

# PEDG2023

## The 2023 IEEE 14th International Symposium on Power Electronics for Distributed Generation Systems (PEDG 2023)

Shanghai, China  
June 9-12, 2023

Sponsored by



Organized by



上海交通大学  
SHANGHAI JIAO TONG UNIVERSITY



# PEDG 2023 PARTNERS

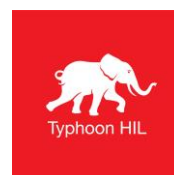
## Gold Sponsors



## Silver Sponsors



## Friendly Sponsors



## Exhibitor



# TABLE OF CONTENTS

Welcome to PEDG 2023 .....	1
Conference Committee .....	2
Social Events .....	4
Conference Venue .....	5
Guidelines .....	7
Conference Agenda Overview (June 9, 2023) .....	8
Conference Agenda Overview (June 10, 2023) .....	9
Conference Agenda Overview (June 11, 2023) .....	10
Conference Agenda Overview (June 12, 2023) .....	11
Keynote Speakers .....	12
Tutorials .....	22
Industry Sessions .....	30
Technical Sessions .....	32
Special Sessions .....	41
Poster Sessions .....	50
MEMO .....	59



# Welcome to PEDG 2023

Welcome to the IEEE 14th International Symposium on Power Electronics for Distributed Generation Systems (PEDG 2023) during June 9-12, 2023 in Shanghai, this is the 3rd time that China hosts this exciting event. Sponsored by IEEE Power Electronics Society, PEDG 2023 is hosted by Shanghai Jiao Tong University. This symposium will provide a professional platform for knowledge exchanging and social networking in the field of power electronics, renewable energies and distributed generations.

Many countries including China have set ambitious goals to achieve carbon neutrality, imposing many new challenges and opportunities that need to be discussed. The technical program of PEDG 2023 covers 8 tutorials, 10 plenary keynote speeches distributed in three days, 9 specially organized sessions, 2 industry sessions, 9 technical sessions and 2 poster sessions. More than 200 registrations from 9 countries have been received.

After a long break of COVID, PEDG 2023 is dedicated to providing more face-to-face social occasions, including a welcome reception, a Young Professional and Women-in-Engineering (YP+WIE) event on Friday evening; a Gala dinner on Saturday evening; a technical tour to the world 1st 35kV superconducting cable transmission project on Sunday afternoon; and a beer social event on Sunday evening.

We would like to express our gratitude to the members of the PEDG 2023 Organizing Committee and all participants for the great PEDG 2023. It is an honor to welcome you as guests to experience the dynamic and diversity in Shanghai.

## Conference Committee



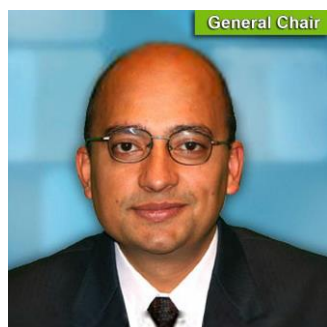
**Xu Cai**  
(Local Organizer)

Shanghai Jiao Tong University, China



**Ke Ma**  
(Local Organizer)

Shanghai Jiao Tong University, China



**Sudip K. Mazumder**

University of Illinois Chicago, USA



**Marco Liserre**

Kiel University, Germany

### Steering Committee

- Juan C. Balda, University of Arkansas, USA
- Frede Blaabjerg, Aalborg University, Denmark
- Liuchen Chang, University of New Brunswick, Canada
- Mark Dehong Xu, Zhejiang University, China
- Rik W. DeDoncker, RWTH Aachen University, Germany
- Deepak Divan, Georgia Tech, USA
- Johan Enslin, Clemson University, USA
- Gerard Hurley, National Univ. of Ireland Galway, Ireland
- Fred C. Lee, Virginia Tech, USA
- Jinjun Liu, Xi'an Jiaotong University, China
- Leo Lorenz, Center of Power Elect., Germany
- Denizar Cruz Martins, Federal Univ. of Santa Catarina, Brazil
- Sudip K. Mazumder, Univ. of Illinois Chicago, USA
- Martin Ordonez, University of British Columbia, Canada
- Don Tan, E2 Systems, USA
- Željko Jakopović, University of Zagreb, Croatia
- Marco Liserre, Kiel University, Germany
- Tianhao Tang, Shanghai Maritime University, China (Local)

