2020 2nd International Conference on Smart Power & Internet Energy Systems (SPIES 2020)

September 15-18, 2020

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Welcome Message from the Conference General Chair

On behalf of 2020 2nd International Conference on Smart Power & Internet Energy Systems, Organizing Committee, it is my immense pleasure to welcome to all delegates, keynote speakers, sponsors, industry delegates and all participants. It is a great honor and pleasure to be the General Chair of SPIES 2020.

Because of the COVID-19, the organizing committee has made the difficult decision to change the SPIES 2020 into virtual conference. All the delegates can participate in the conference under a safe, productive and well-attended atmosphere. Hope everyone can take care and have a good health.

It has been slightly more than 1 year, since this journey began once we agreed on to launch this conference to discuss the emerging challenges and opportunities in power and energy systems. I would like to take this opportunity to express our sincere gratitude to all the supporters. SPIES 2020 is Technically Supported by IEEE Thailand Section, IEEE PES, Prince of Songkla University, Changmai Unversity, Universiti Tenaga Nasional, University of Malaya, Tsinghua University, KITAMI Institute of Technology, King Mongkut's University of Technology North Bangkok, Universite de Bretagne Occidentable, Shanghai University of Electric Power and Curtin University. I also would like to thank our sponsors Typhoon HIL, PSCAD and Frontiers to support the event.

Through this conference, we hope we could engage with all of the participants in a constructive discussion on related conference topics and exchange ideas. We are glad to receive more than 170 submissions from Japan, China, France, New Zealand, Australia, Indonesia, Egypt, Malaysia, Thailand, India, Denmark, UK, USA and so on. Finally 106 papers are in conference proceedings. Every papers were reviewed by at least 2 reviewers to maintain the conference quality. Thanks for their great efforts and excellent works.

The SPIES 2020 Organizing Committee wishes you a very successful conference, we have a number of keynote addresses along with many technical presentations. We hope you will keep many fond memories from your participation in this conference.

Dr. Kuaanan Techato,
Prince of Songkla University, Thailand
Dean Chairperson of Sustainable Energy Management Ph.D. & Master Programs

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Introduction of Keynote Speakers

Keynote Speaker I

Prof. Innocent Kamwa (IEEE Fellow)
Hydro-Quebec Research Institute (IREQ), Canada

Innocent Kamwa obtained his B.S. and Ph.D. degrees in Electrical Engineering from Laval University, Québec City in 1985 and 1989 respectively. He has been a research scientist and registered professional engineer at Hydro-Quebec Research Institute since 1988, specializing in system dynamics, power grid control and electric machines. After leading System Automation and Control R&D program for years he became Chief scientist for smart grid, Head of Power System and Mathematics, and Acting Scientific Director of IREQ in 2016. He currently heads the Power Systems Simulation and Evolution Division, overseeing the Hydro-Quebec Network Simulation Centre known worldwide. An Adjunct professor at Laval University and McGill University, Dr. Kamwa's Honors include four IEEE Power Engineering best paper prize awards, Fellow of IEEE and Fellow of the Canadian Academy of Engineering. He is also the Recipient of the 2019 IEEE Charles Proteus Steinmetz Award and 2019 IEEE/PES Charles Concordia Power Systems Engineering Award.

Introduction of Keynote Speakers

Keynote Speaker II

Prof. Junji Tamura
Kitami Institute of Technology, Japan

Junji Tamura (M'86–SM'92) received his B. Sc. Eng. Degree from Muroran Institute of Technology, Japan, in 1979, and M.Sc. Eng. and Dr. Eng. degrees from Hokkaido University, Japan, in 1981 and 1984 respectively, all in electrical engineering. He became a lecturer in 1984, an Associate Professor in 1986, and a Professor in 1996 at the Kitami Institute of Technology, Japan.

From 1991 to 1992, he had joined the Energy Systems Research Center of University of Texas at Arlington (UTA) as a visiting research Professor. He had been a chairman of the committee of Rotating Machinery of IEEJ (The Institute of Electrical Engineers of Japan) from 2008 to 2010, and he was a conference chair of International Conference on Electrical Machines and Systems 2012 (ICEMS 2012, Sapporo, Japan) in 2012. From 2006 to 2014, he had been a Vice President, and from 2014 to 2018 he had been an Executive Vice President of the Kitami Institute of Technology. He is currently a Professor and the Head of the Laboratory of Electric Machinery of the Kitami Institute of Technology, Japan. His main research interests and experience include analysis of synchronous machines, analysis and simulation of power system dynamics and stability, and analysis and control system design of wind power generation system. He has authored or co-authored about 180 peer-reviewed journal papers and presented about 220 papers in international conferences.

Introduction of Keynote Speakers

Keynote Speaker III

Paul Roege, P.E.

Senior VP for Strategic Initiatives, Typhoon HIL, Inc.

Paul Roege is a lifelong energy aficionado who currently is focusing on the role of energy in growing resilience among communities and regions, building to the enterprise level. He advocates re-thinking the constraints imposed by today's energy markets, instead invoking new technologies to allow everyone to participate in value creation through energy management, collaboration, and use.

As a US Army officer, Colonel Roege led development of new concepts and strategies that shifted the focus from simply treating energy as a scarce commodity, instead emphasizing creative ways to invoke energy capabilities most effectively to achieve such operational needs as awareness, mobility, and stealth. This concept of Energy-Informed Operations offers a model for more constructive, creative, democratic models for civilian community energy networks, especially in remote and developing areas. Paul has over 34 years of international experience in both civilian and military capacities, including nuclear operations and safety, energy system engineering, and facility construction and operations. He is a registered professional engineer, a West Point graduate and alumnus of Boston University (MBA) and MIT (Nuclear Engineer).

Introduction of Keynote Speakers

Keynote Speaker IV

Prof. Mohamed El Hachemi Benbouzid (IET Fellow)
University of Brest, France

Mohamed Benbouzid received the B.Sc. degree in electrical engineering from the University of Batna, Batna, Algeria, in 1990, the M.Sc. and Ph.D. degrees in electrical and computer engineering from the National Polytechnic Institute of Grenoble, Grenoble, France, in 1991 and 1994, respectively, and the Habilitation à Diriger des Recherches degree from the University of Picardie "Jules Verne," Amiens, France, in 2000.

After receiving the Ph.D. degree, he joined the Professional Institute of Amiens, University of Picardie "Jules Verne," where he was an Associate Professor of electrical and computer engineering. Since September 2004, he has been with the Institut Universitaire de Technologie of Brest, University of Brest, Brest, France, where he is a Professor of electrical engineering. Prof. Benbouzid is also a Distinguished Professor at the Shanghai Maritime University, Shanghai, China. His main research interests and experience include analysis, design, and control of electric machines, variable-speed drives for traction, propulsion, and renewable energy applications, and fault diagnosis of electric machines. Prof. Benbouzid is an IEEE Senior Member. He is the Editor-in-Chief of the International Journal on Energy Conversion(IRECON). He is also an Associate Editor of the IEEE Transactions on Energy Conversion, the IEEE Transactions on Industrial Electronics, the IEEE Transactions on Sustainable Energy, the IEEE Transactions on Vehicular Technology. He is a Subject Editor for the IET Renewable Power Generation.

Introduction of Keynote Speakers

Keynote Speaker V

Prof. Aoife Foley
Queen's University Belfast, UK

Dr Aoife Foley is a Reader in the School of Mechanical and Aerospace Engineering in Queen's University Belfast and Editor in Chief of Elsevier's Renewable & Sustainable Energy Reviews. She is also a member of the Editorial Board of Elsevier's Renewable Energy and an Editorial Panel member of the Institution of Civil Engineers Proceedings in Transport. She has a BE(Hons) (1996) in Civil Engineering and a PhD (2011) in Energy Engineering from University College Cork and an MScEng (1999) in Environmental & Transportation Engineering from Trinity College Dublin. She is a Chartered Engineer, Fellow of Engineers Ireland and a Fellow of the UK Higher Education Authority and a member of the IEEE Vehicular Technology Society (VTS) and Power Energy Society (PES). She returned to academia in 2009 after 12 years in industry. Prior to joining Queen's University Belfast in 2011, she worked in the School of Engineering in University College Cork as a Lecturer and an Environmental Protection Agency (EPA) Research Fellow. While in industry she worked for ESB International, Siemens, PM Group and SWS Energy primarily in projects in energy, waste, pharmaceutical and telecommunications. She has three specific research areas; wind power integration, power and gas systems and transport electrification. Her research income to date includes competitive national and international awards (e.g. EPSRC, US-Ireland SFI NSF DfE & EC H2020) and industry funding (e.g. Carbon Trading Ltd., SSE) totalling £2.4M (ownership £866k since 2010). She has a h-index of 22 (Scopus), 19 (Web of Science) and 23 (Google Scholar) and she has published more than 100 articles.

Introduction of Keynote Speakers

Keynote Speaker VI

Prof. Farhad Rachidi (IEEE Fellow)
Swiss Federal Institute of Technology, Switzerland

Farhad Rachidi (M'93–SM'02–F'10) received the M.S. degree in electrical engineering and the Ph.D. degree from the Swiss Federal Institute of Technology, Lausanne, Switzerland, in 1986 and 1991, respectively. He was with the Power Systems Laboratory, Swiss Federal Institute of Technology, until 1996. In 1997, he joined the Lightning Research Laboratory, University of Toronto, Toronto, ON, Canada. From 1998 to 1999, he was with Montena EMC, Rossens, Switzerland. He is currently a Titular Professor and the Head of the EMC Laboratory with the Swiss Federal Institute of Technology, Lausanne, Switzerland. He has authored or co-authored over 200 scientific papers published in peer-reviewed journals and over 400 papers presented at international conferences.

Dr. Rachidi is currently a member of the Advisory Board of the IEEE Transactions on Electromagnetic Compatibility and the President of the Swiss National Committee of the International Union of Radio Science. He has received numerous awards including the 2005 IEEE EMC Technical Achievement Award, the 2005 CIGRE Technical Committee Award, the 2006 Blondel Medal from the French Association of Electrical Engineering, Electronics, Information Technology and Communication (SEE), the 2016 Berger Award from the International Conference on Lightning Protection, the Best Paper Award of the IEEE Transactions on EMC (2016 and 2018), and the Motohisa Kanda Award for the most cited paper of the IEEE Transactions on EMC (2012-2016 and 2014-2018). In 2014, he was conferred the title of Honorary Professor of the Xi'an Jiaotong University in China. He served as the Vice-Chair of the European COST Action on the Physics of Lightning Flash and its Effects from 2005 to 2009, the Chairman of the 2008 European Electromagnetics International Symposium, the President of the International Conference on Lightning Protection from 2008 to 2014, the Editor-in-Chief of the Open Atmospheric Science Journal (2010-2012) and the Editor-in-Chief of the IEEE Transactions on Electromagnetic Compatibility from 2013 to 2015. He is a Fellow of the IEEE and of the SUMMA Foundation, and a member of the Swiss Academy of Sciences.

General Information

Paper Presentation

SPIES 2020 will be held virtually during 15-18 September, 2020. The length of the presentation is restricted to 15 minutes including questions. The authors presenting a paper are strongly advised to keep their oral presentation within 15 minutes (10 to 15 slides) and to let 3 minutes for questions.

Paper Publication

The accepted and presented papers of the 2020 2nd International Conference on Smart Power & Internet Energy Systems (SPIES2020) will be published in conference proceedings to be archived into IEEE Xplore® Digital Library, indexed by Ei Compendex, Scopus, INSPEC, Thomson Reuters' Web of Science, and others.

Special Issues and Section:

1. Renewable & Sustainable Energy Reviews (Impact Factor – 10.556, Print ISSN - SSN: 1364-0321) Top 15% papers in the area of renewable and sustainable energy will be recommended by the Conference Technical Committee for a special section from this Elsevier Flagship Journal. The extended version of the recommended papers will be peer-reviewed by the Journal's Guest Editorial panel.

2. IET Renewable Power Generation (Impact Factor - 3.605, Print ISSN - 1752-1416): Selected papers in the area of renewable energy will be recommended by Conference Technical Committee for a special issue from this IET Flagship Journal. The extended version of the recommended papers will be peer-reviewed by the Journal's Guest Editorial panel.

3. IET Generation, Transmission & Distribution (Impact Factor - 3.229, Print ISSN - 1751-8687): Selected papers in the area of power system and smart grid will be recommended by Conference Technical Committee for a special issue from this IET Flagship Journal. The extended version of the recommended papers will be peer-reviewed by the Journal's Guest Editorial panel.

4. Frontiers in Energy Research: The journal is indexed in Scopus (Citescore 3.35) and Web of Science (Impact Factor - 2.746), ISSN: 2296-598X, submissions of extended version of papers to the special issue will be peer-reviewed and benefit of a 30% discount on publication cost. Only recommended papers by Conference Technical Committee can be submitted to this special issue after the conference is over.

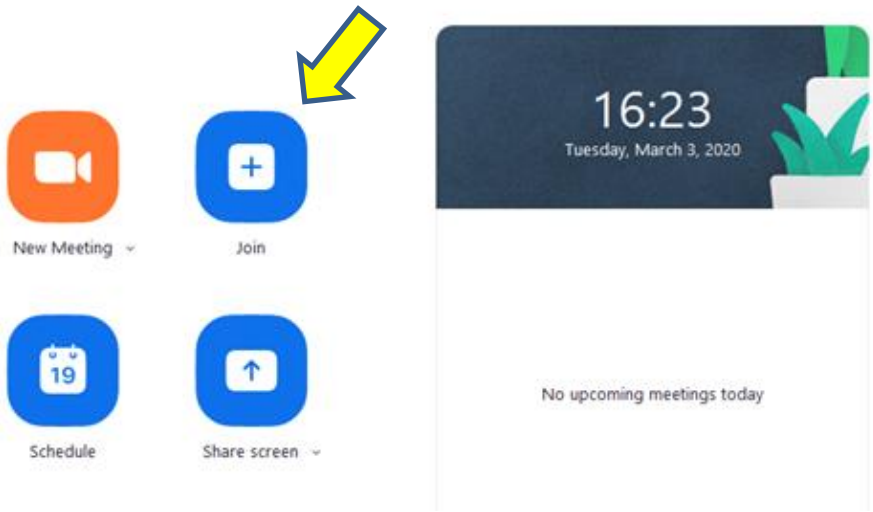
Best Presentation Award

Three papers awards will be presented after the conference.

Instructions for the Online Tool "ZOOM"

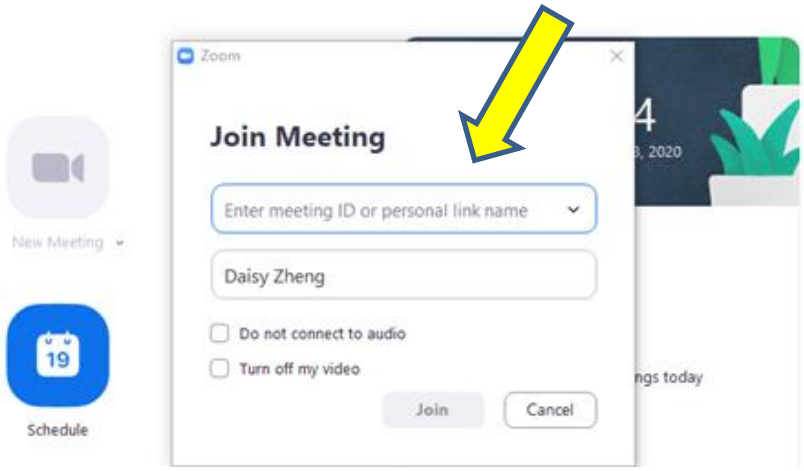
1. You can download the software "Zoom" from this URL: http://www.zoom.us/

2. How to join online conference in Zoom



Please click "join"

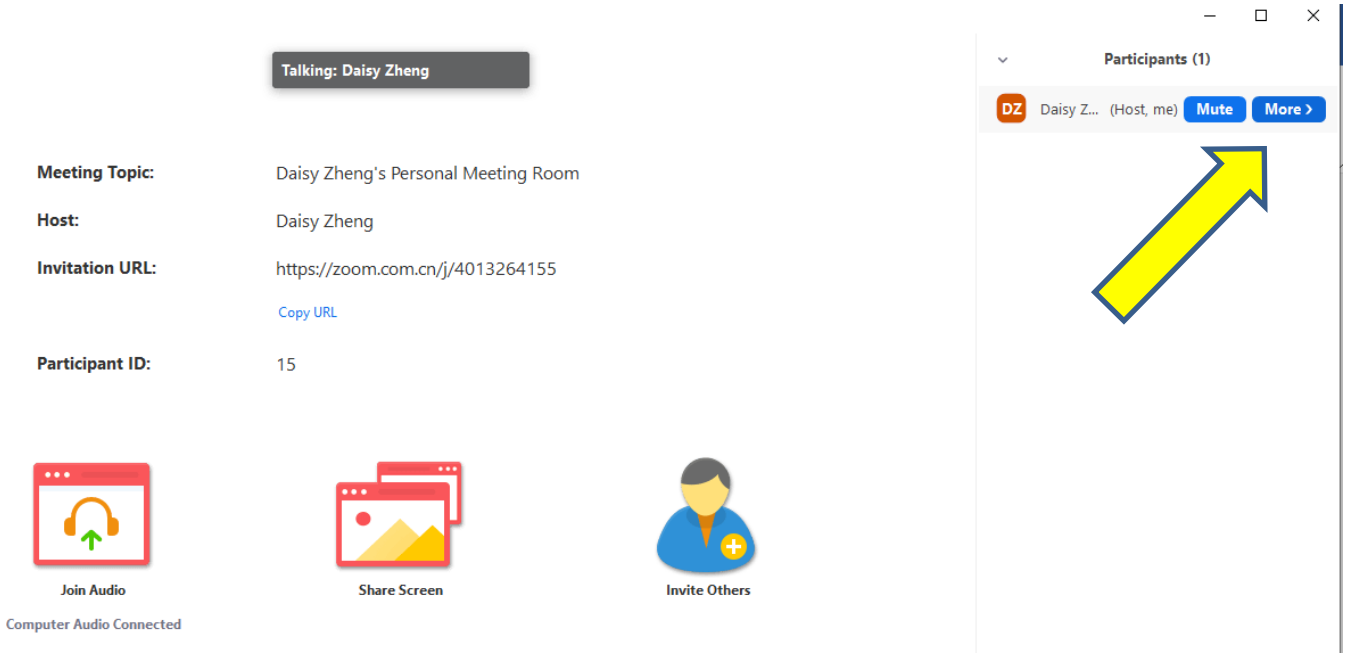
3. Fill in the Conference ID

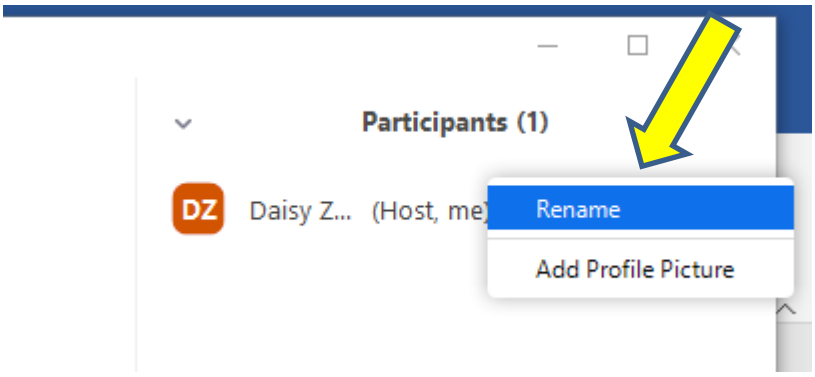


Please fill in the Online-Meeting Room ID and join the online conference.

Instructions for the Online Tool "ZOOM"

4. How to rename

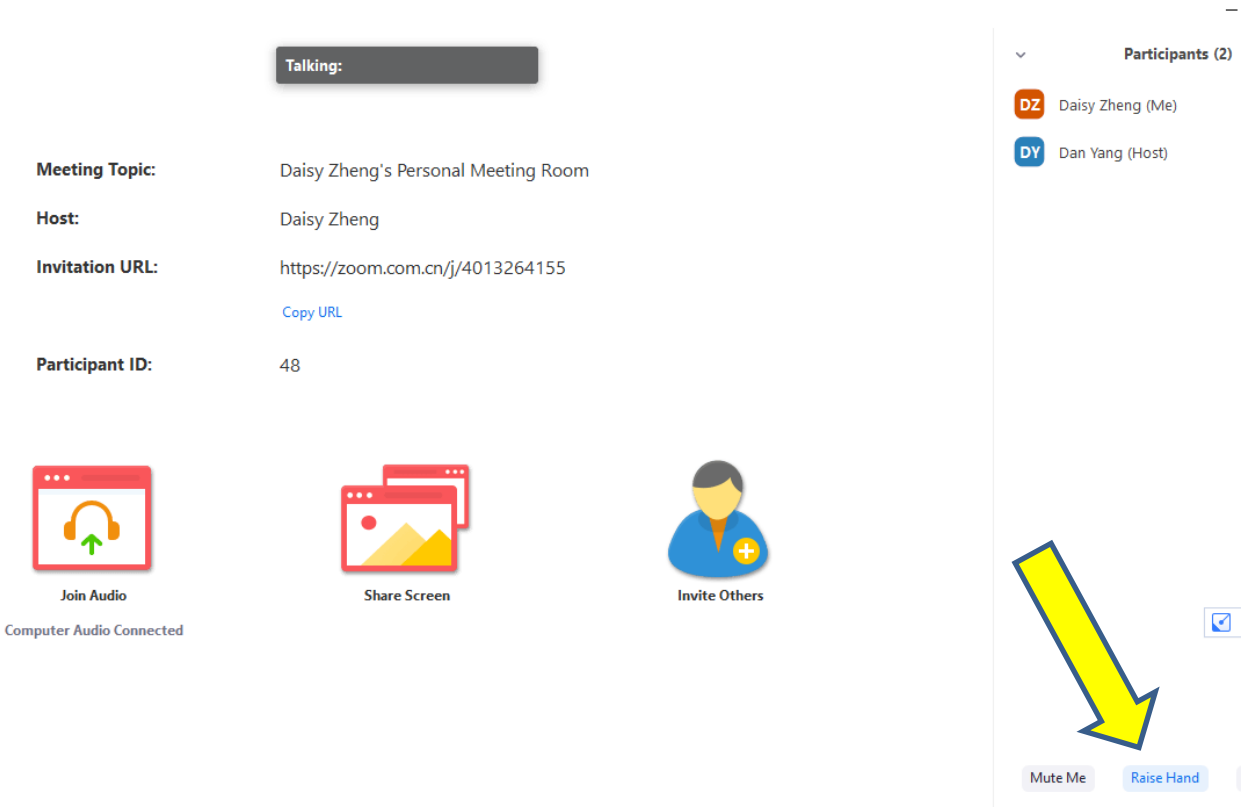




First, you can click"More"
Then, you can click "rename".
If you are keynote speaker, your name need to be renamed as KN+your name.
If you are presenter, your name need to be renamed as SPXXXX (your paper id)+ your name.
If you are listener, your name need to be renamed as listener + your name.

