovery (D-model), retailer recovery (SR-model) and third party recovery (ST-model) are dis-cussed respectively. The results indicate that there is no one-size-fits-all recovery strategy. But it

is observed that when the relation-ship of recycling prices changes, the optimal recovery strategy al-ways changes from D-model to SR-model or ST-model with competition becomes increasingly fierce, which provides managerial insights for decision-makers about collection channel selection in closed-loop supply chains.

Construction of Long-term Quality Assurance System of Green Supply Chain of Agri-products

Fenfang Ye, Guanwei Jang, Jing Zhao

Guangdong University of Science and Technology, China

E2005
10:15-10:30

The safety problem of agri-products affects people's health. It is important to establish a long-term Quality assurance system of green supply chain of agri-products in China which is a large agricultural country. In this paper, the operation quality of green supply chain of agri-products is taken as a research object. On the basis of literature review and market investigation, a long-term quality assurance system of green supply chain of agri-products is constructed.Firstly, the green supply chain of agri-products is composed of five links: green supply, green planting, green logistics, green marketing and green recycling. According to above, the hierarchical structure of the index system is constructed: five primary indicators, fifteen secondary indicators and twelve tertiary indicators. Fuzzy-AHP method is used to evaluate the quality level of green supply chain of agri-products. Secondly, the construction of quality assurance system for supply chain of agri-products can be constantly improved and promote the improvement of greenness of supply chain through the four links:plan, do , check and act. The research achievement can provide consumers with green, pollution-free and organic agri-products, improve the market competitiveness of agri-products supply chain, reduce environmental pollution and save resources, promote the harmonious development of human and nature.

Research on Evaluation method of Integrated Energy Service Level of Power Generation Enterprises

Yi Li, Baozhong Zhou

Huadian Electric Power Research Institute Co., Ltd., China

E13003
10:30-10:45

China is in a critical period of energy transformation. With the in-depth adjustment of Internet information technology, renewable energy technology and power system reform, the development of comprehensive energy services is the main direction of the development of electricity sales companies, and it is also an important way to improve energy efficiency, reduce energy costs and promote the profitability of electricity sales companies. At present, the comprehensive energy service is gradually forming a new industrial form, but the current evaluation method of the comprehensive energy service level of power generation enterprises is not perfect. In this context, this paper first studied the relevant literature at home and abroad, on this basis, combined with the related theories and evaluation methods of comprehensive energy services and the relevant significance of business service capability evaluation, to illustrate the importance of this research. In this paper, a comprehensive energy service level evaluation index system is constructed to evaluate the power enterprises from four aspects, including four categories of marketing, operation management, economic benefit and social benefit index and 25 secondary indexes. Analytic Hierarchy Process (AHP) and fuzzy comprehensive evaluation method are used to determine the weight and final evaluation basis.

Session 5

E1006
10:45-11:00

Effects of Inorganic Salts on Enzymatic Saccharification Kinetics of Lignocellulosic Biomass for Biofuel Production

Marttin P. Gundupalli, Prapakorn Tantayotai, Kitipong Rattanaporn, Wasinee Pongprayoon, **Malinee Sriariyanun**

King Mongkut's University of Technology North Bangkok, Thailand

Utilization of agricultural waste, or lignocellulosic biomass, is one of the strategies to reduce the environmental problem caused by combustions after harvesting seasons. Biorefining process to convert lignocellulose to value-added biochemicals and biofuels has been developed. Inorganic salt pretreatments improve enzymatic saccharification efficiency. However, salt residues inhibit activities of cellulase enzyme. In this work, the inhibitory effects of two types of inorganic salts, NaCl and KCl, on commercial cellulase enzyme, Accellerase 1500, were studies using the Michaelis-Menten model. The kinetic properties, in terms of Km and Vm, on three types of cellulose substrates, including CMC, Avicel, and sugarcane bagasse, were calculated based on Lineweaver-Burk plot. The obtained kinetic values showed that Vm of Accellerase 1500 reduced to 58.21% and 81.25% with the presence of 0.5 M KCl when using CMC and Avicel as substrates, respectively. On the other hand, the Km values of cellulases were also reduced with the presence of NaCl and KCl, suggesting the accessibility of enzymes to substrates. Additionally, sugar yields obtained from sugarcane baggase as substrates for biofuel production were also increased with the presence of 1M NaCl and 1M KCl.