# Organization Committee

## Technical Program

- Kai Sun, Tsinghua University, China
- Hong Li, Beijing Jiaotong University, China
- Yanan Chen, Zhejiang University, China
- Chen Zhang, Shanghai Jiao Tong University, China
- Fei Gao, Shanghai Jiao Tong University, China
- Zian Qin, TU Delft, Netherlands
- Georgios Konstantinou, University of New South Wales, Australia
- Giampaolo Buticchi, University of Nottingham Ningbo, China
- Ariya Sangwongwanich, Aalborg University, Denmark

## Special Session

- Laili Wang, Xi'an Jiaotong University, China
- Chao Wu, Shanghai Jiao Tong University, China
- Hengzhao Yang, ShanghaiTech University, China

## Tutorial

- Yongheng Yang, Zhejiang University, China
- Dong Jiang, Huazhong University of Science and Technology, China
- Ming Liu, Shanghai Jiao Tong University, China

## Publication

- Jing Lyu, Shanghai Jiao Tong University, China

## Finance

- Hao Hua, Shanghai Jiao Tong University, China

## Local & Student Activities

- Fei Wang, Shanghai University, China
- Miao Zhu, Shanghai Jiao Tong University, China
- Chen Xu, Shanghai University, China
- Rui Li, Shanghai Jiao Tong University, China
- Gang Shi, Shanghai Jiao Tong University, China
- Han Wang, Shanghai Jiao Tong University, China
- Minfan Fu, ShanghaiTech University, China

## Social Events

### Welcome Reception

**Time** Friday, June 9, 2023, 17:30-18:45

**Venue** 3F / Riverview 1+2

### Young Professionals & Women in Engineering Reception

\* 50 seats limited; pre-registration confirmation needed

**Time** Friday, June 9, 2023, 19:00-21:00

**Venue** Villa 9

### 'Ginlong' Gala Dinner

**Time** Saturday, June 10, 2023, 18:30-20:30

**Venue** 2F / Grand Ballroom

### Industry Site Tour

\* 60 seats limited; pre-registration confirmation needed

**Time** Sunday, June 11, 2023, 13:30-16:00

**Venue** No. 60 Qinzhou North Road, Xuhui District, Shanghai

**Activity** The World's First 35kV Superconducting Cable Demonstration Project at Xuhui District, Shanghai (40 mins)

#### Details

1. Line 1 (carry 30 passengers)  
Departure: 13:30  
Back to hotel: 15:30
2. Line 2 (carry 30 passengers)  
Departure: 14:00  
Back to hotel: 16:00

**Note** Bus will departure and drop off at 'InterContinental Shanghai Expo - IHG'

### Beer Social Event

**Time** Sunday, June 11, 2023, 18:30-20:30

**Venue** Villa 7 & Lounge



Scan to View Social Events' Details

# Conference Venue

## Conference Venue

### Venue

InterContinental Shanghai Expo – IHG  
上海世博洲际酒店

### Address

No.1188 Xueye Road, Pudong New Area Shanghai 200125 Mainland China  
上海市浦东新区雪野路 1188 号