Instructions for the Online Tool "ZOOM"

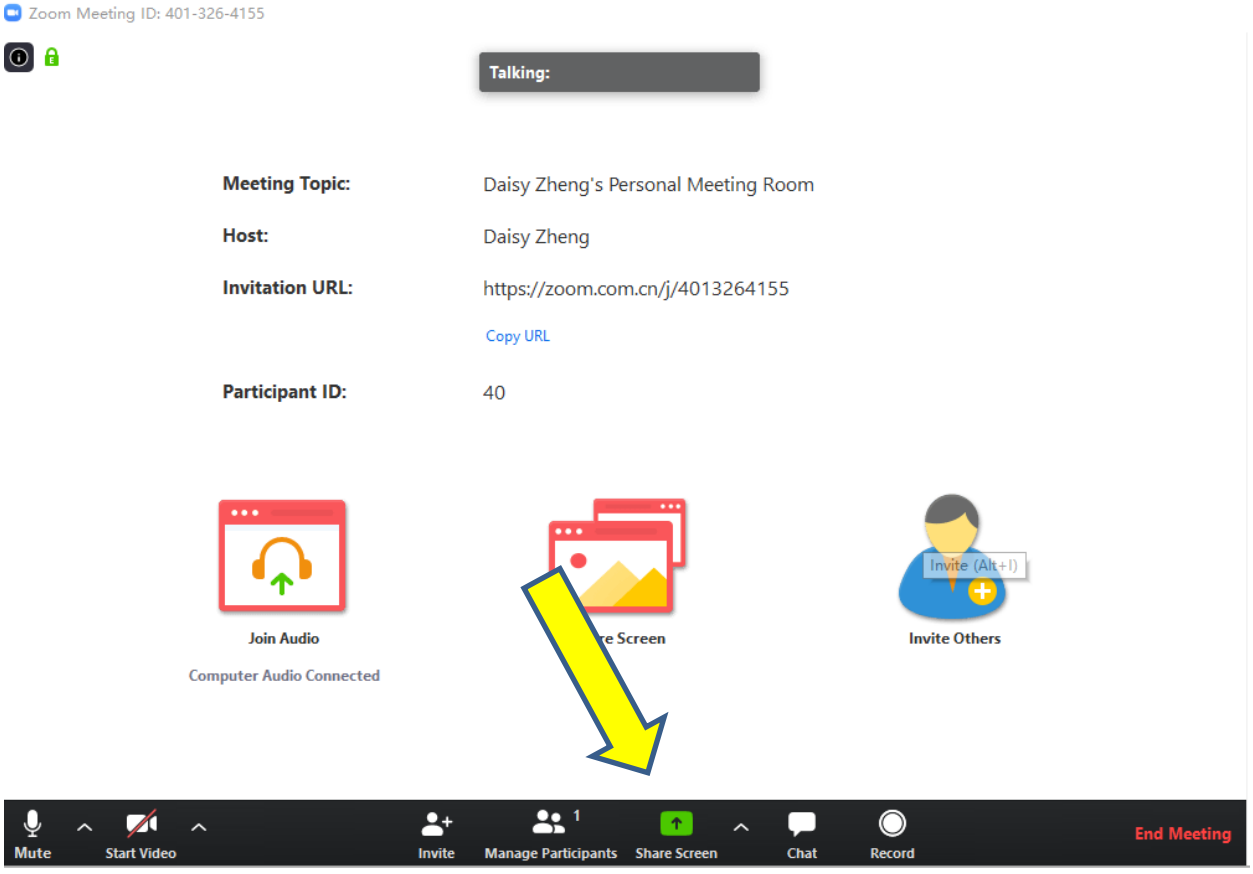
5. How to Use Raise Your Hands and Ask Questions in Zoom



If you have any problems during the conference, you can click "raise your hands" or use "chat" to communicate with the conference secretary and the conference secretary will help you. When you have questions about keynote speeches, you can also use "raise your hands" function.

Instructions for the Online Tool "ZOOM"

7. How to Share Your Screen



When you do your presentation, you need to share your screen.
You can click "share screen".

SPIES 2020 PROGRAM-Simple Version

	Morning						Afternoon					
Sep 14 Zoom Test	PSCAD (Tutorial) 8:30-8:45	Typhoon HIL (Tutorial) 8:45-9:00	Innocent Kamwa 9:00-9:15	Junji Tamura 9:15-9:30	Paul Roege, P.E. 9:30-9:45	Lunch (11:50-1:30)	Fei Gao& Elena Breaz 1:30-1:45	Dylan Lu& C.M.F.S. Reza 1:45-2:00	Mohamed Benbouzid 2:00-2:15	Aoife Foley 2:15-2:30	Farhad Rachidi 2:30-2:45	
Sep 14 Zoom Test	Session-11 8:30-9:00	Session-13 9:00-9:30	Session-19 9:30-10:00	Session-21 10:00-10:30		Lunch (11:50-1:30)	Session-15 1:30-2:00	Session-17 2:00-2:30	Session-23 2:30-3:00	Session-25 3:00-3:30	Session-27 3:30-4:00	Free Test 4:00-4:30
Sep 14 Zoom Test	Session-12 8:30-9:00	Session-14 9:00-9:30	Session-20 9:30-10:00	Session-22 10:00-10:30		Lunch (11:50-1:30)	Session-16 1:30-2:00	Session-18 2:00-2:30	Session-24 2:30-3:00	Session-26 3:00-3:30	Session-28 3:30-4:00	
Day -1 Sep 15	Session-1 (8:30-10:00) PSCAD (Tutorial)	Booth-1 (10:00-10:20) Frontiers	Session-2 (10:20-11:50) Typhoon HIL (Tutorial)			Lunch (11:50-1:30)	Session-3 (1:30- 3:00) Fei Gao& Elena Breaz	Booth-2 (3:00-3:20) Frontiers	Session-4 (3:20- 4:50) Dylan Lu& C.M.F.S. Reza			
Day-2 Sep 16	Session-5 (8:15-9:30) Opening KN1	Booth-3 (9:30-9:45) PSCAD	Session-6 (9:45-10:45) KN2	Booth-4 (10:45-11:00) Typhoon HIL	Session-7 (11:00-12:00) KN3	Lunch (12:00-1:15) Booth-5 Frontiers (1:15-1:30)	Session-8 (1:30-2:30) KN4	Booth-6 (2:30-2:45) Typhoon HIL	Session-9 (2:45-3:45) KN5	Booth-7 (3:45-4:00) PSCAD	Session-10 (4:00-5:00) KN6	
Day-3 Sep 17	Session-11 (8:30-10:00)	Booth-8 (10:00-10:20) PSCAD	Session-13 (10:20-11:50)			Lunch (11:50-1:30)	Session-15 (1:30- 3:00)	Booth-9 (3:00-3:20) Typhoon HIL	Session-17 (3:20- 4:50)			
Day-3 Sep 17	Session-12 (8:30-10:00)	Booth-10 (10:00-10:20) PSCAD	Session-14 (10:20-11:50)			Lunch (11:50-1:30)	Session-16 (1:30- 3:00)	Booth-11 (3:00-3:20) Typhoon HIL	Session-18 (3:20- 4:50)			
Day-4 Sep 18	Session-19 (8:30-10:00)	Booth-12 (10:00-10:20) PSCAD	Session-21 (10:20-11:50)			Lunch (11:50-1:30)	Session-23 (1:30- 3:00)	Booth-13 (3:00-3:20) Typhoon HIL	Session-25 (3:20- 4:50)	Session-27 (5:00-6:15)		
Day-4 Sep 18	Session-20 (8:30-10:00)	Booth-14 (10:00-10:20) PSCAD	Session-22 (10:20-11:35)			Lunch (11:50-1:30)	Session-24 (1:30- 3:00)	Booth-15 (3:00-3:20) Typhoon HIL	Session-26 (3:20- 4:50)	Session-28 (5:00-6:30)		

Tips: 1. The time in the schedule is according to **Thailand Standard Time**.
2. Online test is for testing the Internet connection and helping participants get familiar with software Zoom.
3. If you are not free during your text time, you can enter **Free Test** room (ID: 69110736851) from 4:00pm- 4:30pm on September 14 to text.

SPIES 2020 PROGRAM-ZOOM Link for all the Sessions

Session Number	Zoom Link	Name	Test Time	Presentation Time
1	https://zoom.us/j/97397478385	PSCAD (Tutorial)	Sep. 14 8:30-8:45	Sep. 15 8:30-10:00
2	https://zoom.us/j/97397478385	Typhoon HIL (Tutorial)	Sep. 14 8:45-9:00	Sep. 15 10:20-11:50
3	https://zoom.us/j/97397478385	Prof. Fei Gao and Dr. Elena Breaz (Tutorial)	Sep. 14 13:30-13:45	Sep. 15 13:30-15:00
4	https://zoom.us/j/97397478385	Prof. Dylan Lu and Dr. C.M.F.S. Reza (Tutorial)	Sep. 14 13:45-14:00	Sep. 15 15:20-16:50
5	https://zoom.us/j/97397478385	Opening Remarks & Prof. Innocent Kamwa (Keynote)	Sep. 14 9:00-9:15	Sep. 16 8:30-9:30
6	https://zoom.us/j/97397478385	Prof. Junji Tamura (Keynote)	Sep. 14 9:15-9:30	Sep. 16 9:45-10:45
7	https://zoom.us/j/97397478385	Paul Roege, P.E. (Keynote)	Sep. 14 9:30-9:45	Sep. 16 11:00-12:00
8	https://zoom.us/j/97397478385	Prof. Mohamed El Hachemi Benbouzid (Keynote)	Sep. 14 14:00-14:15	Sep. 16 13:30-14:30
9	https://zoom.us/j/97397478385	Prof. Aoife Foley (Keynote)	Sep. 14 14:15-14:30	Sep. 16 14:45-15:45
10	https://zoom.us/j/97397478385	Prof. Farhad Rachidi (Keynote)	Sep. 14 14:30-14:45	Sep. 16 16:00-17:00

Tips: 1. The time in the schedule is according to **Thailand Standard Time**.
2. Online test is for testing the Internet connection and helping participants get familiar with software Zoom.
3. If you are not free during your text time, you can enter **Free Test** room (ID: 69110736851) from 4:00pm- 4:30pm on September 14 to text.

SPIES 2020 PROGRAM-ZOOM Link for all the Sessions

Session Number	Zoom Link	Paper ID	Test Time	Presentation Time
11	https://zoom.us/j/69110736851	SP0122, SP0126, SP0133, SP0135, SP0138, SP0140	Sep. 14 8:30-9:00	Sep. 17 8:30-10:00
12	https://zoom.us/j/68592956837	SP0088, SP0144, SP0148, SP0153, SP0162, SP0168	Sep. 14 8:30-9:00	Sep. 17 8:30-10:00
13	https://zoom.us/j/69110736851	SP0020, SP0036, SP0065, SP0108, SP0116, SP0124	Sep. 14 9:00-9:30	Sep. 17 10:20-11:50
14	https://zoom.us/j/68592956837	SP0110, SP0118, SP0032, SP0040, SP0149, SP0019	Sep. 14 9:00-9:30	Sep. 17 10:20-11:50
15	https://zoom.us/j/69110736851	SP0014, SP0016, SP0025, SP0094, SP0146, SP0159	Sep. 14 13:30-14:00	Sep. 17 13:30-15:00
16	https://zoom.us/j/68592956837	SP0054, SP0064, SP0075, SP0080, SP0164, SP0166	Sep. 14 13:30-14:00	Sep. 17 13:30-15:00
17	https://zoom.us/j/69110736851	SP0061, SP0082, SP0085, SP0096, SP0107, SP0115	Sep. 14 14:00-14:30	Sep. 17 15:20-16:50
18	https://zoom.us/j/68592956837	SP0063, SP0087, SP0090, SP0106, SP0113, SP0117	Sep. 14 14:00-14:30	Sep. 17 15:20-16:50

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SPIES 2020 PROGRAM-ZOOM Link for all the Sessions

Session Number	Zoom Link	Paper ID	Test Time	Presentation Time
19	https://zoom.us/j/69110736851	SP0006, SP0053, SP0056, SP0057, SP0060, SP0105	Sep. 14 9:30-10:00	Sep. 18 8:30-10:00
20	https://zoom.us/j/68592956837	SP0021, SP0030, SP0098, SP0099, SP0123, SP0136	Sep. 14 9:30-10:00	Sep. 18 8:30-10:00
21	https://zoom.us/j/69110736851	SP0004, SP0011, SP0052, SP0114, SP0142, SP0163	Sep. 14 10:00-10:30	Sep. 18 10:20-11:50
22	https://zoom.us/j/68592956837	SP0018, SP0042, SP0044, SP0109, SP0141	Sep. 14 10:00-10:30	Sep. 18 10:20-11:50
23	https://zoom.us/j/69110736851	SP0028, SP0033, SP0038, SP0145, SP0066, SP0139	Sep. 14 14:30-15:00	Sep. 18 13:30-15:00
24	https://zoom.us/j/68592956837	SP0012, SP0048, SP0050, SP0081, SP0084, SP0092	Sep. 14 14:30-15:00	Sep. 18 13:30-15:00
25	https://zoom.us/j/69110736851	SP0022, SP0029, SP0062, SP0155, SP0160, SP0167	Sep. 14 15:00-15:30	Sep. 18 15:20-16:50
26	https://zoom.us/j/68592956837	SP0005, SP0031, SP0071, SP0154, SP0156, SP0158	Sep. 14 15:00-15:30	Sep. 18 15:20-16:50
27	https://zoom.us/j/69110736851	SP0137, SP0015, SP0026, SP0058, SP0169	Sep. 14 15:30-16:00	Sep. 18 17:00-18:15
28	https://zoom.us/j/68592956837	SP0043, SP0095, SP0143, SP0119, SP0170, SP0017	Sep. 14 15:30-16:00	Sep. 18 17:00-18:30

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SPIES 2020 PROGRAM-ZOOM Link for all the Booths

Booth Number	Zoom Link	Booth Name	Time
1	https://zoom.us/j/97397478385	Frontiers	Sep. 15 10:00-10:20
2	https://zoom.us/j/97397478385	Frontiers	Sep. 15 15:00-15:20
3	https://zoom.us/j/97397478385	PSCAD	Sep. 16 9:30-9:45
4	https://zoom.us/j/97397478385	Typhoon HIL	Sep. 16 10:45-11:00
5	https://zoom.us/j/97397478385	Frontiers	Sep. 16 13:15-13:30
6	https://zoom.us/j/97397478385	Typhoon HIL	Sep. 16 14:30-14:45
7	https://zoom.us/j/97397478385	PSCAD	Sep. 16 15:45-16:00
8	https://zoom.us/j/69110736851	PSCAD	Sep. 17 10:00-10:20
9	https://zoom.us/j/69110736851	Typhoon HIL	Sep. 17 15:00-15:20
10	https://zoom.us/j/68592956837	PSCAD	Sep. 17 10:00-10:20
11	https://zoom.us/j/68592956837	Typhoon HIL	Sep. 17 15:00-15:20
12	https://zoom.us/j/69110736851	PSCAD	Sep. 18 10:00-10:20
13	https://zoom.us/j/69110736851	Typhoon HIL	Sep. 18 15:00-15:20
14	https://zoom.us/j/68592956837	PSCAD	Sep. 18 10:00-10:20
15	https://zoom.us/j/68592956837	Typhoon HIL	Sep. 18 15:00-15:20

Tips: 1. The time in the schedule is according to **Thailand Standard Time**.
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Session 14 Power System Operations and Control 1

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Session 16 Microgrid

Session 17 Microgrids/ Nanogrids Implementation, Planning, and operation

Session 18 Solar Energy 3

Session 19 Smart Grid Energy Informatics, Management, and Optimisation

Session 20 Power System Operations and Control 2

Session 21 Electrical Load Control and Management

SESSION 22 Smart Grid Protection

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SESSION 23 Power System Operations and Control 3

SESSION 24 Wind Energy

SESSION 25 Energy Storage System

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SESSION 27 Power System Operations and Control 5

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SESSION 28 Power System Operations and Control 6

Details

Session 1

Tutorial SESSION
Day 1-Sep. 15

Morning, September 15, 2020 (Tuesday)
Time: 8:30~10:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Tutorial Session on "Renewable Energy Integration to Weak Grids – System impact studies with PSCAD"

ORGANIZED by

Dharshana Muthumuni, Manitoba Hydro International Ltd.
dharshana@pscad.com

TUTORIAL SESSION DESCRIPTION

The renewable energy penetration levels in the power systems have increased significantly in many parts of the world. The converter based generation show vastly different dynamic characteristics compared to the traditional synchronous machine based generation. Since the generator dynamic characteristic is a dominant factor in the overall system dynamic response and dynamic stability, large-scale renewable integration will present new technical challenges from a power system stability point of view.

The use of appropriate modelling tools can facilitate insights into the performance of weak (low fault levels and inertia) AC systems with high levels of renewable technologies connected in close proximity. Phenomena's such as control interactions and sub-synchronous oscillations are a real challenge and a threat to power system stability and security. Phasor-based RMS simulation programs have key limitations to study weak grids with large penetration of renewables and cannot accurately capture the transient interactions and events that could potentially lead to plant tripping as recently experienced in Australia and Great Britain.

This tutorial session specifically concentrates on studies related to integration of renewable generation (Wind and Solar PV related studies).

WHAT IS COVERED

- Inverter basics
- Power system modelling
- Demonstration of examples
- Analyzing simulation results

Details

Tutorial SESSION
Day 1-Sep. 15

SHORT BIO OF ORGANIZERS

Dharshana Muthumuni, Ph.D., P.Eng., is the Managing Director of the Power Systems Technology (PTC) Centre, a division of Manitoba Hydro International. He oversees the overall operation and development of the Industry Standard PSCAD simulation software. He has over 20 years of experience in engineering studies using a variety of simulation products, including PSCAD™/EMTDC™ and PSS/E. His expertise is regularly sought out by clients around the world for his strong and wide ranging technical knowledge on power system behavior, model development, and simulation studies. He has lead the technical team to solve challenging problems, including HVDC and generation interconnections, wind integration into weak grids, FACTS-based solutions, SSR screening techniques, and power quality and harmonics.

Dharshana has worked extensively and closely with equipment vendors to develop simulation models and techniques to address difficult interconnection problems. He has developed many custom models and simulations techniques for specific studies, including working closely with equipment vendors to address their simulation study requirements.

In addition to his engineering study experience, Dharshana has been a key contributor to the development of the PSCAD simulation tool and has conducted training workshops on a variety of power system topics globally.

Details

Session 2

Tutorial SESSION
Day 1-Sep. 15

Morning, September 15, 2020 (Tuesday)
Time: 10:20~11:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Tutorial Session on "Real-time Simulation and Digital Control of Grid-Tied Inverters: A Test-Driven Approach"

ORGANIZED by

Fernanda de Morais Carnielutti, Federal University of Santa Maria – UFSM
fernanda.carnielutti@gmail.com
Typhoon HIL, INC
ljubomir.novic@typhoon-hil.com

TUTORIAL SESSION DESCRIPTION

The power electronics field has matured over the last sixty years. Today, static converters can efficiently transform electric energy to meet the requirements of many applications. There is no doubt that static converters are the enabling technology for the integration of renewable generation into the electric grid, and that power electronics will play a key role in the renovation of the existing electricity network. In this scenario, in one side, system operators are frequently updating their grid codes to ensure power quality and grid security. On the other side, power converter manufactures have to design reliable products, often with reduced time-to-market, in a competitive environment.

In this tutorial, you shall learn how to design and validate different controllers required for the proper operation of grid-tied inverters using real-time Hardware-in-the-Loop simulation. Emphasis will be given to synchronization algorithms and current controllers, as well as the interaction between these two control subsystems of a grid-tied inverter. By means of a test-driven design approach, the performance of different types of synchronization algorithms and current controllers regarding steady-state, transients and stability can be evaluated in a systematic and easy way, helping to speed-up the design process. A set of tests with automatic report generation is presented to extensively investigate the performance of the considered controllers for a broad range of steady-state and transient conditions, making it possible to reveal the strong and weak points of each current controller considered.

Details

Tutorial SESSION
Day 1-Sep. 15

WHAT IS COVERED

- Inverter basics
- Power system modelling
- Demonstration of examples
- Analyzing simulation results

SHORT BIO OF ORGANIZERS

Prof. Fernanda de Morais Carnielutti received her Bachelor degree in Electrical Engineering in 2010, from Federal University of Santa Maria, UFSM, Brazil. She received her Master and Doctor degrees in 2012 and 2015, respectively. She was chair of the UFSM IEEE Student Branch and of the UFSM IEEE IAS SB Chapter. She was Professor at the Federal University of Santa Maria, UFSM - Campus Cachoeira do Sul, from 2016 to 2018. Currently, she is Professor at the Federal University of Santa Maria, UFSM - Campus Santa Maria, researcher at the Power Electronics and Control Research Group, GEPOC, and member of the of the IEEE Power Electronics, Industrial Electronics and Industry Application Societies. Her research interests include modulation of static power converters, multilevel converters, power electronics for renewable energies and model predictive control.

Typhoon HIL Inc. is the market and technology leader in the rapidly growing field of ultra-high-fidelity controller Hardware in the Loop (C HIL) simulation for power electronics, microgrids, and distribution networks. We provide industry proven, verticall y integrated test solutions along with highest quality customer support. The company was founded in 2008 and since then has been creating products distinguished by the ultimate ease of use, unrivaled performance, leading edge technology, and affordability.

Details

Tutorial SESSION
Day 1-Sep. 15

Session 3

Afternoon, September 15, 2020 (Tuesday)
Time: 13:30~15:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Tutorial Session on "Fuel Cell Technology for Transport applications"

ORGANIZED by

Dr. Elena Breaz, University of Technology of Belfort-Montbeliard, France
elena.breaz@utbm.fr
Prof. Fei Gao, University of Technology of Belfort-Montbeliard, France
fei.gao@utbm.fr

TUTORIAL SESSION DESCRIPTION

Fuel cell is a potential candidate for energy storage and conversion in our future energy mix, which is able to directly convert the chemical energy stored in fuel into electricity. Among the different fuel cell types, proton exchange membrane (PEM) fuel cell is considered one of the potential embarked energy candidates for future transportation.
This lecture will mainly focus on PEM fuel cell technology which is mainly used in transport applications. The PEM fuel cell fundamentals, such as its physics, structure, power characteristics, efficiency, will be presented and discussed. The fuel cell system with its key ancillary components, such as air compressor, hydrogen tank, power converter, will also be introduced. Different powertrain configurations with fuel cells in transport applications will be discussed and shown with real examples around the world. An emphasis on the fuel cell economic aspects and a short introduction to hydrogen economy will be given at last.

WHAT IS COVERED

- Fuel cell fundamentals
- Fuel cell system ancillaries
- Fuel cell powertrains
- Introduction to hydrogen economy

Details

Tutorial SESSION
Day 1-Sep. 15

SHORT BIO OF ORGANIZERS

Dr. Elena Breaz is currently an associate professor at the University of Technology of Belfort-Montbeliard (UTBM), Belfort, France. She received the Master degree in electrical engineering from Technical University of Cluj-Napoca in 2009 and the PhD degree in engineering science in 2012 from the same university in Romania. Her main research areas include fuel cell modeling, electric hybrid vehicle design and real time simulation technology for energy systems. Since 2012, she is also a faculty member of the electrical engineering department of Technical University of Cluj-Napoca.