E1022
11:00-11:15

Comprehensive Evaluation of the Development Level of Urban Ecotourism——Taking Southwest China as an Example

Xuedong Liang, **Bingjing Niu**, Yanghuan Liu, Sipan Li

Sichuan University, China

Eco-tourism is of great significance to the realization of the comprehensive, stable and sustainable development of the tourism industry. Studying the development level of ecotourism can effectively promote the healthy development of tourism. In this paper, the index system based on DPSIR model is established, and the evaluation model of ecotourism development level is constructed by combining the combination weight method and matter-element analysis method. Taking five cities in Southwest China as the research objects to evaluate the development level of ecotourism from 2009 to 2018. The results show that: (1) From 2009 to 2018, the development level of ecotourism in Nanning, Guiyang, Kunming and Chongqing has improved, while the development level of Chengdu has declined slightly. (2) In 2018, the development level of eco-tourism in Guiyang is in grade V, while Nanning, Kunming, Chongqing and Chengdu are in grade III. (3) From 2009 to 2018, the development level of the five cities' ecotourism response subsystem was poor, the development level of the driving subsystem was medium, and the development level of the pressure subsystem and the state subsystem was relatively good.

E1024
11:15-11:30

A Comparative Analysis of Rainfall Prediction Model Based on GPS and BDS Signals

Shenzheng Zuo, Yinan Liu, Yan Wang, Yifan Zhang, Dongmei Zhang

Beijing Metstar Radar CO.,LTD , China

Rainfall prediction plays an important role in guiding agricultural development and natural disaster prediction. However, the prediction of rainfall with many influencing factors is extremely complicated, which makes high-precision prediction very difficult. This work verify the feasibility of using GPS and BDS signals to predict rainfall, and compare their accuracy.This study proposes a neural network model based on GNSS signals to predict rainfall.The paper uses the precipitable water vapor data retrieved by Global Positioning System (GPS) and Beidou positioning system (BDS), combining with neural network algorithm, to predict the actual rainfall. The experiment proves that the assumption is feasible and experimental results show that the mean absolute error of the GPS-based prediction and BDS-based prediction are 0.2-0.25(mm) and 0.15-0.2(mm), respectively. Neural network prediction model performs well.The both results are in line with meteorological requirements, while the latter accuracy is higher.

Impact of Electric Vehicle Adoption on Electricity Consumption and Generation

Atia Ferdousee

Middle Tennessee State University, USA

E1025-A
11:30-11:45

The market share of electric vehicles (EV) is growing in the USA, and there are substantial numbers of federal, state, and county-level incentives for EV consumers. These incentives are in place, primarily, due to environmental concerns. This study focuses on two different but interrelated aspects of EV adoption. First, using monthly county-level data from 2010 to 2019, this study reveals that electric vehicles and their supportive infrastructures, such as charging stations, have a significant effect on residential and commercial electricity consumption in California. Second, analyzing electricity generation information by county, I find that there is significant negative relation between EV adoption and the share of electricity that comes from renewable sources. Although electric vehicles emit lower greenhouse gases than conventional vehicles, they require a significant amount of electricity for charging. If the electricity generation does not involve renewable or cleaner sources, public spending on EV adoption may not contribute to a cleaner environment as much as expected.

Waste Management and Covid-19: What Does the Scientific Literature Suggest?

Samuele Marinello, Francesco Lolli, Rita Gamberini

Centro EN&TECH, Università di Modena e Reggio Emilia, Italy

E2002
11:45-12:00

The studies conducted on the effects of the health emergency due to COVID-19 have shown heavy consequences on human activities (industrial production, economic activities, tourism), but also interesting improvements for the quality of different environmental matrices (water, air, soil). The waste management sector, which represents an essential public utility service, has suffered very negative consequences. In fact, the global change in the behaviour and habits of citizens and the variations in industrial, production and economic processes in general have altered the consolidated dynamics that governed the production and treatment of waste, putting them in crisis. This review intends to provide a structured and critical evaluation of the recent scientific literature about the study of the effect of health emergency on the waste management sector. The results reported showed a general common trend towards a significant increase in the production of hazardous medical waste and packaging plastics, while the increasing or

decreasing trend in household waste does not appear uniform. Industrial waste and those associated with public areas and events are decreasing. The recovery and recycling sector suffered a sharp slowdown. In the face of various gaps and criticalities highlighted by the analysed authors, various possible solutions to improve waste management during emergency situations such as that of COVID-19 have been identified and reported in this review work.