## Sign-in

### Spot

1F / Lobby 酒店大厅

### Time

10:00 am-5:00 pm | June 9, 2023

## Transportation

**Shanghai Pudong International Airport** 47km by car

**Hongqiao Airport** 29km by car

**Shanghai Railway Station** 11km by car

**Gaoke Rd(W) @ Metro Line 6&7** 1.5km

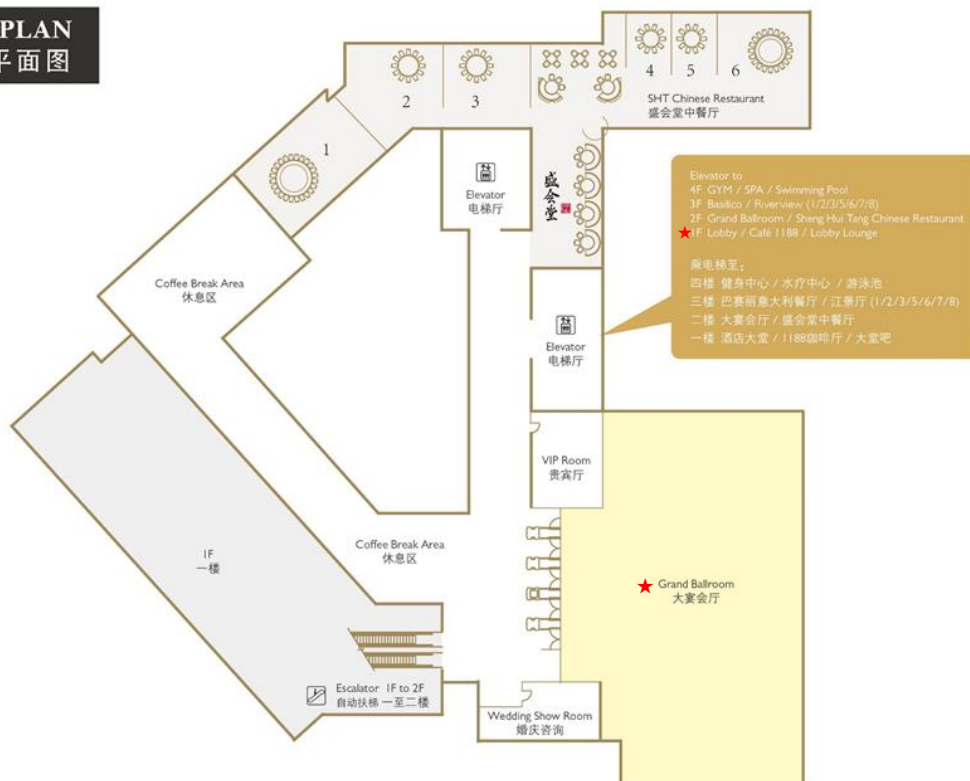
## Floor Plan

### CONFERENCE ROOMS

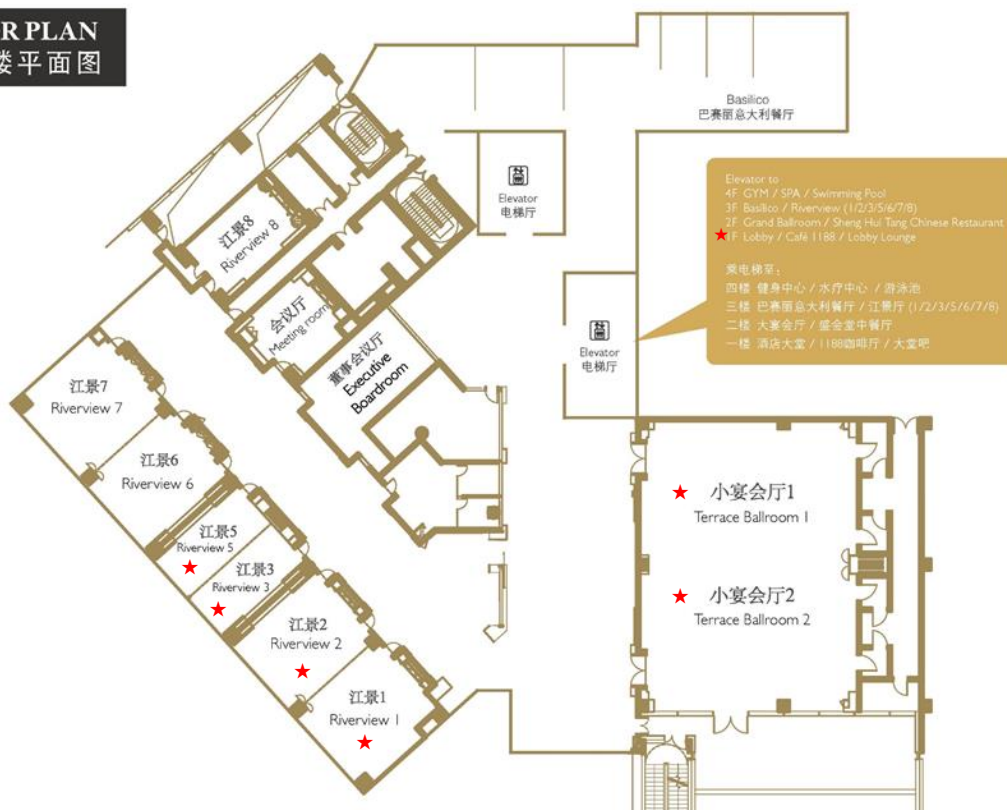
Level	Meeting Room	June 9	June 10	June 11	June 12
1F	Lobby	★	★	★	★
1F	Cafe 1188		★	★	★
2F	Grand Ballroom		★	★	
2F	Grand Ballroom 1				
2F	Grand Ballroom 2				
3F	Riverview 1	★	★	★	★
3F	Riverview 2	★	★	★	★
3F	Riverview 3	★			
3F	Riverview 5	★			
3F	Riverview 1+2	★			★
3F	Riverview 3+5			★	
3F	Terrace Ballroom 1		★	★	
3F	Terrace Ballroom 2		★	★	

(Next Page)

## 2F FLOOR PLAN 酒店二楼平面图



## 3F FLOOR PLAN 酒店 三楼平面图



# Guidelines

## For Onsite Presentation

### Oral Presentation

- The duration of a presentation slot is 20 minutes. Please target your lecture for a duration of about 15 minutes for the presentation plus about 5 minutes for questions from the audience.
- Your punctual arrival and active involvement in each session will be highly appreciated.
- Get your presentation PPT or PDF files prepared and backed up.
- Laptops, projector & screen, laser sticks will be provided by the conference organizer.

### Poster Presentation

- It's expected that at least one author stands by the poster for (most of the time of) the duration of the poster session. This is essential both to present your work to anyone interest in it and to make sure that your presence is verified by committee.