Prof. Fei Gao received the Master's degree in electrical and control system engineering in 2007, and the Ph.D. degree in renewable energy with distinguished Youth Doctor Award in 2010, both from the University of Technology of Belfort-Montbeliard (UTBM), Belfort, France. He is currently a Full Professor at the School of Energy and Computer science of UTBM, where he was an Associate Professor between 2011 and 2017. Prof. Gao is the Fellow of IET and the holder of the French research expertise bonus (PEDR) by the French Ministry of Higher Education and Research. He is also the Editor-in-Chief (2019-2021) of IEEE Industrial Electronics Technology News, and an Associate Editor of IEEE Transactions on Industrial Electronics, IEEE Transactions on Industry Applications, IEEE Transactions on Transportation Electrification and IEEE Open Journal of Industrial Electronics Society, and the Chair of fuel cell system architecture optimization research axis of the national Fuel Cell Research Federation FCLAB in France. He is nominated in 2017 as Conferences/Workshops Committee Chair of IEEE Transportation Electrification Community. He serves since 2018 as Chair of the Technical Committee on Transportation Electrification of the IEEE Industry Electronic Society and serves since 2019 as Secretary of the Technical Committee on Vehicle and Transportation Systems of IEEE Power Electronics Society.

Details

Session 4

Afternoon, September 15, 2020 (Tuesday)
Time: 15:20~16:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Tutorial SESSION
Day 1-Sep. 15

Tutorial Session on "DC Power Packet Dispatching System for Internet of Energy (IoE)"

ORGANIZED by

Assoc. Prof. Dylan Dah-Chuan Lu, University of Technology Sydney, Australia
dylandclu@ieee.org
Dr C.M.F.S. Reza, University of Technology Sydney, Australia
CMFS.Reza@uts.edu.au

TUTORIAL SESSION DESCRIPTION

The rapid development of Internet of Things (IoT) has enabled the Internet of Energy (IoE), which integrates information and power to optimize both energy efficiency and power conversion efficiency of the distributed energy systems. The most straightforward approach to adopting IoE is to add an information layer to the controllers of different power equipment and coordinate the power flow at the expense of additional cost of communication system. An alternative solution is the power-line carrier (PLC) communication technique which can transfer power and information flow simultaneously through the same transmission line. However, traditional PLC technology is not designed to realize time-division and multi-path transmission of power flows. Power packet dispatching system (PPDS) is recently introduced to provide such capabilities for PLC technology. In this tutorial, a review of existing PLC technologies is first explained. The DC PPDS is then introduced along with design considerations of the building blocks such as the energy router and energy mixer. An over-current protection scheme to improve system reliability is given. Several power converter topologies and maximum power point tracking algorithms are explained to demonstrate how energy and power conversion efficiencies can be improved.

WHAT IS COVERED

- Comparative study of existing power and information integrated technologies
- Overview of DC power packet dispatching system (PPDS)
- Design of energy router and energy mixer
- Over-current protection of DC PPDS
- Optimisation of both energy and power conversion efficiencies

Details

Tutorial SESSION
Day 1-Sep. 15

SHORT BIO OF ORGANIZERS

Dr Dylan Dah-Chuan Lu received his Ph.D. degree in electronic and information engineering in 2004, from the Hong Kong Polytechnic University, Hong Kong. In 2003, he joined PowereLab Ltd. as a Senior Design Engineer where he was responsible for industrial switching power supply projects. He was a full-time faculty member with The University of Sydney from 2006 to 2016, where he now holds an Honorary position. Since July 2016, he has been an Associate Professor at the School of Electrical and Data Engineering, University of Technology Sydney, Australia. At present he is the Head of Discipline of Electrical Power and Energy Systems in the School. He has authored and co-authored more than 100 international journals and held 2 patents in power electronics. He has completed more than 20 government, university and industry funded projects in this field. His current research interest includes efficient and reliable power conversion for renewable sources, energy storage systems, and microgrids. He is presently serving as a Chair of Joint Chapter IAS/IES/PELS for IEEE NSW Section and an Associate Editor of the *IEEE Transactions on Industrial Electronics*. Dr C.M.F.S. Reza received his Ph.D. degree in electrical and information engineering from the University of Sydney, Australia, in 2019. He has completed his B.S. degree in electrical and electronic engineering from Chittagong University of Engineering and Technology (CUET), Bangladesh, in 2010, and the M.S. degree in electrical engineering from University of Malaya, Malaysia, in 2014. From November 2011 to October 2014, he was a Research Assistant at the Power Electronics & Renewable Energy Research Laboratory (PEARL), University of Malaya, Malaysia. He is currently working as a Senior Research Assistant at the School of Electrical and Data Engineering, University of Technology Sydney, Australia. He has authored and co-authored several international journals and conferences. His research interests include design, analysis, and control of power electronic converters for renewable energy systems, control algorithm, and system modeling for efficient power packet distribution system.

Dr C.M.F.S. Reza received his Ph.D. degree in electrical and information engineering from the University of Sydney, Australia, in 2019. He has completed his B.S. degree in electrical and electronic engineering from Chittagong University of Engineering and Technology (CUET), Bangladesh, in 2010, and the M.S. degree in electrical engineering from University of Malaya, Malaysia, in 2014. From November 2011 to October 2014, he was a Research Assistant at the Power Electronics & Renewable Energy Research Laboratory (PEARL), University of Malaya, Malaysia. He is currently working as a Senior Research Assistant at the School of Electrical and Data Engineering, University of Technology Sydney, Australia. He has authored and co-authored several international journals and conferences. His research interests include design, analysis, and control of power electronic converters for renewable energy systems, control algorithm, and system modeling for efficient power packet distribution system.

Details

Opening Remarks
Day 2-Sep. 16

Opening Remarks

Morning, September 16, 2020 (Wednesday)
Time: 8:15-8:30 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Addressed by:

General Chair Dr. Kuaanan Techato from Prince of Songkla University in Thailand

General Co-chair Prof. Dongdong Li from Shanghai University of Electric Power in China

Details

Keynote Speeches Abstracts
Day 2-Sep. 16

Session 5

Morning, September 16, 2020 (Wednesday)
Time: 8:30~9:30 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Prof. Innocent Kamwa (IEEE Fellow)
Hydro-Quebec Research Institute (IREQ), Canada
Speech Title: "Enabling New Simulation and Decision Support Tools to Propel Sustainable Power Grids"

Abstract — In its 2019 edition, the DNVL Energy Transition Outlook predicted that in 2050, renewables would account for 66% of global electricity production a while the international energy agency anticipates that the COP21 commitments for Green House Gaz emissions reductions will require to increase the share of renewables in electric energy mix from 10% in 2014 to 37% in 2030, in order to decarbonize electricity production and fully electrify most end uses. This massive ingestion of variable and distributed generation in an ageing electricity grid will significantly transform current planning and operation paradigms, challenges that cannot be effectively addressed without the emergence of an integrated, smarted, and sustainable network. After revisiting the main grid modernization concepts, the speaker will scope the challenges facing utilities in the new context of energy transition and digital transition. Then he will outline some innovation projects developed at IREQ to support Hydro-Quebec in digesting new energy technologies, which pose many challenges while enabling tremendous opportunities: 1) Massive integration of renewable energy resources and distributed resources, 2) Adoption of power electronic equipment allowing greater grid controllability, 4) Deployment of smart sensors such as synchrophasors allowing greater network observability with more cybersecurity risk exposure and 5) Regional deep decarbonization through enormous renewable power fluctuations over long distances and hundreds of daily transactions year-round. The presentation will conclude by discussing current developments at IREQ that leverage network simulation tools into new products and applications such as analysis of Smart Grid and Telecom Grid interactions, Simulation of continental scale grids and Power-hardware in the loop simulator for distributed resources studies.

Details

Keynote Speeches Abstracts
Day 2-Sep. 16

Session 6

Morning, September 16, 2020 (Wednesday)
Time: 9:45~10:45 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Prof. Junji Tamura
Kitami Institute of Technology, Japan
Speech Title: "New Approach to Virtual Synchronous Generator Control of Power Systems"

Abstract — In this keynote speech, firstly the fundamental concept and the theory of virtual synchronous generator (VSG) are reviewed. As renewable power sources like solar stations and wind farms which are controlled basically with power electronic inverters increase, conventional synchronous generators need to be decreased to keep balance between demand and supply. However the power system inertia and synchronizing power, which have been supplied from the conventional synchronous generators, also decrease accordingly, and thus the stability of power systems deteriorates. In order to solve this problem, the concept of VSG has been proposed and developed, in which the power electronic inverter is controlled to mimic the characteristics of conventional synchronous generators. Some representative strategies for constructing VSG which have been proposed and reported so far are introduced. Next a new strategy for achieving the virtual synchronous generator control to enhance the stability of power systems is introduced, which is based on the power flow control of some equipment installed at power systems, i.e., High Voltage Direct Current (HVDC) transmission line, batteries, variable speed wind turbine generators, and LFC (Load Frequency Control) hydro power plant. Output from these power equipment are controlled cooperatively according to the output command from the new virtual synchronous generator control system. The control system is based on PID Fuzzy Logic Controller and the output command is composed of three components, PDroop, PInertia, and PSynch, which are generated by the proportional, integral, and differential controllers and corresponding to damping, synchronization, and inertia effects of conventional synchronous generators respectively. The three components, PDroop, PInertia, and PSynch, are distributed to each power equipment according to their response speed and power capacity. For example, PInertia, which is corresponding to the virtual inertia control power is sent mainly to batteries because their response speed is very fast, and PDroop+PSynch is sent to a conventional LFC hydro generator because power capacity of LFC hydro generator is large and its response speed is relatively fast, which means the "virtual synchronous generator signal" is input to a real synchronous generator and make the real synchronous generator more strong. Finally effectiveness of the new VSG control system is demonstrated through simulation results obtained by using PSCAD /EMTDC software, in which it is presented that the power system stability with large-scale WF installed can be enhanced by the new VSG control system.

Details

Keynote Speeches Abstracts
Day 2-Sep. 16

Session 7

Morning, September 16, 2020 (Wednesday)
Time: 11:00~12:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Paul Roege, P.E.
Senior VP for Strategic Initiatives, Typhoon HIL, Inc.
Speech Title: "The Energy Resilience Leadership Opportunity"

Abstract — Communities around the world have diverse electrical power systems that range from municipal and national networks built up over the past century to rural places with no connecting infrastructure at all. Today, ways of life are being turned on our heads, with new technologies like cell phones and an emerging Internet of Things becoming available and affordable. With this change, our need for energy becomes increasingly urgent and personal. The big question is, "what is the model to meet energy needs in less-developed communities?" In the past, the basic choice was between "stand-alone" systems and centralized distribution networks. However, new generations of "digital power" technology offer the potential for significantly more flexibility, adaptive capacity, and broad participation – key foundations of resilience. With a bit of forethought, home or local co-operative systems can be expanded, networked, and managed in different ways over time, accommodating incremental learning and growth. In this light, remote communities in Asia and Africa have the opportunity not only to follow resilient energy development pathways, but perhaps to "leapfrog" ahead of legacy communities, providing new insights to inform energy democratization.

Details

Keynote Speeches Abstracts
Day 2-Sep. 16

Session 8

Afternoon, September 16, 2020 (Wednesday)
Time: 13:30~14:30 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Prof. Mohamed El Hachemi Benbouzid (IET Fellow)
University of Brest, France
Speech Title: "On Tidal Stream Turbines Drivetrain Technology Options: With or Without a Gearbox?"

Abstract — Tidal stream energy is one of the promising solutions to lower CO2 emissions. It is sustainable and predictable, in fact tidal current oscillations are highly predictable, unlike other types of energy. Tidal stream energy is usually harnessed by means of horizontal axis tidal turbines, which are analogous to wind turbines. However the maximum power extracted from a tidal turbine is 61% higher than a wind turbine of the same input power because of the higher density of water over air. Tidal stream turbines are submerged systems so they have to withstand high loading and harsh submerged conditions. Furthermore many challenges have to be overcome to improve their reliability and availability, and decrease maintenance costs. In particular, the turbine drivetrain and generator option choices affect the availability as well as the cost of energy. In this challenging context, this keynote will address the critical issue of tidal stream turbine drivetrain options, while proposing trends and discussing potential and promising topology options.

Details

Keynote Speeches Abstracts
Day 2-Sep. 16

Session 9

Afternoon, September 16, 2020 (Wednesday)
Time: 14:45~15:45 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Prof. Aoife Foley
Queen's University Belfast, UK
Speech Title: "Meeting the challenge of climate change"

Abstract — The Paris Agreement prioritises urgent finance, technology and capacity-building to rapidly deploy low-carbon renewable energy technologies. The aim of this is to ensure a resilient, safe and sustainable society that can respond effectively to the challenges and opportunities of climate change. As renewable energy steadily grows globally at all levels in the energy system security of energy supply rules for governments, regulators, producers and end-users will need to be re-evaluated. Thus needing an urgent 'join the dots' approach. Currently analyses of energy systems are for the most part high level or piecemeal tending to focus on quantifying energy and greenhouse gas emission transformations and fluxes at a sectoral level. This can be useful to inform, but for a multidimensional complex intersectoral energy system this is just statistical book keeping. New cross-disciplinary approaches are urgently needed by society to respond to the real environmental, technical and economic challenges in order to effectively make our food, energy and water systems resilient, robust and fit for purpose into the future so that our valuable resources are not wasted. This opinion based keynote discusses this dynamic, describes her work and that of others and suggests how we can collaborate successfully to meet the challenge of climate change.

Details

Keynote Speeches Abstracts
Day 2-Sep. 16

Session 10

Afternoon, September 16, 2020 (Wednesday)
Time: 16:00~17:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/97397478385

Prof. Farhad Rachidi (IEEE Fellow)
Swiss Federal Institute of Technology, Switzerland
Speech Title: "Only Time Will Tell: An Introduction to Time Reversal and its Application to Electromagnetic Source Location "

Abstract — Time reversal is a technique that allows to reproduce the past behavior of a system in the future by imposing appropriate initial conditions on the system. The technique has been first developed in the field of acoustics by Prof. Fink and his team in the 1990s. In the past decade, time reversal has also been used in electromagnetics and applied to various other areas of electrical and computer engineering, leading to efficient technologies in source-location identification. In this talk, I will present first the theoretical basis of the time reversal theory, with special attention to electromagnetic fields. The concept of time reversal cavity, allowing to refocus measured waves back to their source, will be described. Applications of time reversal to locate various sources disturbances will be presented. The applications include locating faults in power networks and partial discharges in transformers.

Paper Details

Session 11

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 8:30~10:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Solar Energy 1"
Session Chair: Prof. Noor Izzri Abd. Wahab

SP0138 Presentation 1 (8:30~8:45)

Price-Based Demand Response Strategy for Coordinated PV Distributed Generation and Demand Side Management in Distribution Network

Sarttra Pawakul and Watcharin Srirattanawichaikul
Chiang Mai University, Thailand

Abstract — This paper presents a model for demand response programs in distribution networks with photovoltaic distributed generation. The demand- price elasticity approach proposed in this paper considers the load profile for customers, participating in demand response programs. The objective of this research is to demonstrate the best strategy for using the critical peak pricing tariff as well the proposed tariff, designed to minimize its drawbacks. The main goal of the proposed tariff is to take advantage of PV system output power for demand reduction. The benefit and drawbacks of each demand response program are considered, including evaluation of customer electricity costs, losses in the distribution system, and utility electricity purchase costs. The case study consists of a photovoltaic system connected to feeders in the distributed grid. The simulated model of the proposed method was built using DIgSILENT PowerFactory software. The proposed tariff was calculated using MATLAB, with a goal of improving improve the effectiveness of price-based demand response programs. Validation of simulation results is carried out through a time sequence analysis over an hourly simulation period. The economic profits and losses are analyzed under Time of Use tariffs, Critical Peak Pricing tariffs, and the proposed tariffs, with a high penetration level of the photovoltaic system.

SP0126 Presentation 2 (8:45~9:00)

Impact of PV Plant and Load Models on System Strength and Voltage Recovery of Power Systems

Abdulrhman Alshareef[1], Rakibuzzaman Shah[2] and N. Mithulananthan[1]
1, The University of Queensland, Australia
2, Federation University Australia, Australia

Abstract — In recent years, non-conventional inverter-based sources, namely, wind, PV, and others have emerged as excellent alternatives to the traditional synchronous machine for power generation. It has also been reported that the so-called system strength may be reduced with high penetration of non-conventional generations (NCGs). A number of methods have been used to assess system strength which may not reflect the interdependency or reciprocal influence of various factors affecting it. This paper presents a thorough assessment to quantify the implications of and the interaction of various factors affecting system strength, with the voltage recovery index being used as a quantification tool.

Paper Details

Session 11

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0133 Presentation 3 (9:00~9:15)

Dynamic Voltage Signature of Large Scale PV Enriched Streesed Power System

Saeed Alzahrani[1], Rakibuzzaman Shah[2], N. Mithulananthan[1] and Arthit Sode- Yome[3]
1, The University of Queensland, Australia
2, Federation University Australia, Australia
3, Electricity Generating Authority Thailand (EGAT), Thailand

Abstract — Renewable power generations including flexible demand and energy storage systems leverage significant changes in network operation. Thereby, power systems with high renewable penetration manifest deteriorated resilience to disturbances. Hence, the stable operation of the system could be affected. With a paradigm shift, dynamic voltage stability becomes one of the major concerns for the transmission system operators (TSOs). Predicting the dynamic voltage signature for the transmission system with high penetration of renewables is essential to assist in selecting appropriate corrective control. This paper utilized a comprehensive assessment framework to identify the dynamic voltage signature of the power system with PV and various loads. The voltage recovery index has been chosen as the quantifiable index to extricate the dynamic voltage signature. The applicability of the proposed framework is discussed using simulation studies on the IEEE-39 bus test system.

SP0140 Presentation 4 (9:15~9:30)

PID Controller Design for Solar Tracker via Modified Ziegler Nichols Rules

Chan Aye Aung, Yogesh V. Hote, Gopinath Pillai and Shivam Jain
Indian Institute of Technology Roorkee, India

Abstract — In this paper, Ziegler Nichols tuning rules for the tuning of proportional integral derivative (PID) controller (ZN-PID) are modified via shift in the critical point of the plant to satisfy the criterion for the desired phase margin of the system. The given approach entails the use of a direct formula for the formulation of modified ZN-PID controller, which obviates the need for the use of highly randomized soft computing algo-rithms, complex nonlinear control strategies and time consuming iterative approaches of controller design. The capability of the modified Ziegler Nichols rules is demonstrated via investigation of the transient and disturbance rejection performance of the solar tracking system. A wide comparison in terms of simulation results and computation of error indices with multifarious existing techniques is performed to demonstrate the superiority of the ZN-PID technique.

Paper Details

Session 11

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0122 Presentation 5 (9:30~9:45)

INTEGRAL BACKSTEPPING CONTROL FOR WATER PUMPING SYSTEM FED BY MPPT FUZZY-LOGIC PV SOURCE

Fateh Mehazzem[1] and Abdellatif Reama[2]
1, Antilles University, Guadeloupe
2, ESIEE-Paris, Université Paris-Est 2, France

Abstract — The work presented in this paper concerns modeling, and simulation of a controlled solar pumping system, composed of: photovoltaic panels, power converters, induction motor and the water pump. MPPT FUZZY-LOGIC approach gives better performance optimization of photovoltaic production system according to the sunshine in order to work permanently at the optimum operating point. The pump system is driven by an induction motor. For that, integral backstepping control structure is proposed. It gives interesting features in terms of stability using recursive Lyapunov design, increases robustness despite parameters variation, and provides a good tracking performance. Simulation of the proposed solution is validated under Matlab/Simulink. Results demonstrate clearly that the proposed control structure provides fast dynamic response and stable static power output, even when weather conditions (irradiation) are rapidly changing.

SP0135 Presentation 6 (9:45~10:00)

Bidirectional Power Flow Control of Solar PV Array Based Multifunctional E-Mobility Charger

Saurabh Shukla, Ahmed Al Durra, Tarek H. M. El-Fouly and Ehab F. El-Saadany
Khalifa University, United Arab Emirates

Abstract — This paper deals with bidirectional power flow based solar photovoltaic array powered electric vehicle (EV) charger with reactive power compensation. This configuration consists of a solar PV array that charges storage battery of EV and feeds the grid with remaining power simultaneously. For extracting maximum power, DC-DC boost converter is used and a three-phase voltage source converter (VSC) is used for the DC link voltage regulation. This arrangement provides extra opportunity to earn revenue at high electricity tariff by discharging energy to the grid. The proposed configuration is equally capable of reactive power balance. A brushless DC (BLDC) motor is used for ancillary purpose and is powered by battery charger under grid outage condition. The proposed charger is modelled and its performance is tested under different conditions of active and reactive power flow control in MATLAB/ Simpower system toolbox with the harmonic contents of grid current within 5% in every mode as per IEEE 519 standard. The charger is designed with three-phase, 230 V, 50 Hz utility grid.

Paper Details

Session 12

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 8:30~10:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Solar Energy 2"
Session Chair: Prof. N. Prabaharan

SP0088 Presentation 1 (8:30~8:45)

Coordination Control and Protection for Photovoltaic DC Distribution System

Congbo Wang[1], **Ke Jia[1]**, Bohan Liu[2] and Jiankang Zhang[3]
1, State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources (North China Electric Power University), China
2, State Grid AC Project Construction Co. Ltd., China
3, Northwest Branch of State Grid Corporation of China, China

Abstract — Multi-terminal distributed photovoltaic are integrated into the flexible DC distribution system for higher energy conversion efficiency. However, the special fault characteristics of DC system bring challenges to protection such as: 1) Due the complex structure of flexible DC distribution system with multi-terminal distributed photovoltaic, the protection cannot set a clear boundary using single-ended measurement. 2) The DC faults last about several milliseconds and its fault characteristics controlled by power converters' variable control algorithms, thus causing the difficulty in fault location. Therefore, a novel fault detection and location method-based protection scheme is proposed to deal with these issues. The proposed method utilizes the coordinated control between local protection and the converters in the system, eventually, the problem of unclear protection boundary was solved. Meanwhile, the proposed protection method can distinguish the correct faulted area by calculating harmonic impedance of these characteristic signals. Simulation results show that it is effective to achieve the combination of control and protection through the well controllability of power electronics. The principle is simple and reliable.

SP0144 Presentation 2 (8:45~9:00)

Determination of Optimal PV Energy Share Considering Voltage Stability Index

Khaidir Ali, Lesnanto Multa Putranto, Adha Imam, Tumiran and Muhammad Yasirroni
Universitas Gadjah Mada, Indonesia

Abstract — In this study, the FPA (flower pollination algorithm) method is used for optimize the location and capacity of photovoltaic distributed considering voltage stability index (VSI). The proposed method is used in the KTN 03 bus system case study (Yogyakarta city). This operation is conducted for a half-day (10:00 AM - 2:00 PM) operation. There are two scenarios used in this study. Scenario 1 with PV placed on one bus and scenario 2 assuming all buses can be installed PV. The value generated in the two-scenario simulation, the total loss becomes 3.060 MW in scenario 1 and 3.1459 MW in scenario 2. Increased stability index values are seen on all lines. However, the smallest VSI values were obtained at lines 9, 18, and 35. The total energy loss in scenario 1 is 1.5300 MWh and scenario 2 is 1.5729 MWh. The PV energy share was obtained for 4.72% and 5.86% in both scenarios.

Paper Details

Session 12

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0168 Presentation 3 (9:00~9:15)

Anti-Islanding Method for Houses Equipped with Electric Vehicles and Photovoltaic System

U.B. Irshad[1], S. Rafique[1], M.J. Hossain[2], S.C. Mukhopadhyay[1]
1, Macquarie University, Australia
2, UTS, Australia

Abstract — Integration of electric vehicles (EVs) are exponentially increasing in the global market and by enabling vehicle-to-grid (V2G) EVs can inject power back into the grid. However, in an event of unintentional islanding, injecting power into the grid may causes potential safety threats to people, equipment, and power system. This paper proposes an adaptive reactive power mismatch method to detect islanding events. When islanding occurs, the proposed method drifts the system frequency away from the nominal value. Then the islanding event is detected based on frequency variations. Results show that the proposed method effectively detects islanding event within 0.801 milliseconds and have negligible non-detection zone.

SP0153 Presentation 4 (9:15~9:30)

Influence of Induction Motor in Stability of Power System with High Penetration of Large-Scale PV

Abdulrhman Alshareef[1], Mithulananthan Nadarajah[1] and Rakibuzzaman Shah[2]
1, The University of Queensland, Australia
2, Federation University Australia, Australia

Abstract — Inverter-Based Energy Resources (IBERs) have become an ordinary portion of the generation mix in power systems. Furthermore, converter-based technology has come to dominate modern motor loads on the consumption side. This transition in components towards accommodating power electronic devices alters the dynamic response of the power system. This paper investigates the impact of these elements on the dynamic stability of the power system. Firstly, this study successes to optimize a suitable model for converter-based motor loads. Secondly, indices of transient and voltage stabilities are used to quantify the strength of the power system at different circumstances incorporating the induction motor loads. Finally, this analysis provides an insight into the mutual interactions between transient and voltage stabilities. It is concluded that converter-based motor loads improve the voltage recovery when compared with direct-connected induction motors. However, the system is vulnerable to transient stability with the proliferation of inverter-based motor loads when IBERs dominant in the generation mix.

Paper Details

Session 12

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0162 Presentation 5 (9:30~9:45)

Economic Assessment of Rooftop Photovoltaic Investment by Considering Uncertainty Solar Irradiation: A case Study of Semarang City, Central Java, Indonesia

Rizki Firmansyah Setya Budi, Sarjiya and Sasongko Pramono Hadi
Universitas Gadjah Mada, Indonesia

Abstract — Rooftop Photovoltaic (PV) built by the private sector is an option to reduce the government's burden in achieving the new and renewable energy target. However, the fluctuating global horizontal irradiation (GHI) value causes uncertainty in the profit of rooftop PV investment and causes the private sector to doubt. Therefore, this research analyses the impact of the GHI uncertainty on the economics of rooftop PV investments. This research used Semarang city as a case study. The uncertainty was modelled using the Monte Carlo simulation. The results show that the levelized cost of electricity (LCOE) is always below the tariff and above the generation cost. It implies that it is more profitable if it is built by the private sector (PLN's customers) rather than build by PT. PLN itself. The LCOE of rooftop PV in Semarang has an average value of 8.23 cents USD/kWh with an average net present of 11,265 USD.

SP0148 Presentation 6 (9:45~10:00)

Robust Continuous Nonlinear Predictive Controller (CNMPC) via Integral Sliding Mode Control (ISMC) for Grid-Tied PV Inverter

Biyadgie Ayalew, Abass Afolabi Yahaya and Ahmed Al Durra
Khalifa University, United Arab Emirates

Abstract — This paper presents robust continuous non linear control for grid tied PV inverter by combining model predictive control (CNMPC) and integral sliding mode control (ISMC). Based on cascaded control structure, combination of CNMPC and ISMC is proposed for both outer and inner control loops. Low pass filter is used to extract the equivalent of the discontinuous switching of ISMC so that the outputs of ISMC and CNMPC are added. Moreover, it is mathematically illustrated that the equivalent of ISMC is actually the same as the magnitude of disturbance. The performance of the proposed controller is verified through series of simulation tests. The combined controller shows robust response for parameter uncertainty and external disturbances such as dc current from PV. It is also shown that the grid current total harmonics distortion(THD) is within the international standards.

Paper Details

Session 13

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 10:20~11:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Power Electronics Converter/Inverter"
Session Chair: Prof. N. Prabaharan

SP0020 Presentation 1 (10:20~10:35)

Space High Voltage Power Module Design

Zhao Wen-jie, Wan Cheng-an, Gao Yi-fei, ,Zhang Guo-shuai, Zheng Yan, Chen Yong-gang
Beijing Spacecraft, China Aerospace Science and Technology Corporation

Abstract — With the rapid development of world aerospace technology, next-generation technologies such as high-power electric propulsion, space welding and future space solar power stations have put forward higher requirements on the power level, reliability and conversion efficiency of space high-voltage power supplies. The key to space high-voltage power supply design is to improve the reliability and efficiency of the power supply. Aiming at this situation, this paper proposes a high-reliability space high-voltage converter. Based on the experiments, we take the phase-shifted full bridge series resonance circuit to optimize the efficiency of the high-voltage converter, the optimization results and electrostatic field of the experimental circuit board are simulated and verified. Finally, the development direction of space high-voltage power supply is summarized and the outlook is put forward.

SP0036 Presentation 2 (10:35~10:50)

A Wide Duty Cycle Magnetic Isolation MOSFET Drive Circuit for Aerospace High-Reliability Power Supply

Jianchao Wu, Wenjie Zhao and Guoshuai Zhang
Beijing Spacecraft, China Aerospace Science and Technology Corporation, China

Abstract — A magnetically isolated MOSFET driving circuit based on a driving transformer has been widely used in aerospace secondary power supplies. Based on the analysis of two typical magnetically isolated driving circuits, a new type of driving circuit is proposed. This circuit has the characteristics of zero negative voltage, high reliability, and wide duty cycle operating range. It is very suitable for a new generation of aerospace high-efficiency high-power-density power supply topology, and it has important significance for improving the efficiency of space borne secondary power supplies.

Paper Details

Session 13

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0065 Presentation 3 (10:50~11:05)

A wideband synchronous sampling method for power analyzer

Kai Chen, Yang, Gou, Zhou and Gen Qiu
University of Electronic Science and Technology of China, China

Abstract — In the power analyzer, synchronous sampling is needed to achieve high precision power and harmonic calculation. And the fundamental frequency measurement is important for synchronous sampling. However, due to the existence of harmonic components in the voltage/current signal, it is difficult to accurately measure the fundamental frequency of the signal for the traditional frequency measurement method. This paper proposes a new synchronous sampling architecture to realize the accurate fundamental frequency measurement for the signal. In the developed scheme, the frequency refinement method is adapted to solve the problem of signal discontinuity in discrete Fourier transform (DFT). Then the one-dimensional search method is used to accurately measure the fundamental frequency. In the experimental results, the synchronous sampling algorithm has a large signal frequency measurement range of 10 to 400 Hz with an error of less than 0.001 Hz + 0.01% * fundamental frequency. The wideband synchronous sampling proposed in this paper achieves high measurement accuracy.

SP0108 Presentation 4 (11:05~11:20)

Design of an LED Sink Driver Using a Switched-Inductor/Switched-Capacitor Buck-Boost Converter with High Voltage Gains

Kei Eguchi[1], Akira Shibata[1], Farzin Asadi[2], Takaaki Ishibashi[3], Yujiro Harada[3]
1, Fukuoka Institute of Technology, Japan
2, Kocaeli Üniversitesi, Turkey
3, National Institute of Technology, Kumamoto College, Japan
4, Kumamoto National College of Technology, Japan

Abstract — A novel light emitting diode (LED) sink driver using a switched-inductor and switched capacitor (SISC) buck-boost converter is proposed in this paper. The proposed LED driver can achieve a high voltage gain by cascading the SI buck-boost block and the SC doubler block with a flying capacitor. The proposed negative SISC topology can provide not only high voltage gain but also flexible controllability of LED currents. The performance of the proposed SISC buck-boost converter was clarified by simulation program with integrated circuit emphasis (SPICE) simulations. In the performed simulations, the proposed SISC buck-boost converter can improve power efficiency about 6% from the conventional hybrid buck-boost converter when the duty factor D is 0.5 and the output power is 500mW. Furthermore, the feasibility of the proposed SISC topology was confirmed by breadboard experiments.

Paper Details

Session 13

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0116 Presentation 5 (11:20~11:35)

4.15 W SIDO Buck Converter with Low Cross Regulation Using Adaptive PCCM Control

Tzung-Je Lee[1], **Chih-Kai Wang[2]** and Chua-Chin Wang[2]
1, Cheng Shiu University, Taiwan
2, National Sun Yat-Sen University, Taiwan

Abstract — A 4.15 W SIDO buck converter is proposed in this paper. By using the adaptive PCCM control, the FW (freewheel) phase is automatic adjusted to improve the efficiency, which is the weakness in traditional PCCM control. Besides, the current mode comparison is utilized, such that the comparators are not required for the mode control. The proposed design is implemented using TSMC 0.18 um CMOS HV process. Based on the simulation results, the circuit achieves the cross regulation of 0.097 mV/mA and 0.066 mV/mA for the dual outputs with the load current variation from 0.5 A to 0.4 A and from 0.45 A to 0.5 A, respectively.

SP0124 Presentation 6 (11:35~11:50)

Current Rating Analysis of a Nine-Switch based Unified Expandable Power Converter Considering Different Configurations

Hamed Bizhani[1], S.M. Muyeen[2], Fatemeh R. Tatari[3], Kuaanan Techato[4], Lazhar Ben-Brahim[5] and Frede Blaabjerg[6]
1, University of Zanjan, Iran
2, Curtin University, Australia
3, University of Birjand, Iran
4, Prince of Songkla University, Thailand
5, Qatar University, Qatar
6, Aalborg University, Denmark

Abstract — Using low switch converters due to their cost-effectiveness has been an interesting topic in different applications such as grid integration of distributed generation systems and multi-machine drives. Recently, a nine-switch based unified expandable power converter (UEPC) has been presented for integration of multi permanent magnet synchronous machine (PMSG) based wind energy systems (WESs) in which the number of switches in comparison with the conventional configurations is significantly reduced. Nevertheless, since all switches are shared between all ports and therefore, the currents of different ports pass through all switches, the current rating of the switches might be higher than the conventional structure. In this paper, to minimize the total required current rating of the semiconductor as well as the installation cost of the UEPC, different acceptable configurations considering different port for grid connection are evaluated and the best port for grid connection is proposed. Finally, to verify the analysis results, the simulation of a three-port version of UEPC is carried out using MATLAB/Simulink software. The simulation results also confirm that when the grid is connected to the middle port, the minimum instantaneous currents pass through the switches.

Paper Details

Session 14

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 10:20~11:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Power System Operations and Control 1"
Session Chair: Prof. Jahangir Hossain

SP0040 Presentation 1 (10:20~10:35)

Fault Detection in Active Hybrid Distribution Networks: Overcoming Uncertainty

Shahram Negari and **David Xu**
Ryerson University, Canada

Abstract — Fault detection in active hybrid distribution networks that contain distributed energy resources and employ both alternating current and direct current is a highly complex and challenging task. Such networks are inherently stochastic, partially observable, and suffer from noisy or corrupt data. This paper proposes a fault detection method based on Bayesian inference paradigm and employs its corresponding graphical representation, that is Bayesian Belief Network (BN), to detect faults. The BN takes advantage of causal data produced by a distributed state estimation algorithm and correlational redundant data gathered from various devices to overcome uncertainty in making plausible decisions about the status of the system. Simulation results prove the value of the proposed technique in improving the reliability of conventional protection and relaying schemes.

SP0110 Presentation 2 (10:35~10:50)

A PVDF-film Energy Harvesting Circuit Using 40-nm CMOS Process

Chua-Chin Wang[1], **Pin-Chuan Chen[1]**, Ya-Hsin Hsueh[2], Cheng-Tang Pan[1], Chung-Kun Yen[1], Tzung-Je Lee[3] and John Richard Hizon[4]
1, National Sun Yat-Sen University, Taiwan
2, National Yunlin University of Science and Technology, Taiwan
3, Cheng Shiu University, Taiwan
4, Philippines Diliman University, Philippines

Abstract — This paper presents an energy harvest circuit design integrated with piezoelectric devices made of polyvinylidene fluoride PVDF films. The piezoelectric devices will be used in wearable electronics, e.g., insole and clothes, to prevent child or elderly missing. The proposed design consists of a low-voltage piezoelectric energy harvest circuit, PVDF films, and discretes, which will be integrated with Bluetooth lowenergy (BLE) Tx/Rx. Therefore, when the kid or elder is out of a pre-defined distance, the missing beacon via Bluetooth devices will alarm to the family so take actions. The harvest circuit is realized using TSMC 40nm CMOS process, wherein the proposed 2-stage stepping-up architecture boosts the generated from 120 mV to 1 V. Since the output of PVDF film is an AC signal, an AC/DC converter based on a voltage multiplier not only carries out AC/DC conversion, but also elevate the DC voltage to 0.26 V, which is then through boosted by DC/DC converter to 1 V. The all-PVT-corner post-layout simulations demonstrate the worst output power is 4.2 mW, which is more than enough to drive a low-power wireless frontend, e.g. Bluetooth lower energy (BLE) Tx/Rx.

Paper Details

Session 14

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0118 Presentation 3 (10:50~11:05)

3D Stator Bar Modelling with Investigation on the Effect of Shapes and Sizes of Cavities and Distribution of Electric Field

Daphne Tay Ye Chee[1], Hadi Nabipour-Afrouzi[1], Chin-Leong Wooi[2], Kamyar Mehranzamir[3], Jubaer Ahmed[4] and Mohammad Ali Bagherian[3]
1, Swinburne University of Technology Sarawak Kuching, Malaysia
2, Universiti Malaysia Perlis, Malaysia
3, University of Nottingham Malaysia, Malaysia
4, Swinburne University of Technology Sarawak Kuching, Malaysia

Abstract — Insulation system is one of the most vital elements in high voltage equipment and hence, investigation on the condition and mechanism of failure of high voltage insulations is essential. This paper presents the study on the effect on the cavity's position and sizes and the corresponding electric field and potential distribution in the 3-Dimensional stator bar insulation. The 3D stator bar modelling is implemented using COMSOL software and simulated using Finite Element method (FEM). The outcome of the simulation work shows the uniformity and strength of electric field in the stator bar insulation is affected by the sizes and shapes of the cavity. In terms of the shapes, the ellipsoidal cavity sustains the greatest electrical stress of magnitude of 5.34kV/mm as compared to the spherical cavity which withstands only 4.05kV/mm when the cavities size is 0.22mm. Apart from that, the electric field intensity of ellipsoidal cavities is discovered to endure a drop of around 13-14%, while a drop of 22-23% for spherical cavities when the cavity sizes increased from 0.22mm to 1.10mm. The results from this modelling work aid in improving the understanding over the electrical breakdown in stator bar insulation system.

SP0032 Presentation 4 (11:05~11:20)

Deep Learning-Based Intrusion Detection System for Electric Vehicle Charging Station

Manoj Basnet and **Mohd. Hasan Ali**
University of Memphis, United States

Abstract — The integration of the open communication layer to the physical layer of the power grids facilitates the automation, remote control, scheduling, etc., in the grids. However, cybersecurity threats are inherent with the open communication layer, which can violate the confidentiality, integrity, and availability (CIA) of the grid resources. The soaring usage and popularity of electric vehicles (EVs) demand the robust deployment of trustworthy electric vehicle charging station (EVCS). We propose the novel deep learning-based intrusion detection systems (IDS) to detect the denial of service (DoS) attacks in the EVCS. The deep neural network (DNN) and long-short term memory (LSTM) algorithms are implemented (in python 3.7.8) to detect and classify DoS attacks in the EVCS. Results show that both the DNN and LSTM based IDS achieved more than 99% accuracy. However, the LSTM method is superior to the DNN method in terms of accuracy, precision, recall, and measure.

Paper Details

Session 14

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0149 Presentation 5 (11:20~11:35)

Heuristic Inertia Estimation Technique for Power Networks with High Penetration of RES

Peter Makolo, Ramon Zamora and Tek-Tjing Lie
Auckland University of Technology – AUT, New Zealand

Abstract — The inertia-less renewable energy sources (RESs) are potential to replace conventional synchronous generators with their associated inertias in the power system. The increased penetration of RESs into the grid will, therefore, lead to variability and unpredictability of system inertia due to stochastic nature of RESs. This paper, therefore, presents a heuristic technique to estimate the varying inertia in the power network using normal operating conditions. In this approach, phasor measurement units (PMUs) are used to extract data from the network and hence used to estimate the dynamic model representing the network. The higher order estimated model is then decomposed to lower order model for not only easy analysis and simplified inertia estimation process but also reduced computation burden. Contrasted to other approaches using large disturbance, the suggested technique can estimate inertia constant of the network using normal operating conditions. The technique has been tested using numerical simulations of a modified IEEE 14-bus network modelled in industry accepted DIgSILENT™ PowerFactory® tool.

SP0019 Presentation 6 (11:35~11:50)

Influence of Battery Energy Storage Location on the Dynamic Performance of Hybrid AC/DC Microgrid

Morteza Daviran Keshavarzi and **Mohd Hasan Ali**
The University of Memphis, United States

Abstract — Energy storage systems provide ancillary services as well as minimization of power fluctuations caused by intermittent renewable energy sources (RES) and variable loads in microgrids. Energy storage selection criteria in microgrids are usually based on power management and economic aspects, neglecting its dynamic performance functionality. In this paper, a comprehensive study of the impact of the Battery Energy Storage System (BESS) placement on the dynamic performance of Hybrid AC/DC Microgrid (HMG) is presented. For the evaluation purposes, two major locations, such as the AC grid or DC grid are considered for the BESS. The detailed dynamic model of the test HMG system is simulated under vari-ous disturbances cases when the BESS is operated either in AC or DC sub-grid. Simulation results show that the HMG with both BESSs is resilient against disturbances. However, the DC side BESS has superior performance to the AC side BESS in controlling large-signal grid disruptions.

Paper Details

Session 15

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 13:30~15:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Grid Interfacing Challenges for Renewable Energy Systems"
Session Chair: Prof. Md. Rifat Hazari

SP0014 Presentation 1 (13:30~13:45)

Stabilization of Power System including Wind Farm by Two-Step P and Q control of HVDC Interconnection Line

Ayaka Nakamura[1], Atsushi Umemura[1], Rion Takahashi[1], Junji Tamura[1], Atsushi Sakahara[2], Fumihito Tosaka[2] and Ryosuke Nakamoto[2]
1, Kitami Institute of Technology, Japan
2, Hokkaido Electric Power Co., Inc., Japan

Abstract — Penetration of renewable energy sources, such as wind power generation and PV power generation, into the power systems has been increasing significantly. Especially, wind power generation has attracted attention due to their superior characteristics such as low cost and high energy conversion efficiency. However, the power system including large-scale wind farm (WF) can become unstable during a fault condition because WF can be decoupled due to the instantaneous voltage drop in accordance with the grid code of Fault Ride Through (FRT) requirement. This paper proposes a new two-step control strategy using High Voltage Direct Current (HVDC) interconnection line. The proposed system controls the active power and the reactive power delivered to the grid from the HVDC interconnection line during a fault condition. The effectiveness of the proposed method is confirmed by simulation analyses on PSCAD/EMTDC software.

SP0016 Presentation 2 (13:45~14:00)

Improved Voltage Oscillation Damping and Tracking of Subgrid of a Hybrid AC/DC Microgrid using Robust Integral Linear Quadratic Gaussian Control

Sajal K. Das[1], Dristi Datta[2], Subrata K. Sarker[2], Shahriar Rahman Fahim[1], Md. Rafiqul I slam Sheikh[1] and Faisal R. Badal[1]
1, Rajshahi University of Engineering & Technology, Bangladesh
2, Varendra University, Rajshahi

Abstract — Future grids will consist of many small and large subgrids that will require complex control for grid interaction as well as tracking of operation. This paper presents the design of a robust integral linear quadratic Gaussian (ILQG) controller for damping and tracking control of subgrid voltage of hybrid microgrid. The design of ILQG is carried out by augmenting the subgrid dynamics with an integrator that takes power from the DC bus connecting with AC and PV based DC grid. The subgrid consists of a parallel combination of several uncertain and unknown loads that may produce the voltage oscillation. The performance of ILQG is evaluated for various load dynamics and compared with the LQG, LQR, and integral controller in terms of bandwidth. The robustness of proposed controller is studied by considering a number of uncertainties within subgrid model. Results show that the proposed ILQG controller provides improved robust performance than others.

Paper Details

Session 15

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0025 Presentation 3 (14:00~14:15)

Cooperative Virtual Inertia Control of PMSG based wind generator and battery for Power System Stability Enhancement

Takamasa Sato, Atsushi Umemura, Rion Takahashi and Junji Tamura
Kitami Institute of Technology, Japan

Abstract — Recently, renewable energies are attracting attention because of no CO2 emission and no dissipations of fossil fuel. Renewable energy generation systems are promising energy sources, but there is a problem that they do not have, in general, inertia and synchronizing power. If the system inertia and the synchronizing power of the system decrease, the stability of the system will decrease. Therefore, various researches have been conducted to add virtual inertia effect to asynchronous dispersed power sources. In this paper, cooperative virtual inertia control of variable-speed wind power generator using a permanent magnet synchronous generator (PMSG) and large storage battery is proposed, in which Fuzzy Logic is adopted to design the cooperative virtual inertia control system.

SP0094 Presentation 4 (14:15~14:30)

Extended Self-Tuning Filter-Based Synchronization Technique for Unbalanced and Distorted Grid

Hafiz Ahmed[1], Samet Biricikyz[2,3] and Mohamed Benbouzid[4,5]
1, Aerospace and Automotive Engineering, United Kingdom.
2, European University of Lefke, Turkey.
3, Technological University Dublin, Ireland.
4, University of Brest, France.
5, Logistics Engineering College, Shanghai Maritime University, China

Abstract — Control of grid-connected converters (GCC) is a challenging task in adverse grid conditions. Due to increasing presence of inverter-interfaced renewable energy sources and nonlinear loads, adverse grid conditions are often can not be avoided. Self-tuning filter (STF) is an widely used technique for the control of GCC in adverse conditions. However, the existing literature only considers balanced grid condition. This paper extends STF for unbalanced grid. Proposed extension is obtained by considering STF in state-space framework together with model of the unbalanced grid. Using open-loop frequency estimation technique, frequency-adaptive STF is proposed that is able to operate in unbalanced and distorted grid. Mathematical analysis are presented to demonstrate the frequency selective property of the extended STF. Comparative numerical simulation results are provided to demonstrate the suitability of the proposed technique.

Paper Details

Session 15

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0146 Presentation 5 (14:30~14:45)

Thirteen-Level Modified Packed U-Cell Multilevel Inverter for Renewable-Energy Applications

Sherouk Fouda[1,3], Marwa S. Salem[2,4], Ahmed Saeed[3], Ahmed Shaker[1] and Mohamed Abouelatta[1]
1, Ain Shams University, Egypt
2, University of Ha'il, Egypt
3, Future Univeristy in Egypt, Egypt
4, Modern Science and Arts University, Egypt

Abstract — Multilevel inverters are getting more interest to be used in several applications due to their various advantages compared to Multilevel inverters are getting more interest to be used in several applications due to their various advantages compared to the classical inverters. In this paper, a modified packed U-cell inverter is proposed to provide thirteen-level smooth waveform at the output. The proposed inverter uses eight switches and three DC sources, which is very less compared to the classical inverters. The efficient multi-carrier PWM switching technique is employed to control the operation of the inverter and to reduce the current harmonics. Simulations are carried out using Matlab/Simulink package to investigate the performance of the proposed inverter. The improvement in the output waveform and the reduced harmonic distortion are pointed out, which prove the efficiency of the proposed inverter.the classical inverters. In this paper, a modified packed U-cell inverter is proposed to provide thirteen-level smooth waveform at the output. The proposed inverter uses eight switches and three DC sources, which is very less compared to the classical inverters. The efficient multi-carrier PWM switching technique is employed to control the operation of the inverter and to reduce the current harmonics. Simulations are carried out using Matlab/Simulink package to investigate the performance of the proposed inverter. The improvement in the output waveform and the reduced harmonic distortion are pointed out, which prove the efficiency of the proposed inverter.