### Name Badge

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

### Reminder

- please remember to take all personal belongings with you whenever you leave a conference room or public area. Do not leave bags or laptops unattended.
- Please silence your cell phones during presentations or sessions to minimize the disruptions.

# Conference Agenda Overview

June 9, 2023 - Friday			
10:00-17:00	<b>Sign-in</b>		Lobby @ 1F
10:00-12:00	<b>Tutorial 1</b>	Modelling, Stability Analysis, and Control of Grid-Connected Wireless Power Transfer System	Riverview 1
	<b>Tutorial 2</b>	Design and Application of High-Power High-Voltage High-Frequency Transformers (H3Ts)	Riverview 2
	<b>Tutorial 3</b>	Recent Advances on High-Power DC/DC Converters for DC Generation, Distribution, and Transmission	Riverview 3
	<b>Tutorial 4</b>	Power Electronics and Control of Photovoltaic Systems as Primary Sources	Riverview 5
12:00-14:00	Lunch Break	Lunch on your own	/
14:00-16:00	<b>Tutorial 5</b>	Power Qualities and Their Compensators in Distributed Power Generation Systems	Riverview 1
	<b>Tutorial 6</b>	Advanced Control and Management of DC Microgrids	Riverview 2
	<b>Tutorial 7</b>	Recent Advances on Modular Multilevel Converters	Riverview 3
	<b>Tutorial 8</b>	Modeling, Analysis and Suppression of Wideband Oscillations in Wind Farms Integrated with Ac/DC Transmission	Riverview 5
17:30-18:45	<b>Welcome Reception</b>		<b>Riverview 1+2</b>
19:00-21:00	<b>Young Professionals &amp; Women in Engineering Reception</b>		<b>Villa 9</b>