SP0159 Presentation 6 (14:45~15:00)

Forced Oscillation in Power System with Renewable Generations

Tossaporn Surinkaew[1], Kianoush Emami[1], Rakibuzzaman Shah[2], Syed Islam[2] and N. Mithulananthan[3]
1, CQUniversity, Australia
2, Federation University, Australia
3, The University of Queensland, Australia

Abstract — Forced disturbance (FD) with various bands of frequency may ignite forced oscillation (FO) in power systems. The FO is significantly intensified when the frequencies of FDs are nearly equal to inter-area modes in the range of 0.2 to 0.8 Hz. In modern power systems, penetration of renewable generations (REGs), e.g. wind and solar generators, may provoke the FO due to stochastic outputs. The stochastic outputs can be regarded as FD injection since variations of the outputs from these generators can probably be in the range of inter-area oscillation frequency.Therefore, the penetration of REGs in modern power systems can contribute to the FO. This paper analyzes the impacts of FO on power systems affected by the REGs. System configurations of the REGs owning to the FO is thoroughly investigated. Simulation result is validated in the modified 14-Machine Southeast Australian (SE-A) power system under various operating conditions.

Paper Details

Session 16

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 13:30~15:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Microgrid"
Session Chair: Prof. Elhoussin Elbouchikhi

SP0054 Presentation 1 (13:30~13:45)

Improved Multivariable PPF Controller to Mitigate Damping and Cross Coupling Effects of LCL-Type Filter in PV Islanded Microgrids

Subarto Kumar Ghosh[1], Md. Rafiqul Islam Sheikh[1], **Sajal Kumar Das[1]**, S. M. Muyeen[2], Ajay Krishno Sarkar[1] and H. R. Pota[3]
1, Rajshahi University of Engineering & Technology, Bangladesh
2, Curtin University, Australia
3, The University of New South Wales, Australia

Abstract — An improved multi-input multi-output (MIMO) pos-itive position feedback (PPF) controller is designed for LCL-filtered voltage source inverter of solar powered islanded micro-grid. The proposed controller is designed based on multi-input multi-output framework and simulated annealing optimization algorithm. This controller provides high performance in terms of damping, closed-loop bandwidth, tracking and cross coupling effects reduction to the LCL-filtered solar powered inverter unit. Moreover, the designed controller is robust against the shift in resonance frequency of LCL-filter due to filter parameters and line inductance variations. Simulation results of open- and closed loop system are presented and the result show that the proposed controller provides high performance for a 102.59 kW solar powered islanded microgrid.

SP0064 Presentation 2 (13:45~14:00)

Optimal Power Flow of Power Networks With Penetration of Renewable Energy Sources By Harris hawks Optimization Method

Mohamed A. M. Shaheen[1], Hany M. Hasanien[2], S. F. Mekhamer[1] and Hossam E. A. Talaat[1]
1, Future University in Egypt, Egypt
2, Ain Shams University, Egypt

Abstract — This article describes a new approach of using the harris hawks optimization (HHO) for the solution of the optimal power flow (OPF) problem. The main objective is to reach the minimum generators' fuel cost satisfying the limitations of the networks. First, an optimal siting of photovoltaic (PV) generators and/or wind generators for the studied systems is performed. Then, different OPF problem scenarios are performed with the penetration of renewable energy sources. The active power produced by the generators is the problem search space. The employment of the HHO algorithm led to better results of the OPF problem. The IEEE 57-, and 118-bus test systems are used to check the validity of the presented algorithm. Simulations of different scenarios are implemented on these two test systems. Variable daily load curves are considered. The results verified that the HHO is superior to the genetic algorithm in solving OPF problem considering various scenarios.

Paper Details

Session 16

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0075 Presentation 3 (14:00~14:15)

Optimal Power and Heat Scheduling of Microgrids under Renewable Generation Uncertainties

Mojtaba Mohseni[1], Mehrdad Abedi[1], Hossein Jafari[1], Ehsan Heydarian-Forushani[2] and **Ameena Saad Al-Sumaiti[3]**

1, Amirkabir University of Technology, Iran

2, Esfahan Elec. Power Dist. Company, Iran

3, Advanced Power and Energy Center, Khalifa University of Science and Technology, United Arab Emirates

Abstract — Technology development, government incentives, and global concerns about rising greenhouse gases make the renewable power generations to a viable option in smart microgrids. The uncertainty of renewable energy resources creates essential challenges for microgrid operator in different aspects. Moreover, the future microgrids can also supply the customer's heat demand due to their proximity to load. On this basis, optimal operation of future microgrids is a complex problem which must be solved in an appropriate way. This paper proposed an integrated power and heat generation scheduling in microgrid context considering the uncertainty of simulation approach. In order to evaluate the effectiveness of the proposed method, the model has been implemented on atypical microgrid. The obtained results reveal the effectiveness of the presented framework.

SP0080 Presentation 4 (14:15~14:30)

Study of Voltage Oscillation in Multi-Converter Based DC Microgrid

Mohammad Habibullah[1], N.Mithulananthan[1], **Rakibuzzaman Shah[2]** and K. Bhumkittipich[3]

1, The University of Queensland, Australia

2, Federation University, Australia

3, Rajamangala University of Technology, Thailand

Abstract — This paper presents the impact of various disturbances in the multi converter-based DC microgrid. Source, load, and the contingency on both side have been considered for this investigation. It is found that disturbances can potentiallydeteriorate the controller performance and contribute to oscillation and resonance at DC bus. In this investigation, a small-scale multi converter-based DC microgrid is designed first,and case studies have been conducted with the traditional singlevariable controller. Three methodologies including impedance scanning, fast Fourier transform (FFT) analysis, and timedomain simulation have been applied concurrently to check the small-signal stability on DC bus in DC microgrid. It is noticed that the disturbances at the same time on the source and load side are more influential than the single side disturbance. Besides, source-side voltage disturbance is also appearing significant, considered to the load disturbances. This analysis framework would help a researcher/planner in designing a stable multi converter-based DC microgrid.

Paper Details

Session 16

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0164 Presentation 5 (14:30~14:45)

Multi-Agent based Autonomous Control of Microgrid

Mohammad Hasanuzzaman Shawon[1], Arindam Ghosh[1], SM Muyeen[1], Murilo S. Baptista[2] and Syed Islam[3]
1, Curtin University Perth, Australia
2, University of Aberdeen Aberdeen, UK
3, Federation University Australia Melbourne, Australia

Abstract — Microgrid (MG), a revolutionary concept in the energy infrastructure, plays an important role for the establishment of a resilient grid infrastructure. Since its emergence, it has evolved around a number of cutting edge technologies for its smooth operation and control. Among them multi-agent system (MAS) provides an intelligent and decentralized platform for the control of microgrid. This paper highlights the application of a MAS in an AC microgrid, including a detailed structure of microgrid, the communication interface between microgrid and multi-agent platform. A detailed small scale microgrid model has been simulated in MATLAB/SIMULINK environment, whereas the agent platform has been implemented in JADE (Java Agent Development Framework) platform. The MAS autonomously detects main grid outage and facilitates seamless transition from grid-connected mode to islanding mode; thus ensures overall smooth operation of the power network. Simulation results are presented to verify the effectiveness of the MAS based control system.

SP0166 Presentation 1 (14:45~15:00)

Achieving New and Renewable Energy Target: A Case Study of Java-Bali Power System, Indonesia

Sarjiya, Rizki Firmansyah Setya Budi and Lesnanto Putra Multanto
Universitas Gadjah Mada, Indonesia

Abstract — New and renewable energy (N&RE) become alternative energy to reduce the dependency on fossil energy in the power sector. However, many countries have encountered obstacles in the process of reducing dependency. The obstacles that arise are very specific depending on the conditions of the country. Therefore, the strategies are taken by each country also different. An example is in Indonesia. Indonesia's National Energy Policy (NEP) has a mandate to achieve N&RE target of 23% in 2025 and 31% in 2050. Because of the unique characteristic of Indonesia, the strategies to achieve these targets differ from other countries. This research used the Java-Bali power system in Indonesia as a case study to find the strategies. A generation expansion planning (GEP) by considering alternative strategies to achieve the target in Java-Bali has been conducted. This research used the MoMANI-OSeMOSYS as a GEP model. Three scenarios have been developed: business as usual (BAU), renewable energy (RE), and new and renewable energy (N&RE) scenario. The results show that the implementation of the N&RE target causes the generation cost increase and the CO2 emission decrease. Achieving the N&RE target requires the role of nuclear energy.

Paper Details

Session 17

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 15:20~16:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Microgrids/ Nanogrids Implementation, Planning, and operation"
Session Chair: Prof. Yassine Amirat

SP0061 Presentation 1 (15:20~15:35)

Reuse Legacy to Repower the Microgrids–An Affordable Solution for Test and Restoration of Repurposed Lead Acid Batteries

Khadim Ullah Jan[1], Anne Migan Dubois[1], Demba Diallo[1], Waqar Uddin[2], Mashood Nasir[3] and Imran Khan[1]
1, Université Paris-Saclay, France
2, Pusan National University, South Korea
3, Aalburg University, Denmark

Abstract — Initial cost is an important consideration as many problems raised by the insufficient battery capacity had eventu- ally resulted in microgrid failure. The trending use of expensive, but more efficient and maintenance-free lithium-ion batteries in millions of light vehicles such as golf carts will decommission a large amount of existing lead acid batteries to be used for electrification purposes at a much lower cost. These used batteries in their second life can significantly reduce the storage cost of electrification in off-grid systems or in the most demanding business activities such as powering vendor hand-carts and community shops. Though, the used batteries are sold at a cheaper price, they still require costly equipment and time- consuming tests to evaluate if and for how long they can be re- purposed. This paper is prepared to propose a rapid, low cost, and bulk test procedure for lead acid battery characterization, capacity measurements, and restoration without any of their known history or datasheet using deep cycling process. Parameters are suggested to help in the remaining life ident-ification and to qualify these batteries for grouping in power packs based on their health and capacity. Finally, a process to review test results and make appropriate decisions regarding battery reuse or recycling is provided.

Paper Details

Session 17

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0115 Presentation 2 (15:35~15:50)

An Optimal Energy Management Strategy Under Hybrid Generation and Price-based Demand Response Program in Smart Grid

Adil Imran[1], Ahmed Wahid[1], Muhammad Ilyas[1], Imran Khan[1], **Ghulam Hafeez[1,2]**, Khadim Ullah Jan[3] and Demba Diallo[3]
1, University of Engineering and Technology, Pakistan
2, COMSATS University Islamabad, Pakistan
3, Universit´e Paris-Saclay, France

Abstract — The hybrid generation system of a photovoltaic, energy storage system, electric vehicle, and utility has developed to solve energy management problems, and, therefore scheduling household energy consumption scheduling under such a hybrid generation system becomes important. Also, household load, electric vehicle, and energy storage systems are treated as the controllable load that is scheduled according to price-based DR programs for efficient energy management. This study aims to introduce and develop a heuristic optimization algorithm to solve the energy management problem of household controllable load with a hybrid generation system under price-based DR programs. To validate the performance, the proposed model is compared with the benchmark models like a genetic algorithm (GA) and without a scheduling scenario. Simulation results illustrate that the proposed energy management model manages energy consumption under a hybrid generation system to reduce electricity cost, peaks in demand, carbon emissions, and user-discomfort.

SP0085 Presentation 3 (15:50~16:05)

Blockchain-Integrated Virtual Power Plant Demonstration

Ashot Mnatsakanyan, Hamad Albeshr, Ali Al Marzooqi and Endika Bilbao
Dubai Electricity and Water Authority, UAE

Abstract — The penetration of distributed energy resources keeps increasing in most of electricity markets, becoming an essential part of smart grid systems. This, along with advancements in power converters and control systems, led to formation of various aggregation mechanisms, such as Virtual Power Plants (VPP) or demand response (DR) aggregators, enabling participation of small and medium scale distributed energy resources (DER) in electricity markets. Such mechanisms typically entail control of DER assets at specified time periods to provide grid services such as peak shaving. However, the transparency of operations when controlling the aggregated DERs is a risk from the asset owner's perspective and may lead to various types of disputes with the aggregator or operator. In order to tackle this issue, we have developed a blockchain-based mechanism that handles all transactions within a VPP on a distributed data ledger, enabling full transparency of the system. The blockchain system is integrated with an actual VPP setup with a total aggregated size of 1.8MWs composed of renewables, energy storage systems and controllable loads. The proposed mechanism contributes to grid digitalization and enables new applications in power systems, incentivizing larger penetration of DERs and their participation in ancillary services.

Paper Details

Session 17

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0082 Presentation 4 (16:05~16:20)

An Optimal Energy Management Strategy Under Hybrid Generation and Price-based Demand Response Program in Smart Grid

Energy Management System for an Islanded Renewables-based DC Microgrid

Muhammad Fahad Zia[1], Mashood Nasir[2], Elhoussin Elbouchikhi[3], **Mohamed Benbouzid[1,4]**, Juan C. Vasquez[2] and Josep M. Guerrero[2]
1, University of Brest, France
2. Aalborg University, Denmark
3, ISEN Yncr´ea Ouest, France
4, Shanghai Maritime University

Abstract — DC microgrids are gaining attention of researchers and engineers due to the increasing deployment of renewable energy sources with energy storage systems, enhanced utilization of DC power electronics devices, and added advantages of no harmonics and synchronization issues. They are viable solutions for providing electricity to off-grid remote communities, like islands and remote areas. However, they need energy management systems for optimally scheduling the distributed energy generation and storage systems. Hence, this paper proposes a supervisory energy management system for optimal operation ofislanded DC microgrid. Energy management system is responsible for determining optimal scheduling of each energy source and ensuring maximum utilization of renewable energy sources and supply demand balance. The proposed energy management model has been validated experimentally and practical results prove the effectiveness of the proposed method.

SP0096 Presentation 5 (16:20~16:35)

Frequency Separation-based Power Management Strategy for a Fuel Cell-Powered Drone

Mohamed Nadir Boukoberine[1], Zhibin Zhou[2], **Mohamed Benbouzid[1,3]** and Teresa Donateo[4]
1, University of Brest, France
2, ISEN Yncr´ea Ouest, France
3, Shanghai Maritime University
4, University of Salento, Italy

Abstract — This paper deals with fuel cell-powered drones power management while targeting fuel cell lifetime extension. In this context, a hybrid system topology, based on a fuel cell, a supercapacitor, and a DC/DC boost converter, is adopted so as to achieve a high efficiency lightweight drone platform. System components are first sized according to the drone mission requirements and the electric sources characteristics. For power management purposes, a frequency separation-based approach is adopted to share the requested power between the two sources. Indeed, the flight power demand profile is split into high and low frequency components. In this context, the fuel cell is controlled with the DC/DC boost converter to handle low frequency components while the supercapacitor supplies or absorbs all the power peaks. Simulations are carried out using a real power profile extracted from an experimental flight test of a small hexacopter. The achieved results clearly show that the proposed power management strategy enables extending the fuel cell lifetime inducing faster response and therefore improving the drone maneuverability.

Paper Details

Session 17

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 3-Sep. 17

SP0107 Presentation 6 (16:35~16:50)

Optimal Sizing of Networked Microgrid using Game Theory considering the Peer-to-Peer Energy Trading

Liaqat Ali[1], S. M. Muyeen[1], Arindam Ghosh[1] and Hamed Bizhani[2]
1, Curtin University, Australia
2, University of Zanjan, Iran

Abstract — This paper proposes a peer-to-grid (P2G) energy trading combined with peer-to-peer (P2P) energy trading scheme based on a cooperative game theoretical technique to optimize sizes of the generation resources and battery, and achieve maximum payoff from a networked microgrid. The selected architecture consists of two microgrids in which both microgrids contain solar panels, wind turbines, and batteries to meet the requirements of the load. In the first stage, a game theory technique based on particle swarm optimization (PSO) method is used to find the optimum sizes of the generation resources and batteries considering the conventional P2G combined with P2P energy trading. In the second stage, considering two energy trading scenarios including P2G and P2G combined with P2P capability, the maximum payoffs of both microgrids are optimized and compared.

Paper Details

Session 18

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 3-Sep. 17

Morning, September 17, 2020 (Thursday)
Time: 15:20~16:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Solar Energy 3"
Session Chair: Prof. Hassan A Khan

SP0087 Presentation 1 (15:20~15:35)

Optimal Placement, Sizing and Operating Power Factor of PV for Loss Minimization and Voltage Improvement in Distribution Network via DigSilent

Mohamed Abdul Rasheed, **Renuga Verayiah** and Ba-swaimi Saleh
College Of Graduate Studies, Universiti Tenaga Nasional, Malaysia

Abstract — With the increase in concern of global warming, most nations are pushing for a greener option to the current fossil fuel-based generation schemes. Due to its versatile opportunities, Photovoltaic (PV) installations are becoming more widespread. Unlike the conventional generation systems PV is located closer to the load centers. This gives possibility of injecting PV at optimal locations to minimize system losses and improve voltage profile. Appropriate location and size of PV is vital for the stability of the system. This paper, considers different voltage stability indices to determine precise PV location, explores effects of PV sizing and impact of PV power factor fluctuations. To validate the stability of the proposed scheme, simulation is done for IEEE 33 bus system and IEEE 14 bus system with DigSilent. When system is optimized it showed a great improvement to the voltage profile with considerable loss reduction.

SP0117 Presentation 2 (15:35~15:50)

Protection Coordination with High Penetration of Solar Power to Distribution Networks

Mahamad Nabab Alam, Saikat Chakrabarti and Vinay Kumar Tiwari
Indian Institute of Technology Kanpur, India

Abstract — High penetration of renewable power generation to radial distribution networks (RDNs) is a threat to proper protection coordination of overcurrent protection scheme. Bidirectional power flow and rise in short-circuit currents are the two major factors affecting the existing protection schemes. Additionally, the recon-figurable ability of modern RDNs further complicates protection coordination. In this paper, the impact on protection coordination of directional overcurrent relays (DOCRs) because of the high penetration of solar photovoltaic (PV) power to RDNs has been analyzed, and suitable protection settings have been proposed. Also, feeder reconfiguration has been considered in the presented settings of DOCRs. This protection scheme has been validated on a real existing reconfigurable RDN on the campus of the Indian Institute of Technology Kanpur. Also, recommendations have been presented for proper protection coordination in the presence of high penetration of PV system and feeder reconfiguration.

Paper Details

Session 18

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0063 Presentation 3 (15:50~16:05)

Using BESS to Achieve Power System Dynamic Stability when High Solar Penetration is present: Case study Sri Lanka

C. Devin Aluthge[1], K.T.M. Udayanga Hemapala[2] and J. Rohan Lucas[2]
1, LTL Transformers (pvt) Ltd., Sri Lanka
2, University of Moratuwa, Sri Lanka

Abstract — This paper focuses on the need of Primary and Secondary Frequency control of a low inertia power system. The Sri Lankan Power System is taken as a case study. Due to the high penetration of wind and solar injection to the Sri Lankan power system, the inertia of the system is reduced drastically. The dynamic stability of the system due to high solar power penetration, is first discussed. The problems of the current system and the repercussions of such problems to the power system are then discussed related to the stability of the system where there is severe machine tripping. The paper also points out the remedial action needed to be taken in order to increase the power quality of the power system. The main remedial actions addressed in this paper are Battery Energy Storage Systems (BESS) and supercapacitors. In the third section of the paper a discussion is done on the BESS systems that are already installed in the world and how they are incorporated to achieve dynamic stability.

SP0090 Presentation 4 (16:05~16:20)

20V HV Energy Harvesting Circuit with ACC/CV Mode and MPPT Control for a 5 W Solar Panel

Tzung-Je Lee[1], Po-Kai Su[2] and Chua-Chin Wang[2]
1, Cheng Shiu University, Taiwan
2, National Sun Yat-Sen University, Taiwan

Abstract — A HV energy harvesting circuit with ACC/CV mode and MPPT control is proposed for a 20 V/5 W solar panel. By considering the CC/CV charging process of the Li-ion battery and the changing maximum power point of the solar panel, the adaptive constant current (ACC) mode with PWM and MPPT control is utilized to improving the efficiency when the light source is not strong and the battery is not full. While the battery reaches full-charged, the constant voltage (CV) mode is used to prevent the damage to the Li-ion battery. The proposed design is implemented using TSMC 0.5 um UHV process. Based on the simulation results, the circuit achieves the tracking efficiency of 98% for the photocurrent from 0.1 A to 0.3 A.

Paper Details

Session 18

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 3-Sep. 17

SP0106 Presentation 5 (16:20~16:35)

A Comparative Study Between Modified MPPT Algorithms Using Different Types of Solar Cells

Doaa Khodair[1,2], Ahmed Shaker[1], Hossam E. Abd El Munim[1], Ahmed Saeed[2] and Mohamed Abouelatta[1]
1, Ain Shams University, Egypt
2, Future University in Egypt, Egypt

Abstract — The I-V characteristics of the solar cells depend on solar irradiance, shading and temperature, which impact the maximum power point (MPP). This paper presents a comprehensive comparative study between the performance of four MPP tracking (MPPT) algorithms: the Modified Variable Step Size Perturb and Observe (M-VSS-P&O) and Modified Variable Step Size Incremental Conductance (M-VSS-INC) and the conventional P&O and INC. Simulations carried out using Matlab-Simulink to investigate the performance of the two solar cells under STC conditions and in a sudden change in solar irradiance. The simulation results, in both cases, reveal that the modified algorithms could make a correct decision in tracking the MPP and hence achieve better performance regarding the response time and the steady-state power oscillation than the conventional algorithms.

SP0113 Presentation 6 (16:35~16:50)

High Efficiency Tandem Perovskite/CIGS Solar Cell

Mohamed Mousa[1], Mostafa M. Salah[1], Fathy Z. Amer[2], Ahmed Saeed[1] and Roaa I. Mubarak[2]
1, Future University in Egypt, Egypt
2, Helwan University, Egypt

Abstract — This paper presents a study of a tandem Perovskite/CIGS cell, its performance parameters, and the effect of temperature variations on these parameters. The variation of each sub-cell short-circuit current density value with absorption thickness of perovskite (top) sub-cell has been done to find the matching point, as the two sub-cells equivalent to two series cells. The combining of two sub-cells shows the ability to absorb photons spectrum up to 1120 nm and perform a conversion efficiency about 30.5% (at room temperature) higher than each sub-cell. The variation of temperature from 260 K up to 360 K shows that the power conversion efficiency decreases almost linearly from 33.5% to 26.6%. The validity of the proposed tandem cell is proved by comparing its results with the recent published results. The proposed tandem cell shows one of the highest power conversion efficiency relative to the recent published results.

Paper Details

Session 19

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 8:30~10:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Smart Grid Energy Informatics, Management, and Optimisation"
Session Chair: Prof. Irfan Ahmad Khan

SP0056 Presentation 1 (8:30~8:45)

Interval Forecasting of Hourly Electricity Spot Prices using Rolling Window Based Gaussian Process Regression

Nasir Mehmood and Naveed Arshad
Lahore University of Management Sciences, Pakistan

Abstract — Electricity price forecasting is important to the energy companies in planning and decision making. Gaussian process (GP) regression is a powerful tool for probabilistic fore-casts of time series data. In this paper, we employ GP regression for prediction interval (PI) based forecasting of electricity spot prices. At each hour of the day, a new parameter set is computed incorporating most recent available electricity price data. We compare performance of several kernels. Likelihood ratio (LR) test statistics are used to measure goodness of the out-of-sample forecasts. Results show that our scheme outperforms other schemes in literature. In one case, LR statistics are slightly better for an existing quantile regression averaging (QRA) based scheme .But QRA scheme employs 12 other forecasting schemes followed by performing regression on the forecasts by those 12 schemes. However, our results significantly better than other individual forecasting schemes such as ARX/SNARX and averaging schemes such as SIMPLE/LAD.

SP0057 Presentation 2 (8:45~9:00)

A Combined Approach of Connecting Small Energies to Meet the Challenges of Developing Countries

Mohammad Khhurshed Alam
American International University-Bangladesh (AIUB), Bangladesh

Abstract — To maintain the developments of the current competing world need enormous amount of energy as a form of electrical energy. A number of methods are proposed and implemented to meet the challenges of the electric power generation. This paper aims to propose a combined electric generation process from the wastage, basically in the developing countries. The main contribution of this paper is to show the way to combine several interconnected process that can be implemented for the electric power generation. The framework is solely designed for a developing country like Bangladesh to mitigate its future uprising requirement of the energy. The proposal is designed for the consideration of the future ecology, too. Eventually, this proposal will provide guidelines for the decision makers of a developing country for power generation with making their environment clean.

Paper Details

Session 19

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0060 Presentation 3 (9:00~9:15)

Cuttlefish Optimization Algorithm based Optimal PI Controller for Performance Enhancement of an Autonomous Operation of a DG System

A. M. Hussien[1], S. F. Mekhamer[2] and Hany M. Hasanien[1]
1, Ain Shams University, Egypt
2, Future University in Egypt, Egypt

Abstract — This paper presents a novel application of the Cuttlefish Algorithm (CFA) to improving the performance of an inverter-based DG system. The inverter has been controlled using vector cascaded control method which depends on the proportional-integral (PI) controller. The proposed CFA is used to control the PI controller parameters. The response surface methodology (RSM) is used to achieve the objective function of the optimization problem. The validity of the system is proved by the simulation results which are achieved using PSCAD/EMTDC. The system is studied under three different operating conditions which are 1) system conversion from grid-connected to islanded mode, and 2) three phase faults during islanded mode. The validity of the proposed controller is proved by comparing its results with the particle swarm optimization (PSO) method results.

SP0105 Presentation 4 (9:15~9:30)

A Review on Impact Analysis of Electric Vehicle Charging on Power Distribution Systems

Syed Rahman[1], Irfan Ahmad Khan[1], **M. Hadi Amini[2,3]**
1, Texas A&M University, USA
2, Florida International University, USA
3, Sustainability, Optimization, and Learning for InterDependent networks laboratory (solid lab), USA

Abstract — With superior performance, zero-emission, and less maintenance cost, EVs are forecasted to replace the conventional internal combustion engines entirely. The charging time of EVs is seen as a significant hindrance to EV adaptation. There are two different charging methods: (a) Slow charging – via the domestic power supply and (b) Fast charging – via commercial charging stations. With high penetration levels of EV forecasted in the future, EV load would become a significant part of any utility load curve. Compared to other stationary loads connected to the grid, EV battery loads, on the other hand, are highly mobile in nature, i.e., the location of EV load is not specified in the distribution line throughout the day. Additionally, distribution systems are not rated for high overload capacities and are usually characterized by congestion zones in heavily populated areas (which would become worse with the addition of EV loads). Thus, the impact of EVs load o the utility grid must be analyzed both on the circuit level and system level. This paper discusses the power topologies used for EV charger realization, followed by the grid performance issues introduced by different EV charger topologies. The impact of EV load on grid power quality, power system equipment, and grid performance indicator are also explained in detail. Then the paper presents a brief review of different analyses and studies performed to assess the impact of higher EV penetration levels on the distribution side of the utility grid. Finally, strategies proposed to improve the grid performance by reinforcing the existing structure are discussed.

Paper Details

Session 19

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0006 Presentation 5 (9:30~9:45)

Rider Optimization Algorithm for Optimal DG Allocation in Radial Distribution Network

Mansur Khasanov[1], Salah Kamel[2], Hany M. Hasanien[3], and Ahmed Al-Durra[4]
1, Chongqing University, China
2, Aswan University, Egypt
3, Ain Shams University, Egypt
4, Khalifa University of Science & Technology, U.A.E.

Abstract — Over the last few years, with a growing interest in energy security and climate change, the integration of renewable energy sources (RES) and energy efficiency, including power loss minimization, are the two pillars of sustainable energy solutions. This paper proposes an application for a recent optimization technique called the rider optimization algorithm (ROA). The ROA has been inspired by a group of riders. The ROA is applied for determining the optimal allocation of Photovoltaic (PV) and Wind turbine (WT) based distributed generation (DG) units with the aim of minimizing the total power losses. In this regard, the most suitable nodes to place the DGs are identified using Power Loss Sensitivity Factor (PLSF) in order to reduce the search space, then ROA is applied to identify their optimal locations and sizes. The developed technique has been tested on the standard 33-node system. The results obtained by the developed technique are compared with those obtained by other well-known algorithms.

SP0053 Presentation 6 (9:45~10:00)

Economic and Environmental Impact of Vehicle-to-Grid (V2G) Integration in an Intermittent Utility Grid

Hayder Ali[1], Sajid Hussain[1], **Hassan A. Khan**[1], Naveed Arshad[1] and Irfan Ahmad Khan[2]
1, LUMS, Pakistan
2, Texas A&M University at Galveston, United States

Abstract — The importance of vehicle-to-grid (V2G) power transfer is increasing due to increased penetration of electric vehicles (EVs) along with an increasing focus on reducing fossil fuel emissions. The V2G feature of EVs has the potential to increase grid stability and optimize power flows at the distribution scale for many developed regions. However, in many developing regions, the grid is mostly intermittent, and the role of EVs must be redefined in many unique scenarios. In line with this rationale, this paper assesses two scenarios; 1, the role of V2G in reliable utility grid (a typical case in developed countries), and 2, the role of V2G in intermittent utility grid (a common scenario in developing countries). Assessment is based on the role of V2G in operational kWh cost reduction and CO2 emission reduction with tangible benefits of V2G operation as compared to business as usual.

Paper Details

Session 20

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Thursday)
Time: 8:30~10:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Power System Operations and Control 2"
Session Chair: Prof. Somporn Sirisumrannukul

SP0123 Presentation 1 (8:30~8:45)

A review on optimal power flow problems: conventional and metaheuristic solutions

Paul Charles[1], Fateh Mehazzem[2] and Ted Soubdhan[1]
1, Antilles University, Guadeloupe
2, Université des Antilles, Guadeloupe

Abstract — Multi-terminal distributed photovoltaic are integrated into the flexible DC distribution system for higher energy conversion efficiency. However, the special fault characteristics of DC system bring challenges to protection such as: 1) Due the complex structure of flexible DC distribution system with multi-terminal distributed photovoltaic, the protection cannot set a clear boundary using single-ended measurement. 2) The DC faults last about several milliseconds and its fault characteristics controlled by power converters' variable control algorithms, thus causing the difficulty in fault location. Therefore, a novel fault detection and location method-based protection scheme is proposed to deal with these issues. The proposed method utilizes the coordinated control between local protection and the converters in the system, eventually, the problem of unclear protection boundary was solved. Meanwhile, the proposed protection method can distinguish the correct faulted area by calculating harmonic impedance of these characteristic signals. Simulation results show that it is effective to achieve the combination of control and protection through the well controllability of power electronics. The principle is simple and reliable.

SP0021 Presentation 2 (8:45~9:00)

The modelling of stress assessment based on Solid state electronic switch and research on it's safety characteristics

Hui-Yao Li, Wen-Jie Zhao, Cheng-An Wan, Xin-Shun Zhou, Zhi-Po Ji and Bo-lin Zhang
Beijing Spacecraft, China Aerospace Science and Technology Corporation

Abstract — Based on the problem of non-matching of protective characteristics before and after the use of solid-state power distribution, this paper proposes a stress assessment model in the short-circuit mode of solid-state electronic switch, and realizes the calculation method of transient junction temperature of power semiconductor devices in the short-circuit mode. The parasitic parameters and influencing factors of the solid-state power distribution circuit are analyzed based on the whole satellite state. The solution of the front and back level protection characteristics matching is given to ensure the safety of the solid-state power distribution aerospace application, which has a strong guiding significance and application value.

Paper Details

Session 20

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0030 Presentation 3 (9:00~9:15)

Research on SVG Control Based on Grid Voltage Tracking

Erliang Kang, **Huanyu Liu**, He Yang, Ting Zhao and Yu Tian
Harbin univercity of science and technology, China

Abstract — With the increasing tension of energy and the increasing pollution of the environment, wind energy is used as a clean energy source for power generation. Because natural wind is uncontrollable and difficult to store, it is difficult to control output power like conventional energy generation.In this paper, a new Static Var Generator (SVG) control scheme is proposed. This scheme directly uses the grid-side voltage as the modulation wave to compare with the carrier wave to generate an Sinusoidal Pulse Width Modulation(SPWM) control signal to drive the SVG. After simulation in Matlab (Simulink) and Multisim, this method can not only ensure the smooth connection of SVG to the grid, but also compensate the reactive power required by the grid.

SP0099 Presentation 4 (9:15~9:30)

Block-chain Based Energy Trading in ADN with its probable impact on Aggregated Load Profile and Available Distribution Capability

Devesh Shukla[1], Shailendra Singh[1], Satyendra Pratap Singh[2], Amit Kumar Thakur[1] and S.P. Sing[1]
1, IIT (BHU) Varanasi, India
2, Arya College of Engineering and IT, India

Abstract — Technological advancements are leading to new frontiers in power grid operation, monitoring, control, and commercialization. The conventional notion of unidirectional power flow from centralized generating stations to probable consumers through unidirectional distribution systems is now changing with the active participation of consumers as prosumers and distributed energy resources. In order to maintain security, privacy and avoid double-spending while performing energy trading through online mechanisms a strong and reliable mode of energy transaction platform is required. Blockchain technology has proven as a stable and reliable platform for maintaining the distributed ledger that could be utilized for hosting and managing the energy transactions of the grid. In this paper, a blockchain-based energy trading mechanism in presence of internet of things has been proposed and the impact of employing blockchain technology on the aggregated load profile and available distribution capability of the ADN has been performed in Modified IEEE 123 bus distribution feeder.

Paper Details

Session 20

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0136 Presentation 5 (9:30~9:45)

Comparison of Electric Bus Power Consumption Modelling and Simulation Using Basic Power Model, ADVISOR and FASTSim

Chai Wayne Ng and Laoonual Yossapong
King Mongkut's University of Technology Thonburi, Thailand

Abstract — Modelling tools for electric vehicle power consumption simulation can range from simple, fast, less accurate models requiring few inputs to slow, highly complex, accurate models requiring many detailed inputs. Models for real-time applications like electric vehicle range estimation need near instantaneous computation time. ADVISOR and its successor, FASTSim are vehicle simulators developed by US National Renewable Energy Lab. They are sufficiently sophisticated as design tools but simulation time can be slow for real time applications. The aim of this paper is to develop a Basic power consumption Model in Simulink and benchmark its speed and accuracy against these two simulators. Real-world driving profiles obtained from experiments conducted on an electric bus were used for validation. Results show that Basic Model has comparable spread of accuracy compared to both simulators while having significantly faster computation time. It can be concluded that a Basic Model could provide sufficient accuracy for real-time application.

SP0098 Presentation 6 (9:45~10:00)

Machine Learning Algorithms Against Hacking Attack and Detection Success Comparison

Levent Yavuz[1], Ahmet Soran[1], Ahmet Önen[1] and Sm Muyeen[2]
1, Abdullah Gül University, Turkey
2, Curtin University, Australia

Abstract — Power system protection units has got enormous importance with the growing risk of cyber-attacks. To create sustainable and well protected system, power system data must be healthy. For that purpose, many machine learning applications have been developed and used for bad data detection. However, each method has got different detection and application process. Methods has superiority over other methods. Although, an algorithm can detect some injections easily, same algorithm can be fail when injection type changed. So methods have got different success results when the injection types changed. For that reason, different injection types are applied on power system IEEE 14 bus system via created special hacking algorithm. PSCAD and python linkage has been used for simulation and detection parts. 3 different injection types created and applied on the system and five different most popular algorithms (SVM, k-NN, LDA, NB, LR) tested. Each algorithm's performances are compared and evaluated.

Paper Details

Session 21

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Thursday)
Time: 10:20~11:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Electrical Load Control and Management"
Session Chair: Prof. Kei Eguchi

SP0052 Presentation 1 (10:20~10:35)

Utilization of Innovative Materials toward Permanent Magnet Synchronous E–Motors for Traction Application: A Review

Donovan O'Donnell, Samantha Bartos, Jimi Tjong and Narayan Kar
University of Windsor, Canada

Abstract — This paper examines recent optimization attempts of Permanent Magnet Synchronous Machine (PMSM) design involving the utilization of innovative materials. Recent attempts at material based enhancements to PMSM design are divided into several sections based on key machine components. In the area of core design, the replacement of electromagnetic steel with new material is highlighted. With regard to winding design, several materials have been examined as replacement for the conductive copper used as the traditional winding material. The use of enhanced materials for next generation magnets is also investigated in this paper. Additionally, the utilization of novel materials for the weight intensive PMSM motor housing, cooling channels, and rotor shaft are investigated. Lastly, the utilization of enhanced materials for PMSM insulation of enhanced thermal performance is examined. Overall, this paper will highlight the strong potential of advanced materials to greatly enhance PMSM design and their viability for use in traction applications.

SP0142 Presentation 2 (10:35~10:50)

Analysis and Experimental Study in a Load Break Switch for a Smart Distribution System

Praditpong Suksirithawornkul, Teratam Bunyagul and Noppadol Charbkaew
King Mongkut's University of Technology North Bangkok, Thailand

Abstract — This paper presents an analysis and experimental study in a load break switch (LBS) using the smart microgrid of Khun Pae Village, Chiang Mai province, Thailand as the testbed location. An LBS can be automatically controlled by various signaling arrangements that are incorporated with a feeder remote terminal unit (FRTU), current transformer (CT), and voltage transformer (VT). Sometimes the metering CTs are used to detect fault currents. This can be saturated during a heavy fault. Thus, this paper proposed the simplified equivalent circuit to study the CT saturation in an LBS for a smart distribution system. The simulation was conducted by the DigSilent Power Factory and PSCAD simulation tools for verification of the proposed method. The results of the simulation software and experimental testing by using a current source transformer and on-site testing showed that there were slightly different secondary current values of these case studies. In this paper, the proposed analysis and experiment provided modeling and a measuring method of CT saturation testing in an LBS for a smart distribution system.

Paper Details

Session 21

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0004 Presentation 3 (10:50~11:05)

Efficient Energy Managemet System Based on Demand Shifts in Domestic Grid Considering Emission and Tax on Carbon

Mohammad Hossein Fouladfar[1], Amir Baharvandi[2], **Mousa Marzband[3]**, Nagham Saeed[4] and Ameena Saad al-sumaiti[5]
1, Islamic Azad University of Bushehr branch, Iran
2, Shiraz University of Technology, Iran
3, Northumbria University, United Kingdom
4, University of West London, United Kingdom
5, Khalifa University, United Arab Emirates

Abstract — Nowadays, there is a global need for energy management to reduce cost, planet damage and dependence on fossil fuels to save energy. In this paper, we suggest an efficient Energy Management System (EMS) with an emphasis on Demand Response (DR), the planning of generation units in the grid and exchanges between the grid and the upstream network, with the aim of reducing the Market Clearing Price (MCP), Emission Reduction (ER) and consequently reductions of Tax on Carbon (ToC). In the proposed problem, technical and economic constraints include any producer/consumer equipment, as well as the DR, ER, ToC, MCP and grid connection requirements to the main upstream network. To find the best possible solution, Particle Swarm Optimization (PSO) methodology is applied. The obtained results showed a noticeable decrease in MCP and ER by 37% and 55%, respectively.

SP0163 Presentation 4 (11:05~11:20)

Research on switching overvoltage of noload transformer with long cable

Ren Hongtao
Hua Dong Engineering Corporation Limited, China

Abstract — In order to find out the regular and influencing factors of switching overvoltage in the process of power plant grid connection, so as to provide technical basis for the operation mode of switching on no-load transformer with long cable in the later process of power transmission, firstly, the mechanism of overvoltage generated in the process of switching no-load transformer is studied, and its nonlinear working area is calculated based on the actual test data of transformer, and then the equivalent modeling of a 500kV power plant is built up on EMTP (Electro-Magnetic Transient Program), the transient characteristics of overvoltage generated by switching on no-load transformer are simulated. Finally, taking XLPE (Cross linked polyethylene) cable on the high-voltage side of transformer as variable, the influence of XLPE cable on the overvoltage generated by switching no-load transformer is studied, and suggestions for suppression are put forward. The results show that obvious overvoltage of no-load transformer will be produced in the process of power plant grid connection. Under the switching angle 00, the maximum overvoltage can reach 1.69p.u. The length of XLPE cable has no obvious effect on excitation inrush current, but has influence on overvoltage.

Paper Details

Session 21

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0011 Presentation 5 (11:20~11:35)

Permanent Magnet Synchronous Motor Steering Control for Omnidirectional Autonomous Vehicle

Cao Shuyu[1], **Tan Kuan Tak[1]**, Wei Feng[1], Choo Jian Huei[1], Kenneth Sng Eng Kian[1] and Luh Yip-Ping[2]
1, Singapore Institute of Technology, Singapore
2, GTS PLUS Pte. Ltd, China

Abstract — This paper presents a position trajectory control and velocity trajectory feedforward control scheme implemented in the permanent magnet synchronous motor (PMAC) steering servo control for omnidirectional autonomous intelligent vehicles. With this proposed control scheme, smooth and accurate steering motion can be achieved with minimized dynamic acceleration and deceleration current. Depending on the application requirements, the end-users of autonomous vehicles will have the freedom to configure the dynamic performance of the steering servo motion with proper settings of the maximum steering speed and the maximum steering motion acceleration rate.

SP0114 Presentation 6 (11:35~11:50)

Comparative Analysis of Search Algorithm based Loss Minimization Techniques used in Vector Controlled Induction Motors

Hamed Bizhani[1], S.M. Muyeen[2], Fatemeh R. Tatari[3], Fei Gao[4] and Hua Geng[5]
1, University of Zanjan, Iran
2, Curtin University, Australia
3, University of Birjand, Iran
4, University of Technology of Belfort-Montbéliard, France
5, Tsinghua University, China

Abstract — This paper presents a comprehensive study for online loss minimization of induction motor (IM) drives. Each loss minimization algorithm has its advantages and disadvantages. In order to achieve effective conclusion for search algorithm based loss minimization techniques (SABLMTs), a compari-son between five optimization algorithms including the genetic algorithm (GA), particle swarm optimization (PSO), chaotic optimization algorithm (COA), simulated annealing (SA), and imperialist competitive algorithm (ICA) is presented. For this purpose, the induction motor and its loss model considering core loss in the d-q reference frame are used. The optimum magnetization current along with the linkage flux are determined in a way that the induction motor loss is minimized considering different loads. The performance of the online optimization-based vector-controlled IM is analyzed using MATLAB/Simulink software in which the online algorithms are implemented by Embedded Matlab Function block in the Simulink environment. The simulation results show that using the SABLMTs provides better efficiency for IM drives especially in light loads without imposing any undesired effects on the dynamic performance of the IM drives. At the end, to make a proper conclusion, different SABLMTs are compared in terms of the processing time and accuracy.

Paper Details

Session 22

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Thursday)
Time: 10:20~11:35 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Smart Grid Protection"
Session Chair: Prof. Jahangir Hossain

SP0018 Presentation 1 (10:20~10:35)

A Novel Wavelet Aided Probabilistic Generative Model for Fault Detection and Classification of High Voltage Transmission Line

Shahriar Rahman Fahim[1], **Sajal K. Das[1]**, Yeahia Sarker[1], Md. Rafiqul Islam Sheikh[1], Subrata K. Sarker[2] and Dristi Datta[2]
1, Rajshahi University of Engineering & Technology, Bangladesh
2, Varendra University, Bangladesh

Abstract — This paper presents a novel discrete wavelet trans-form (DWT) based probabilistic generative model for fault detection and classification (FDC) of transmission line. The transmission lines frequently experience the number of shunt faults that affects the system stability, damages the load and increases the line restoration cost. Therefore, a robust and precise model is needed to detect and classify the faults for the rapid restoration of faulty phases. In this paper, we propose a deep belief networks (DBN) model for FDC based on discrete wavelet transformation which is made of multiple layers with restricted Boltzmann machine (RBM) that enables the model to learn the probability reconstruction over its inputs. The effectiveness of the proposed DBN is tested by using the number of input signals under various sampling frequencies and obtained results compared with existing methods. Results show that the proposed model is capable to perform precise FDC of transmission line.
Index Terms—Transmission line, Wavelet transform, Super-vised and unsupervised learning and Robust algorithm.

SP0042 Presentation 2 (10:35~10:50)

Cyber Security Risk Analysis and Protection Structure Design for Power Distribution IoT

Chao-qun KANG[1], Lian-jie HE[1], Zi-long HAN[1] and Ye XIA[2]
1, Shanghai energy interaction research institute, China
2, China Electric Power Research Institute, China

Abstract — Power distribution internet of things (IoT) is an integrated product of distribution monitoring system and internet of things. By analyzing the security risks faced by each section in the power distribution IoT, an integrated cyber-security protection structure based on unified key system and unified security monitoring system is constructed. Security protection methods of perception layer, network layer, platform and application layer are proposed. Attacking experiments are realize to demonstrate the effectiveness of the proposed protection structure.

Paper Details

Session 22

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0044 Presentation 3 (10:50~11:05)

Research on Automatic Test System of On-site Relay Protection Device

Ye Xia[1], Wei Li[1], Xiaoli Zhang[1], Chaoqun Kang[2], Hongjun Zhou[3] and Bingtao Zheng[4]
1, China Electric Power Research Institute, Chna
2, Shanghai energy interaction research institute, China
3, Beijing Ponovo Power Co., Ltd, China
4, State Grid Hunan Electric Power Company Limited Hydropower Company, China

Abstract — The local configuration scheme of relay protection has become the trend of substation development in the future. Based on the modular design idea, an automatic test system suitable for on-site relay protection device is developed, so as to realize synchronous closed-loop test for several local protection devices of the same type from different manufacturers. The automatic test system can synchronously modify the setting values, control words and pressing plates of multiple devices. It can synchronously apply excitation to multiple devices to complete the function test of electrical quantity, automatically generate the test report, which greatly shorten the test time of local protection device. At the same time, through the analysis of the data model of the local protection device, the protection function of the tested device configuration is obtained, and the corresponding test cases are generated intelligently, which can highly improve the development efficiency of the test cases. Under the premise of ensuring the reliability of detection, the research results are applied to three sets of local protection devices for synchronous automatic test, which extremely improves the detection efficiency of local protection devices, and it has achieved good results in preliminary application.