# Conference Agenda Overview

June 10, 2023 - Saturday			
08:30-08:50	Opening Ceremony		Grand Ballroom
08:50-09:25	<b>Keynote Speech 1</b>	<b>Liucheng Chang</b> , University of New Brunswick, Canada / Past President of PELS	
09:25-10:00	<b>Keynote Speech 2</b>	<b>Dehong Xu</b> , Zhejiang University, China / Vice President of PELS	
10:00-10:40	Coffee Break	Poster Session P01	Foyer
10:40-11:15	<b>Keynote Speech 3</b>	<b>Marco Liserre</b> , Kiel University, Germany / Chair of PELS Technical Committee on Electronic Grid System	Grand Ballroom
11:15-11:50	<b>Keynote Speech 4</b>	<b>Jian Sun</b> , Rensselaer Polytechnic Institute, USA / Vice President of PELS	
11:50-13:30	Lunch		Cafe 1188
13:30-15:30	Technical Session <b>T01</b>	Distributed Generation Interacting with Power Transmission and Distribution Systems	Terrace Ballroom 1
	Industrial Session <b>I01</b>	Power Electronics for Sustainable Sources and Distributed Power System	Terrace Ballroom 2
	Technical Session <b>T02</b>	Energy Storage Systems	Riverview 1
	Technical Session <b>T03</b>	Emerging Topics on Renewables	Riverview 2
15:30-15:50	Coffee Break		Foyer
15:50-17:50	Technical Session <b>T04</b>	DC-DC Conversion and Control Techniques	Terrace Ballroom 1
	Special Session <b>S01</b>	Modeling and Control of Grid Forming Converters in Modern Power System	Terrace Ballroom 2
	Special Session <b>S02</b>	Wide Bandgap Devices and Their Applications in Renewables	Riverview 1
	Special Session <b>S03</b>	Real-Time and Hardware-In-The-Loop Simulations for Power Electronics in Distributed Generation Systems	Riverview 2
18:30-20:30	<b>'Ginlong' Gala Dinner</b>		<b>Grand Ballroom</b>

# Conference Agenda Overview

June 11, 2023 - Sunday			
08:30-09:05	<b>Keynote Speech 5</b>	<b>Jinjun Liu</b> , Xi'an Jiaotong University, China / President of China Power Supply Association	Grand Ballroom
09:05-09:40	<b>Keynote Speech 6</b>	<b>Tianwen Yin</b> , Shanghai Electrical Apparatus Research Institute (Group) co., Ltd / Rotating President	
09:40-10:20	Coffee Break	Poster Session P02	Foyer
10:20-10:55	<b>Keynote Speech 7</b>	<b>Yunwei Li</b> , University of Alberta, Canada / Vice President of PELS	Grand Ballroom
10:55-11:30	<b>Keynote Speech 8</b>	<b>Xinbo Ruan</b> , Nanjing University of Aeronautics and Astronautics, China / 2022 PELS Sustainable Achievement Awardee	
12:00-13:30	Lunch		Cafe 1188
13:30-15:30	Industrial Session <b>I02</b>	Real-Time Simulation Technology and Applications in Sustainable Energy System	Terrace Ballroom 1
	Special Session <b>S04</b>	Power Conversion, Energy Management, And Multi-Energy Complementarity in Microgrid I	Terrace Ballroom 2
	Technical Session <b>T05</b>	Power Electronics Devices and and Components	Riverview 1
	Special Session <b>S05</b>	Design, Modeling and Control of Power Electronic Converters for Pulsed Power Applications	Riverview 2
	Technical Session <b>T06</b>	DC-AC Conversion and Control Techniques	Riverview 3+5
15:30-15:50	Coffee Break		Foyer
15:50-17:50	Technical Session <b>T07</b>	Dynamic Performance Evaluation and Improvement of DC-DC/DC-AC Converters	Terrace Ballroom 1
	Special Session <b>S06</b>	Power Conversion, Energy Management, And Multi-Energy Complementarity in Microgrid II	Terrace Ballroom 2
	Special Session <b>S07</b>	Magnetic Components for Next-generation Power Electronics	Riverview 1
	Technical Session <b>T08</b>	Control and Protection of Emerging Multi-port Converters for Interconnected Renewable Systems	Riverview 2
	Special Session <b>S08</b>	Integration of PV Power into Distribution Grids: Advanced Topologies and Control Strategies	Riverview 3+5
13:30-16:00	<b>Industry Site Tour: The World's First 35kV Superconducting Cable Demonstration Project</b>		<b>Check page 4</b>
18:30-20:30	<b>Beer Social Event</b>		<b>Villa 7 &amp; Lounge</b>

# Conference Agenda Overview

June 12, 2023 - Monday			
08:30-09:05	<b>Keynote Speech 9</b>	<b>Marta Molinas</b> , Norwegian University of Science and Technology, Norway / Women in Engineering	Riverview 1+2
09:05-09:40	<b>Keynote Speech 10</b>	<b>Lei Huang</b> , Sieyuan Electric co., Ltd / Vice Chief Engineer of Central Research Institute	
09:40-09:55	Closing Ceremony		
09:55-10:15	Coffee Break		Foyer
10:15-12:15	Technical Session <b>T09</b>	Stability and Reliability Assessment of Power Electronics for Distributed Generation Systems	Riverview 1
	Special Session <b>S09</b>	Hydrogen Systems for On-board and Off-board Applications	Riverview 2
12:15-13:30	Lunch		Cafe 1188



Scan to Download Program Here

# Keynote Speakers

Chair:

**Beijing Time** 08:50-09:25 | June 10, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Liuchen Chang

- University of New Brunswick, Canada
- Fellow of the Canadian Academy of Engineering
- Past President of PELS
- IEEE Fellow

### Technical Requirements for Integrating Distributed Energy Resources

**Abstract:** The transition of the electricity industry into a low-carbon-intensity sector has led to the global trend of a steady increase in the penetration level of distributed energy resources (DERs). These DER systems are generally small units connected in power distribution systems, different from the traditional large generation facilities in bulk electrical systems. While the integration of these DER units in electric grids has brought significant challenges for grid operation, the tremendous potential of DERs in supporting power systems with flexible resources has not been fully explored by utilities. This presents significant opportunities for advancement in technologies for DER management and controls, enabled by power electronic technologies. This presentation focuses on the recent advancements in DER markets in the context of power system transition, and the technical requirements for integrating DERs into power systems. An overview of the evolution in interconnection standards over the past 25 years reveals the progress of technical requirements for DERs, which forms a major part of the presentation based on the presenter's technical experience working on DER integration. As power electronic technologies are critical to system integration, performance enhancement and grid operation support involving DER systems, the pursuit for high performance and functionality has driven the advances in power converter technologies, including components, topologies, controls, and system support functions. Part of the presentation is based on the extensive review of the state-of-the-arts technologies conducted by the IEEE International Technology Roadmap of Power Electronics for Distributed Energy Resources (ITRD).