SP0109 Presentation 4 (11:05~11:20)

Analysis of Fault Characteristics of Hybrid Multi-terminal HVDC Transmission System

Meng Li, Keao Chen, Jinghan He, Yiping Luo, Xiaojun Wang, Guomin Luo, Dahai Zhang
Beijing Jiaotong University, China

Abstract — Hybrid multi-terminal high-voltage direct current (HVDC) systems have become the most competitive and promising candidate for HVDC system. With the development, a new topology is proposed, whose receiving terminal involves line-commutated converters (LCCs) and modular multi-level converters (MMCs). The analysis of fault characteristics is lacking in this new hybrid multi-terminal HVDC system with complex topology and control strategies. In this paper, a typical topology simulation model of hybrid multi-terminal HVDC transmission system is built in PSCAD/EMTDC. The fault characteristics of hybrid multi-terminal HVDC system are analyzed, which is the basis for the subsequent protection theory research and practical application of engineering.

Paper Details

Session 22

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0141 Presentation 5 (11:20~11:35)

DESIGN, SIMULATION, AND LABORATORY EXPERIMENTS OF HIGH VOLTAGE STRIKE FOR LIGHTNING PROTECTION SYSTEMS ON FISHING BOAT MODEL

Bernard Evan Kanigara and **Harry Prabowo**
Universitas Gadjah Mada, Indonesia

Abstract — Lightning is a natural phenomenon that often happens. When lightning strikes, the power produced is so large that lightning is very dangerous. One area where lightning often strikes is in the sea. This causes the crew who sailed in the middle of the ocean is vulnerable to lightning strikes. To increase the safety of the ship from the effects of the lightning strike, it needs a lightning protection system in accordance with the type of ship. Lightning protection on ships mainly consists of air termination, down conductor, and ground body. So far, studies on ship protection are only available for metal vessels such as cargo ships and warships. Therefore, studies on the design of lightning protection systems that are suitable for traditional boat types are needed. In this study, the lightning protection system was designed using the rolling sphere method. The design results obtained were then tested using software simulations. Based on the simulation results, the design of the lightning protection system was validated using a high voltage strike laboratory experiment. This experiment was carried out using a voltage impulse stroke to a laboratory-scale ship model. From the results of experiments conducted, the rolling sphere method can be used to determine the height of air termination in the fishing boat. In addition, the addition of conductor cables (overhead wires) can expand the protection zone so that it is better at protecting protection objects.

Paper Details

Session 23

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 13:30~15:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Power System Operations and Control 3"
Session Chair: Prof. Somporn Sirisumrannukul

SP0066 Presentation 1 (13:30~13:45)

Utilizing Data Centers for Inertia and Fast Frequency Response Services
Dlzar Al Kez, Aoife Foley, Paul Brogan and D John Morrow
Queen's University Belfast, United Kingdom

Abstract — This research evaluates data centers as an emergency source of virtual inertia and fast frequency response, using PMUs to detect disturbances. The performance of the proposed method is validated by means of a DIgSILENT PowerFactory simulation, calibrated using a real frequency event that occurred on the Irish power system. Wind generation is significant on the Irish system and significantly higher levels are required to reach renewable energy targets. Wind power, like photovoltaics, are mediated by power electronics that do not inherently respond to frequency variation. This research addresses problems with the drop in system inertia and the availability of primary frequency response on systems with high non-synchronous infeed. Demand response has the potential to replace these services. Typically a large number of domestic, or light industrial, loads are considered for such services, but these present challenges in terms of monitoring and control. This research focuses on the potential of large load data centers that incorporate uninterruptable power supplies as standard, therefore a demand response does not have a direct effect on operation.

SP0038 Presentation 2 (13:45~14:00)

On the Key Factors of Frequency Stability in Future Low-Inertia Power Systems
Shiyong Wu[1], Peng Yang[1], Yunfan Zhang[1], Dongxue Gao[2], Chenghao Li[2] and Feng Liu[1]
1, Tsinghua University, China
2, State Grid Henan Electric Power Company, China

Abstract — The integration of high-penetration of renewable generation has caused sustained reduction of system inertia but also create new capability for frequency regulation. The common understanding is the loss of inertia is the main reason why the system frequency stability deteriorates. In this paper, considering swing dynamics with the primary frequency control, we identify the key factors that mostly affect frequency stability through sensitivity analysis on maximum frequency deviation. Surprisingly, we find that the droop coefficient of the primary frequency control has the most significant influence on the frequency response and hence the frequency stability, while the inertia is the least important, which is somewhat opposite to the common sense. Simulations on the simplified Northwest Chinese power system empirically justify our theoretical results well.

Paper Details

Session 23

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0028 Presentation 3 (14:00~14:15)

An Optimal Preventive Maintenance Method for MMC based VSC-HVDC

Chang Yuan[1],Dumeng Dai[1], Junqing Qiu[1], Lu Chen[1], Haitao Qu[2], Junzheng Cao[2]
1, North China Electric Power University, China
2, CEPRI Electric Power Engineering Co. Ltd, China

Abstract — With the wide application of MMC in power system, its maintenance strategy has become an important issue. As time went by, traditional periodical maintenance will put the inverter at risk of downtime, the maintenance cycle of the condition-based-maintenance strategy of MMC will be greatly shortened, which will increase the maintenance cost. The maintenance strategy proposed in this paper finds the optimal cost of each maintenance cycle. Detailed numerical simulations verified the proposed maintenance strategy.

SP0033 Presentation 4 (14:15~14:30)

Credibility Evaluation of the Phase Identification Algothrim Based on Data Analysis in LVDN

Kun Li[1], Yongjun Zhang[1], Wenhui Hong[1] and Thanhtung Ha[2]
1, South China University of Technology, China
2, Thai Nguyen University of Technology, Viet Nam

Abstract — In the low-voltage distribution network, it's hard to know the identification accuracy of the phase identification algorithm. To solve this problem, this paper proposes a credibility evaluation method which can assess the results of phase identification algorithm, based on data analysis, in the low-voltage distribution network. In this paper, we start from the mechanism of the phase identification algorithm based on the data analysis. Then considering the effect of data quality measured by smart meters, we propose five evaluation indicators of credibility including completion of data, completion of valid meters, unbalance of three-phase voltage, obvious users rate and ratio of time to meters. Next, we build the credibility evaluation model of phase identification result based analytic hierarchy process and polynomial fitting. Finally, simulation results using the real meter datasets of two real low-voltage distribution networks in Guangdong, China to demonstrate the performance of our method.

Paper Details

Session 23

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0139 Presentation 5 (14:30~14:45)

Maximum Variation of Asynchronous Generation in Power System Based on Rotational Inertia and Frequency Response

Somboon Nuchprayoon
Chiang Mai University, Thailand

Abstract — This work describes the effect of increasing penetration of asynchronous generation on rotational inertia and frequency response of power system. It is shown that the both system inertia and frequency bias tend to be lower, as the penetration level is higher. Higher variations of frequency are of concern. It is proposed to determine the maximum allowable variation of asynchronous generation, without violating a constraint of frequency deviation. The maximum variation, not the penetration, can be assessed from quantifying system inertia and frequency bias after integrating asynchronous generation into power system. The assessment method is explained and discussed by using an illustrative example.

SP0145 Presentation 6 (14:45~15:00)

Severity Level of An Insulator in Polluted and Dry Conditions based on Ultraviolet Emission

Tumiran[1], Mochammad Wahyudi[1], Noor Akhmad Setiawan[1], Kukuh Pambudi[2] and Dharma Saputra[2]
1, Universitas Gadjah Mada, Indonesia
2, Indonesia Power, Indonesia

Abstract — In this study, the ultraviolet (UV) emitted by partial discharge which occurred on the insulator in polluted and dry conditions was investigated. The UV image and intensity were recorded for 1 minute per voltage variation per pollutant weight variation. The voltage stress was varied until the flashover occurred. The results showed that there was no consistent relationship between pollutant weight and those two UV emission parameters. In addition, the UV intensity consisted of maximum, minimum, and average values because it fluctuated during the recording. There were two UV image patterns that could be identified, namely the scattered points and the concentrated light (forming an area). The greatest the UV intensity, the highest deviation between the maximum and minimum values, and the largest concentrated light pattern were found during a critical condition.

Paper Details

Session 24

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 13:30~15:00 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Wind Energy"
Session Chair: Prof. Md. Rifat Hazari

SP0012 Presentation 1 (13:30~13:45)

Single Line-to-Ground Fault Special Protection Scheme for Integrated WindFarm Transmission Line Using Data Mining

Osaji Emmanuel[1], Mohammad Lutfi Othman[1], Hashim Hizam[1], Muhammad M. Othman[2], Okeke Chidiebere .A[1] and Nwagbara Samuel .O[1]
1, Universiti Putra Malaysia, Malaysia
2, Universiti Teknologi Mara Malaysia Shah Alam, Malaysia

Abstract — The need to solve the protection compromised currently preventing the smooth coexistence of both conventional fossil generation sources and the renewable green wind farm energy resources (WFER) on the same transmission line during a short circuit fault is the motivation for this study as the solution for meeting the pending future energy sustainability problems. The fast rate of global fossil-fuel reserves depletion, price instability, and climatic impact from the greenhouse gas (GHG) emission levels considered. A novel hybrid Wavelet-Machine Learning (W-ML) special protection scheme with the adoption of extracted 1-cycle wavelet decomposed transient fault signals features in Matlab/Simulink. The result from the supervised learning in the Waikato environment for knowledge analysis (WEKA) software indicated the best performance from Nearest-Neighbours (Lazy.IBK) classifier algorithm with 99.86 % classification for single-line-to-ground (SLG) faults, RMS error value of 0.0322 and instantaneous tripping time. The protection compromise is addressed for the effective future network coexistence.

SP0048 Presentation 2 (13:45~14:00)

Model-Free Power Optimization of Wind Farm Based on Nelder-Mead Method

Zhiwei Xu[1], Hua Geng[1] and Bing Chu[2]
1, Tsinghua University, China
2, University of Southampton, United Kingdom

Abstract — Wake effects generated by wind turbines causes the strong wake interactions among turbines and thus significantly lowers the power output of wind farm. However, it is generally difficult to model the interactions between turbines due to its complexity. To mitigate the wake interactions and thus improve the power output of wind farm, this paper proposes a model-free optimization scheme. The power optimization problem of wind farm is divided into several optimization sub-problems according to the power efficiencies of wind farm under different wind directions. Each optimization sub-problem is solved approximately by developed power optimization algorithm based on Nelder-Mead method. Simulation results show that the proposed scheme can quickly and effectively improve the power output of wind farm in complex wind condition without modeling the wake interactions among the turbines.

Paper Details

Session 24

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0050 Presentation 3 (14:00~14:15)

A Multi-Parameter Algorithm for Wind Power Ramp Detection

Danielle Lyners, Hendrik Johannes Vermeulen and Matthew Groch
Stellebosch University, South Africa

Abstract — The amount of wind power capacity being integrated to the grid is increasing as wind turbine technology improves and more importance is placed on mitigating climate change. However, the stochastic nature of wind power poses various technical and economic challenges to power system operators who must ensure that load and generation are instantaneously balanced. A phenomenon in wind power that is of primary concern to the wind power operators is wind power ramp events. It is vital to obtain a better understanding of these events to be able to manage it better. This paper proposes a new ramp detection model to improve upon the state-of-the-art ramp detection models. The aim of the algorithm is to segregate wind power signals into increasing and decreasing ramps to facilitate ramp detection as well as ensure that all possible ramps of varying duration are found. The ramp detection model is applied to measured wind power data of a utility size wind farm to evaluate its performance. Results indicate that the identification of wind power ramps with the segmentation method, correspond to visual ramp identification.

SP0081 Presentation 4 (14:15~14:30)

A Slip Angle Computation Algorithm for Synchronization and Current Control of a Grid-Connected Doubly-Fed Induction Generator

Thanapon Wongyai and Yuttana Kumsuwan*
Chiang Mai University, Thailand

Abstract — In this paper, the computation of a slip position is introduced for the grid-flux oriented control of a grid-connected doubly fed induction generator. For the DC excitation process in the rotor-side converter, the stator voltage is built at the stator terminals, which is related to the shaft speed and magnetizing current. Therefore, the corrected rotor electrical and slip angular speeds are received. Again, for the AC excitation process, the condition of the synchronizing is proposed by checking the slip position between estimated and real slip angles. If it is matching at the zero angles, the DC excitation is changed to the AC excitation with the real slip angle; in addition, the induced stator voltage and frequency are completely synchronized with the utility grid. For the grid-connected operation, the dq-axes rotor currents are also proposed toregulate the grid-flux and to control the electromagnetic torque. To assess the performance of the proposed control algorithm, computer modeling is developed, the simulation results are provided.

Paper Details

Session 24

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0084 Presentation 5 (14:30~14:45)

Pilot Protection for Wind Power Transmission Line Based on Similarity of Time-Frequency Matrix

Liming Zheng[1], Ke Jia[1], Bohan Liu[2] and Jiankang Zhang[3]
1, State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources (North China Electric Power University), China
2, State Grid AC Project Construction Co. Ltd., China
3, Northwest Branch of State Grid Corporation of China, China

Abstract — The fault characteristics of wind power converter have an adverse effect on conventional protection. According to the analysis of the fault characteristics, a novel pilot protection based on the similarity of time-frequency matrix is proposed. The detailed model of grid-connected wind farm is built in real time digital simulator (RTDS) with external control devices. The simulation results verify the effectiveness of the proposed method. The proposed protection has the characteristics of high speed and high reliability. The proposed method also has good robustness in the case of fault resistance.

SP0092 Presentation 6 (14:45~15:00)

Multi-Objective Optimal Reactive Power Dispatch Considering Probabilistic Load Demand Along with Wind and Solar Power Integration

M.U. Keerio, **Aamir Ali**, Muhammad Saleem, Noor Hussain and Riaz Hussain
Quaid-E-Awam University of Engineering Science and Technology, Pakistan

Abstract — Fast growing of uncertain renewable energy sources (RES) in power system results difficult to control reactive power. The purpose of optimal reactive power dispatch (ORPD) is to find the appropriate values of PV bus voltages, transformer tapings and shunt var compensation. For the solution to ORPD two conflicting objective functions, active power loss and voltage deviation are minimized simultaneously. Because of the stochastic behavior of wind and solar power generation, appropriate probability distribution functions are considered to model them with Monte-Carlo simulation technique. Solution to multi-objective ORPD (MO-ORPD) problem, NSGA-II along with constraint technique is proposed. Furthermore, IEEE standard 30-bus system is adopted to find the superiority and effectiveness of NSGA-II. Two study cases such as deterministic and stochastic (scenario-based) are considered to analyze the simulation results. The obtained simulation results show that the proposed algorithm has the ability to find the global optimal solution in all the scenarios.

Paper Details

Session 25

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 15:20~16:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Energy Storage System"
Session Chair: Prof. MD Shouquat Hossain

SP0022 Presentation 1 (15:20~15:35)

Research on High-Efficiency Battery Charge Regulator Based on Superbuck Topology

Zhang Guo-shuai, Wu Jian-chao, Zhao Wen-jie, Zhi Shu-bo, Zheng Yan and Wan Cheng-an
Beijing Spacecraft, China Aerospace Science and Technology Corporation

Abstract — From the perspective of the space power conditioning unit(PCU) system, this paper studies the battery charging controller based on the Superbuck topology and the characteristics of lithium-ion batteries. We analysis the operating mode of the converter, establish the model of the converter, then we analysis the battery charge control circuit, finally we carry out the simulation and experimental result.

SP0029 Presentation 2 (15:35~15:50)

Control and Sizing of a Hybrid Battery and Compressed Air Energy Storage system

Phaisan Omsin, Suleiman M. Sharkh and Mohamed Moshrefi-Torbati
University of Southampton, UK

Abstract — This paper discusses the sizing and control of a hybrid energy storage system comprising a battery and a compressed air energy storage (CAES) system. The CAES system is connected to the load through a boost converter that controls the air motor's speed to achieve maximum power point tracking (MPPT). A bidirectional converter is used to connect a battery to the load and maintain the output voltage constant. The air motor and battery sizes are estimated for a typical house in the Southern region of the UK. The battery is sized to buffer load fluctuations. All system models have been simulated using MATLAB/Simulink. Two scenarios are considered: a CAES only system controlled in constant voltage mode and a hybrid system comprising CAES with an MPPT controller and a battery with a voltage controller. The results demonstrate that the power rate of air motor is estimated properly by considering the difference between the generated power and demand power. The power difference called energy deficit is used to size the battery. The performance of CAES system is improved by hybridizing with a battery; the system maintains constant voltage when the CAES operates at maximum power point (MPP). The air motor in hybrid system controlled in MPPT mode has approximately 47% greater efficiency than that of air motor controlled in voltage mode.

Paper Details

Session 25

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0167 Presentation 3 (15:50~16:05)

Novel Sizing Method of Energy Storage System Considering Intermitant Usage of EVs in a Constrained Grid

U.B. Irshad[1], S. Rafique[1], M.J. Hossain[2], S.C. Mukhopadhyay[1]
1, Macquarie University, Australia
2, UTS, Australia

Abstract — Charging of electric vehicles (EVs) significantly impact the reliability of the power system. A constrained power grid is a feasible solution to maintain the reliability of the power system. However, in a constrained power grid, it is challenging for the parking lot operator to balance the additional load. The fast and high-power density of batteries makes them a conceivable option for this task if adequately sized. A sizing algorithm is proposed to compute the battery capacity for parking lots while considering the intermittent usage of EVs in a constrained grid. Charging profile of EVs is constructed by considering travel pattern, charging need and driver's behaviour of EVs. The proposed sizing algorithm avoided over/under-sizing of the battery energy storage system and fulfilled the EV charging demand in the parking lot. The accuracy of the proposed battery sizing algorithm is shown by simulation results, characterized by real data of household travel survey and parking occupancy data.

SP0155 Presentation 4 (16:05~16:20)

Power System Performance Enhancement using Superconducting Magnetic Energy Storage unit and Proportional Integral Derivative Control

Luky Handayani[1], A. Abu-Siada[2], Suwarno[1], Nanang Hariyanto[1] and Muhammad Ruswandi Djalal[3]
1, Institut Teknologi Bandung, Indonesia
2, Curtin University, Australia
3, Politeknik Negeri Ujung Pandang, Indonesia

Abstract — Frequency oscillations in power systems may occur due to sudden load change or system disturbance. Such oscillations may result in unsynchronized and undamped signals. In a multi machine system where all generators must operate in synchronism, undamped oscillations may lead to instability. To overcome this issue, this paper proposes a damping control scheme consisting of Superconducting Magnetic Energy Storage (SMES) and Proportional Integral Differential (PID) controller to effectively damp frequency oscillations in multi-machine systems. Control parameters of the proposed SMES-PID system are tuned using Particle Swarm Optimization (PSO) algorithm. Simulation results reveal the effectiveness of the proposed controller in damping the frequency oscillations and maintain system dynamic and transient stability during various disturbance events. It is shown the design can find better quality solution in minimizing overshoot at frequency variations up to 78 % and accelerating the settling time up to 67 %.

Paper Details

Session 25

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0062 Presentation 5 (16:20~16:35)

Developing a framework for a retail electricity model incorporating energy storage

Neil McIlwaine[1], Aoife Foley[1], D. John Morrow[1], Chongyu Zhang[2] and Xi Lu[2]
1, Queen's University Belfast, United Kingdom
2, Tsinghua University, China

Abstract — Embedded generation at the distribution level is an untapped source of voltage, frequency regulation and inertia services for the most part. The distribution level has historically been associated with the delivery of energy sourced from the transmission system via a wholesale electricity market. Due to the growth of embedded generation at the distribution level this flow is changing as solar and wind generation, electric vehicles, heat pumps and demand response activity via smart appliances and storage technologies develop. Therefore it is very important to integrate the retail market and distribution grid operations to optimize energy flows economically and achieve environmental targets. Therefore, at the distribution level, system modeling is required to qualify, quantify and value the installation of embedded energy storage. The aim of this paper is to establish a retail market framework to integrate embedded generation at the grid distribution level to avail of these untapped services.

SP0160 Presentation 6 (16:35~16:50)

Optimization configuration method of industrial user-side energy storage

Ze Wang, Jianbing Yang, Xinhui Du, Yongguang Li and Haotian Su
Taiyuan University of Technology, China

Abstract — Aiming at the punishment problem of large industrial users who exceed the maximum demand under the condition of demand electricity price, an optimal configuration model of user-side energy storage system based on the two-layer decision is proposed. Under the condition of the maximum demand billing in the two-part electricity price, the objective function of the outer layer of the model is the total cost of the energy storage system in the life cycle of the energy storage medium, taking into account the cost of electricity price, energy storage battery and related equipment costs, etc. Factors to obtain the configuration results of energy storage capacity and maximum demand; the inner objective function is the cost of daily electricity consumption by users, and the optimal daily combined load curve is obtained. Through numerical simulation, using quantum genetic algorithm and YALMIP toolbox to optimize the two-layer decision model, the capacity configuration, economy and performance of lithium battery and lead-acid battery are compared, and the validity of the model is verified.

Paper Details

Session 26

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 15:20~16:50 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Power System Operations and Control 4"
Session Chair: Dr. Dlzar Al Kez

SP0005 Presentation 1 (15:20~15:35)

Identifying Optimal Parameters of Proton Exchange Membrane Fuel Cell Using Water Cycle Algorithm

Hamdy M. Sultan[1], **Ahmed S. Menesy[1]**, Salah Kamel[2], Hany M. Hasanien[3], and Ahmed Al-Durra[4]
1, Minia University, Egypt
2, Aswan University, Egypt
3, Ain Shams University, Egypt
4, Khalifa University of Science & Technology, U.A.E.

Abstract — In this paper, the application of Water Cycle Algorithm (WCA) is proposed to solve the optimization problem of estimating the unknown parameters of Proton Exchange Membrane Fuel Cell (PEMFC) model. The effectiveness of WCA is validated using two different commercial FC stacks. In addition, statistical analysis based on different metrics has been conducted to validate the goodness and stability of developed algorithm in solving the optimization problem. The results obtained from the WCA are compared with those obtained by other optimization techniques tackled with the same FC stacks. Moreover, the accuracy of optimized parameters is proved by the dynamic performance of PEMFC stacks under different operating scenarios of cell temperature and reactants' pressures. The obtained results show the effectiveness of developed algorithm as a competitor to other recent optimization techniques in extracting the parameters of PEMFC stacks.

SP0071 Presentation 3 (15:50~16:05)

Lightning Overvoltage Analysis of a 380 kV Gas Insulated Substation using PSCAD/EMTDC

Saad Abdul Basit[1], Chokri Belhaj Ahmed[1], Firoz Ahmad[1] and Mohammed Arif[2]
1, King Fahd University of Petroleum & Minerals, Saudi Arabia
2, Research Engineer III at Research Institute (RI), Saudi Arabia

Abstract — Insulation Coordination is a critical part in the design of high voltage systems. In this paper, lightning overvoltage analysis of a real 380 kV gas insulated substation was performed using PSCAD/EMTDC to verify the insulation design and to investigate the adequacy and location of surge arrester. In lightning overvoltage analysis, direct stroke and back flashover phenomena were considered and each were investigated for two different scenarios. The simulation shows that the substation was well protected from lightning. However, the study also shows that removal of the surge arrester from the power transformers and the shunt rector did not cause insulation limit violations.

Paper Details

Session 26

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0031 Presentation 2 (15:35~15:50)

Household Phase Identification in Low-voltage Distribution Network Considering Vacancy Rate

Lai Zhou[1], Yongjun Zhang[1], Wenhui Hong[1], Jie Tang[2] and Thanhtung Ha[3]
1, South China University of Technology, China
2, Guangdong Power Grid Corporation
3, Thai Nguyen University of Technology, Viet Nam

Abstract — Accurate household phase connectivity is the foundation of outage response, residential demand response, and load balance in the low-voltage distribution network (LVDN). In this paper, considering vacancy rate, an innovative household phase identification (HPI) algorithm based on multiple data obtained from meters in households and distribution transformer is proposed. Firstly, a household classification method based on voltage profile correlation analysis is proposed to deal with the vacant user problem. Then, a quadratic programming model based on the node current law is established to identify households' phase, in which the phase connectivity relationship of the household is designed as the optimization variable. The proposed algorithm is applied on a real-world LVDN in Guangdong. The results indicate that the proposed method effectively increases HPI accuracy compared with the 0-1 integer programming method when there are vacancy rate and measurement error problems in LVDN.

SP0154 Presentation 4 (16:05~16:20)

An Autonomous DG Controller Using Artificial Intelligence Approach for Voltage Regulation

Saifullah Shafiq[1], Bilal Khan[2], and Ali Taleb Al-Awami[2,3]
1, Prince Mohammad Bin Fahd University (PMU), Saudi Arabia
2, King Fahd University of Petroleum & Minerals (KFUPM), Saudi Arabia
3, Researcher at K. A. CARE Energy Research & Innovation Center at Dhahran, Saudi Arabia

Abstract — Most recently, solar photovoltaics (PVs) have gained the significant attention due to the considerable reduction in their manufacturing costs as well as the substantial advancements in power electronic converters. However, the widespread integration of rooftop PVs may arise several challenges, such as over-voltages and frequent tap operations. A proper control strategy is required to mitigate these issues. In this paper, a machine learning-based autonomous distributed generator (DG) control is proposed. The controller takes local measurements such as nodal voltage and its sensitivity to changes in load and/or power, and determines the power cap. The controller is trained on different loading conditions to incorporate daily, monthly, and yearly load variations. Simulation results show that the proposed controller effectively regulates the system voltages as defined by the ANSI C84.1-2016 standard. Moreover, it ensures the fairness among the DGs available at different locations in the distribution system without the need of any communication infrastructure.

Paper Details

Session 26

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0156 Presentation 5 (16:20~16:35)

Optimal Tuning of Unified Power Flow Controller Using Firefly Algorithm to Improve Damping of Inter-Area Oscillations in Multi-Machine System

Rathy Shinta Utami[1], Ahmed Abu Siada[2], Suwarno Suwarno[1], Nanang Hariyanto[1], Muhammad Ruswandi Djalal[3] and Joko Hartono[4]
1, Institut Teknologi Bandung, Indonesia
2, Curtin University, Australia
3, Politeknik Negeri Ujung Pandang, Indonesia
4, PT PLN Research Institute, Indonesia

Abstract — The interconnection system faces inter-area oscillation challenges that affect power system stability. Conventional Power System Stabilizer (PSS) cannot provide effective damping to the inter-area oscillations. This paper deals with a Proportional Integral (PI) controller as a damping control scheme of the Unified Power Flow Controller (UPFC) to improve the damping of inter-area oscillation in a multi-machine system. The proposed PI Controller-based UPFC is tuned using the Firefly Algorithm (FA), and the performance is compared with PSS. Simulation results show that the proposed PI Controller-based UPFC provides a better stability margin than PSS under the different conditions and effectively reduces the overshoot by 53%, accelerating the settling time by 74%, and minimizing area graph by 85%.

SP0158 Presentation 6 (16:35~16:50)

Motivational Game-Theory P2P Energy Trading: A Case Study in Malaysia

Yu Hang Yap[1], Jinnie Wong[1], Wen-Shan Tan[1], Noor Azlinda Ahmad[2], Chin-Leong Wooi[3] and Yuan-Kang Wu[4]
1, Monash University Malaysia, Malaysia
2, Universiti Teknologi Malaysia, Malaysia
3, Universiti Malaysia Perlis, Malaysia
4, National Chung-Cheng University

Abstract — Peer-to-peer (P2P) energy trading allows surplus energy to be traded between distributed energy resources (DER) and prosumers in the community microgrid. In Malaysia, P2P energy trading is still under development, where it is expected to be exclusively participated by commercial and industrial prosumers. This paper proposes how a motivational psychology framework can be used effectively to design P2P energy trading to increase user participation for residential prosumer. All the data such as power consumption and solar energy value are adjusted and modelled in such a way to facilitate the calculation of P2P energy trading in Malaysia. An auction-based P2P market clearing model is then proposed and solved by using the Linear Programming optimization approach. The numerical results show the sustainability and the potential of the proposed P2P energy trading model to attract residential customers to participate in energy trading.

Paper Details

Session 27

Tips: To avoid missing your presentation,
we strongly suggest that you attend the whole session.

Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 17:00~18:15**(Thailand Time)**
ZOOM Link: https://zoom.us/j/69110736851
Topic: "Power System Operations and Control 5"
Session Chair: Prof. Ahmed Al-Durra

SP0137 Presentation 1 (17:00~17:15)

Influence analysis of electricity price mechanisms on CCHP investment and operation planning

Yansong Liu[1], Feng Zhu[1], Jingqi Fu[1] and Bin Zou[1,2]
1, Shanghai University, China
2, Shanghai Key Laboratory of Power Plant Technology, China

Abstract — Electricity price mechanism has an important influence on the operation and investment planning of CCHP under the non-island operation. Based on the MILP model for CCHP, this paper studies the impact of the various electricity price mechanisms, such as fixed tariff, time-of-use tariff, two-part tariff and its combination, on the investment and operation planning of CCHP, as well as on the characteristics of power exchange between CCHP and distribution network. Based on the actual load of a hospital in Shanghai, the research shows that time-of-use price mechanism can significantly reduce the investment and operation cost of CCHP, improve primary energy efficiency, and guide CCHP to participate in peak load shifting. If two-part tariff with TOU is adopted, the power exchange characteristics between CCHP and grid, as well as the economic indexes of the investment and operation planning of CCHP, can be further improved while ensuring the income of the grid.

SP0015 Presentation 2 (17:15~17:30)

Mitigation of Oscillations in SMIB using a Novel Farmland Fertility Optimization based PIDPSS

Aliyu Sabo, **Noor Izzri Abdul Wahab,** Mohammad Lutfi Othman and Mai Zurwatul Ahlam Mohd Jaffar
University Putra Malaysia, Malaysia

Abstract — In this study, the design of proportional integral derivative (PID) PSS (PIDPSS) is proposed for damping oscillations in single machine infinite bus (SMIB) power system in MATLAB/SIMULINK. A new metaheuristics method called Farmland Fertility Algorithm (FFA) inspired by nature is proposed to optimize the PIDPSS parameters via minimizing robust time domain performance indices called Integral of Squared Time multiplied by Squared Error (ISTSE) objective function. The robustness of the ISTSE index was tested by comparing it with four common time integral indices, also, the FFA PIDPSS was compare with Conventional PIDPSS (CPIDPSS) and Invasive Weed Optimization (IWO) algorithm for plausible application in. The phasor simulation results shows that the proposed ISTSE, the speed deviation SMIB transient response in terms of rise time, settling time, peak time were all remarkably improved by an amount of 35.16%, 40.57%, 77.1% and 1% respectively by the proposed FFA method compare to the IWO method.

Paper Details

Session 27

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0026 Presentation 3 (17:30~17:45)

Analytical Approaches on Optimal Placement of STATCOM under Contingency Occasions

Bazilah Ismail[1], **Noor Izzri Abdul Wahab**[2], Mohammad Lutfi Othman[2], Mohd Amran Mohd Radzi[2], Kanendra Naidu Vijayakumar[1] and Muhammad Najwan Mat Naain[1]
1, Universiti Kuala Lumpur British Malaysian Institute, Malaysia
2, Universiti Putra Malaysia, Malaysia

Abstract — Charging of electric vehicles (EVs) significantly impact the reliability of the power system. A constrained power grid is a feasible solution to maintain the reliability of the power system. However, in a constrained power grid, it is challenging for the parking lot operator to balance the additional load. The fast and high-power density of batteries makes them a conceivable option for this task if adequately sized. A sizing algorithm is proposed to compute the battery capacity for parking lots while considering the intermittent usage of EVs in a constrained grid. Charging profile of EVs is constructed by considering travel pattern, charging need and driver's behaviour of EVs. The proposed sizing algorithm avoided over/under-sizing of the battery energy storage system and fulfilled the EV charging demand in the parking lot. The accuracy of the proposed battery sizing algorithm is shown by simulation results, characterized by real data of household travel survey and parking occupancy data.

SP0169 Presentation 4 (17:45~18:00)

Optimal Sequential Distribution Planning for Low Voltage Network with Electric Vehicle Loads

Surasit Sangob and Somporn Sirisumrannukul
King Mongkut's University of Technology North Bangkok, Thailand

Abstract — This paper develops a particle swarm optimization-based methodology for low voltage distribution system planning to support the extensive use of electric vehicles. The entry of electric vehicles unavoidably alters load profile, therefore affecting the voltage of customer load points and capacity loading of the distribution feeders and distribution transformers. The system reinforcement to accommodate the increased EV loads can be achieved by yearly sequential decision making, given updated information of the locations and amount of EV loads. The individual load profile can be simulated by a Monte Carlo Simulation. The objective function is to minimize the total cost associated with installing and dismantling control devices and energy loss over a planning period. The proposed methodology was tested with a 30-bus system. The results show that the optimal yearly schedule can keep the voltage profile and feeder and transformer loading within acceptable operating limits while minimizing the system total cost.

Paper Details

Session 27

ZOOM Link: https://zoom.us/j/69110736851

Oral Presentation Abstracts
Day 4-Sep. 18

SP0058 Presentation 5 (18:00~18:15)

Load Flow Analysis using Intelligence-based Hopfield Neural Network for Voltage Stability Assessment

Veerapandiyan Veerasamy[1], **Noor Izzri Abdul Wahab**[1], Rajeswari Ramachandran[2], Mohammad Lutfi Othman[1], Hashim Hizam[1], Mohammad Zohrul Islam[1], Mohamad Nasrun Mohd Nasir[1] and Andrew Xavier Irudayaraj[1]

1, Universiti Putra Malaysia (UPM), Malaysia, Malaysia

2, Government College of Technology, India

Abstract — This paper presents a novel intelligence-based recurrent Hopfield Neural Network for solving the non-linear power flow equations. The proffered method is an energy function-based approach formulated using the power residuals of the system. The dynamics associated with the neural networks are minimized by intelligence-based technique to determine the unknown parameters such as voltage magnitude and phase angle of the system. A hybrid Particle Swarm Optimization-Gravitational Search Algorithm has been used to minimize these dynamics and the stability of the solution is proved in Lyapunov sense. The effectiveness of method is tested in IEEE 14-bus system and the results obtained are compared to the conventional Newton Raphson method. Moreover, the stability indices such as Voltage Stability Load Index, Line stability index, Fast Voltage Stability Index and Line stability factor pertaining to the assessment of stability under various contingency cases such as N-1 and N-1-1 are evaluated to assess the stability.

Paper Details

Session 28

Tips: To avoid missing your presentation,
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Oral Presentation Abstracts
Day 4-Sep. 18

Morning, September 18, 2020 (Friday)
Time: 17:00~18:15 **(Thailand Time)**
ZOOM Link: https://zoom.us/j/68592956837
Topic: "Power System Operation and Control 6"
Session Chair: Dr. Dlzar Al Kez

SP0043 Presentation 1 (17:00~17:15)

Electric Vehicles and Batteries as Domestic Storage Units in the United Kingdom

Sinan Kufeoglu and Donato Melchiorre
University of Cambridge, United Kingdom

Abstract — This paper assesses the economic feasibility of Vehicle-to-Home (V2H) and domestic battery systems in the United Kingdom (UK). To do the analysis, a UK average Electric Vehicle (EV) and domestic battery have been established; called UKEV and UKBat respectively. The UKEV characteristics were determined by taking a weighted average from the five highest selling EVs in the UK. An arithmetic mean was found for the individual UKBat features from seven models available on the UK market. The UKEV and UKBat were compared under four scenarios. These are Ofgem's two domestic electricity profile classes (PC1, PC2) and two existing time-of-use tariffs; one with two and the other with three rates during a day. Maximum annual saving for the consumer was estimated to be around 35% and 57% per annual electricity bill for the EV and battery, respectively.

SP0095 Presentation 2 (17:15~17:30)

The effect of inner secondary air on the flow field of a swirl burner

Weiliang Wang[1], Qian Wang[1], Junfu Lyu[2], Min Liu[1], Guangxi Yue[2] and Jizhen Liu[3]
1, Jinan University, China
2, Tsinghua University, China
3, North China Electric Power University, China

Abstract — Swirl burner is widely used for coal combustion in boilers. In many swirl burners, the secondary air is divided into two branches, namely inner secondary air (ISA) and outer secondary air (OSA). This paper presents a thorough study on the affecting mechanism of the ISA on the burner flow field via a cold state experiment and a hot state simulation. It is found that, the variation of ISA blade angle has a broad influence on the flow field. As the ISA blade angle increases, the ISA could be mixed earlier with the primary air, which benefits the air stage combustion; besides, its stronger annular jet flow stiffness is good for the entrainment of primary air. The increment of ISA blade angle also increases the annular jet flow stiffness, reduces the main flame recirculation (MFR), and might also move its away from the burner exit in some extent.

Paper Details

Session 28

ZOOM Link: https://zoom.us/j/68592956837

Oral Presentation Abstracts
Day 4-Sep. 18

SP0143 Presentation 3 (17:30~17:45)

Demand Response in Smart Grid – A Systematic Mapping Study

S M Shahnewaz Siddiquee[1], Bianca Howard[2], Ken Bruton[1] and Dominic T. J. O'Sullivan[1]
1, University College Cork, Ireland
2, Loughborough University, United Kingdom

Abstract — Growing demand for electricity and the innovations in smart grid technologies is providing new opportunities for intelligent electrical demand loads control in the form of Demand Response (DR). In this paper, we present a comprehensive review of demand response by conducting a systematic mapping of the field to evaluate the current research trends, knowledge gaps, and the scope of future research of DR in the smart grid applications. Bibliometric analysis has been done to map the research themes under the demand response domain by analyzing the co-relationships in the metadata originated from the SCOPUS database. Thorough content analysis has also been performed, and six emerging research themes have been identified along with fundamental research questions commonly addressed to devise future research directions.

SP0119 Presentation 4 (17:45~18:00)

Development of Biomass-fueled Cogeneration Systems for Off-grid Electrification: Considering the Case of Haida Gwaii Canada

Mohammad Ali Bagherian[1], Kamyar Mehranzamir[1], Hadi Nabipour[2], Marwan Nafea[3], Chin-Leong Wooi[4] and Jubaer Ahmed[5]
1, Nottingham University Malaysia, Malaysia
2, Swinburne University of Technology Sarawak, Malaysia
3, University of Nottingham Malaysia, Malaysia
4, Universiti Malaysia Perlis, Malaysia
5, Swinburne University of Technology, Malaysia

Abstract — Over the past centuries, mankind has revolutionized the world by extracting and utilizing fossil fuels hoping for a better and modernized future. Though considered as the black gold, their extensive consumption started to underpin the growing knowledge and acceptance of the negative effects of our carbon society and its likely demise. In recent time, with development of efficient prime movers and possible utilization of renewable energy resources (RES) for both power and heat production, the concept of cogeneration has emerged and gained considerable attention. Accordingly, this comparative research elaborates on utilization of the most available and versatile RES, bioenergy, in this innovative and efficient technology. In this context, four different biomass-fueled configurations are developed for the purpose of electrifying the Masset village in Canada. Two well-known methods of: Direct Combustion and Gasification are considered in the model development. Further, a comparative conclusion of all methods is drawn from economic perspective.

SP0170 Presentation 5 (18:00~18:15)

Research on the Influence of Vibration Response of Permanent Magnet Motor under Harmonic Current

Jianmin Du, Zhanyang Yu, Yan Li and Jiakuan Xia
Shenyang University of Technology, China

Abstract — Due to the function of chopper circuit of frequency converter, the harmonic current will be produced in the process of inverter. This paper mainly studies the influence of harmonic current with different order and amplitude on the vibration response of permanent magnet synchronous motor. First of all, based on the current waveform under variable frequency power supply, combined with theoretical analysis, the order harmonics are determined. Secondly, the harmonic current injection method is used to analyze the influence of low order harmonic current on the vibration response of the motor. The simulation results show that the low order harmonic current can reduce the vibration response of the motor to a certain extent. Finally, the accuracy of the vibration calculation method is verified by the vibration test of an experimental prototype.

SP0017 Presentation 6 (18:15~18:30)

Method for identifying PMU bad data based on Long Short-Term Memory Network

Wen Xiong[1], Li Wang[1], Renbo Wu[1], Zhiwei Yang[2], Hao Liu[2] and Tianshu Bi[2]
1. Guangdong Power Grid Co., Ltd., China
2. North China Electric Power University, China

Abstract — Phasor measurement units (PMUs) have become one of the most effective tools for state awareness of power systems. However, the complex environment caused PMU data to have quality problems such as data loss, which seriously affected its applications in power systems. This paper proposes a method for identifying PMU bad data based on long short-term memory (LSTM) network. First, the advantages of LSTM in bad data identification are analyzed. Based on the advantages, a two-layer network is constructed, and a decomposition and reconstruction method for original data is proposed. On this basis, two objective functions are defined, and different error characteristics are obtained. A method for determining the threshold of bad data based on decision tree is proposed to realize the identification of bad data. The results by simulations and field data verified PMU data quality is improved, making it better applied to all aspects of the power system.

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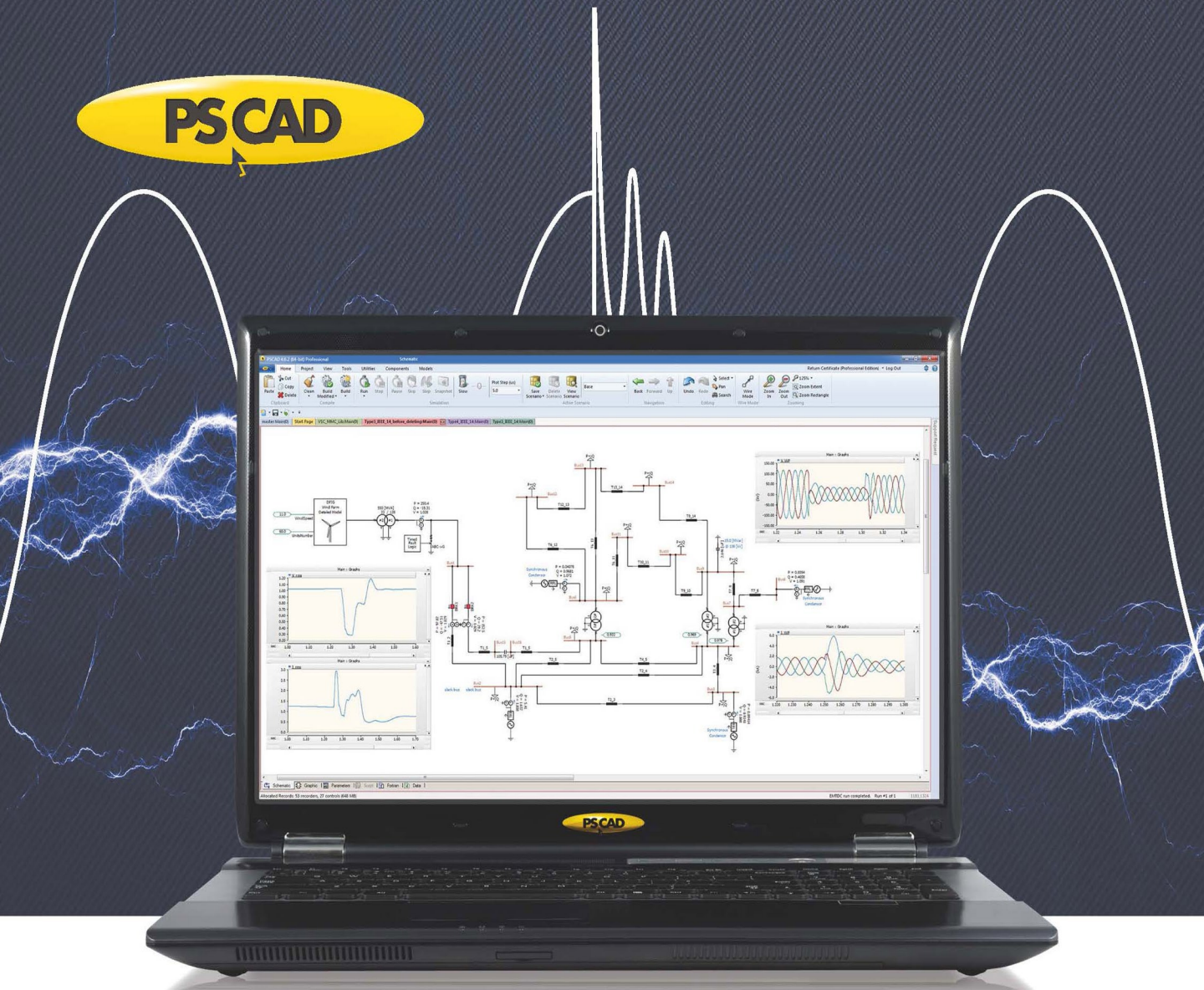

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Keynote session

The Energy Resilience Leadership Opportunity

Time: **16 Sept. 11:00am-12:00pm**
Speaker: **Paul Roege**

Session will cover:

- Electrical power systems around the world
- Models to meet energy needs in developing communities
- Digitalization of power
- Key foundations of resilience
- Energy democratization

Tutorial session

Real-time Simulation and Digital Control of Grid-Tied Inverters: A Test-Driven Approach

Time: **15 Sept. 10:20am-11:50am**
Speaker: **Fernanda de Morais Carnielutti**

Session will cover:

- Design and simulation of synchronization algorithms
- Design and simulation of current controllers
- Stability under strong and weak grid and controller interactions
- Test-driven design
- Controller benchmarking

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- 16 Sept. 2:30pm-2:45pm
- 17 Sept. 3:00pm-3:20pm
- 18 Sept. 3:00pm-3:20pm

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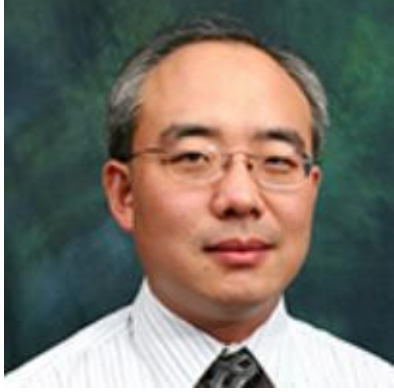

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