### BIO

Liuchen Chang received B.S.E.E. from Northern Jiaotong University in 1982, M.Sc. from China Academy of Railway Sciences in 1984, and Ph.D. from Queen' University in 1991. He joined the University of New Brunswick in 1992 and is a Professor Emeritus at UNB. He was the NSERC Chair in Environmental Design Engineering during 2001-2007, and the Principal Investigator of Canadian Wind Energy Strategic Network during 2008-2014. He is a long-time volunteer for IEEE of 30 years and was the President of the IEEE Power Electronics Society (2021-2022). Dr. Chang was a recipient of CanWEA Templin Award for his contributions in the development of wind energy technologies, Innovation Award for Excellence in Applied Research in New Brunswick for his contributions in smart grid and renewable energy technologies, and PELS Sustainable Energy Systems Technical Achievement Award for his contributions in distributed energy systems. He is a fellow of the Canadian Academy of Engineering. He has published more than 400 refereed papers in journals and conference proceedings. Dr. Chang has focused on research, development, demonstration and deployment of distributed energy systems.

# Keynote Speakers

Chair:

**Beijing Time** 09:25-10:00 | June 10, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Dehong Xu

- Zhejiang University, China
- Vice President of PELS
- Honorary Chair of the China Power Supply Society
- IEEE Fellow

### Advanced Wide-Band-Gap Power Electronics Conversion for Renewable Energy Power Systems

**Abstract:** There is ever-increased demand for Renewable Energy Power Systems with higher efficiency, higher power density, and better dynamics. The Wide-Band-Gap (WBG) device helps push the applications of soft-switching technology to various power electronics conversions. The combination of Wide-Band-Gap devices and advanced power electronics conversion may significantly enhance the performance of Renewable Energy Power Systems. A generic Edge-Align Pulse-Width-Modulation (EA-PWM) and control for soft-switching three-phase conversion systems are introduced. It is suitable for various Renewable Energy Power Systems such as PV and wind power, battery energy storage, Fuel-Cell system, solid-state transformer, etc. Implementation and Experimental results of a soft-switching SiC MOSFET grid inverter and SiC MOSFET three-phase BTB converter are introduced.

### BIO

Prof. Mark Dehong Xu received a Ph.D. degree from the Department of Electrical Engineering of Zhejiang University in China in 1989. He used to be a visiting professor at the University of Tokyo, Virginia Tech, and ETH. He is presently a distinguished professor and director of the Power Electronics Institute at Zhejiang University, China. His research interest includes modeling and control of power electronics circuits and systems, renewable energy systems, and power supplies for data centers. He has authored 16 books and over 300 IEEE Journal or Conference papers. He holds over 50 patents. He received seven IEEE journal or conference prize paper awards. He is IEEE Fellow in 2013. He is IEEE PELS Distinguished Lecturer from 2015-2016. He received the IEEE Power Electronics Society R. D. Middlebrook Achievement Award in 2016. He is an At-Large Adcom Member of the IEEE Power Electronics Society from 2020-2022. He is a Co-Editor-in-Chief of the IEEE Open Journal of Power Electronics and an Associate Editor of IEEE Transactions on Power Electronics. He is the honorable president of the China Power Supply Society. He currently serves as Vice-President Membership of the IEEE Power Electronics Society.

# Keynote Speakers

Chair:

**Beijing Time** 10:40-11:15 | June 10, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Marco Liserre

- Kiel University, Germany
- Chair of PELS Technical Committee on Electronic Grid System
- IEEE Fellow

### Power Electronics for a Smart Energy Management: from Smart Transformer to 100 % Electronic Grid by Means of Grid-Forming and Talkative Power Conversion Technologies

**Abstract:** The goal to decarbonise the energy production and use especially in the transportation sector is challenging the modern power system. Power electronics is now playing a different role respect to 20 years ago, taking directly responsibility for the electric grid, eventually evolving towards an electronic grid. Power converters will play a grid-forming role being not only in charge of adjusting voltage level and create different AC and DC supply but also to control generation, loads and power flow among them. The Smart Transformer, which is a fundamental node of the future electronic grid, is now in the process to be standardized as for IEEE and CIGRE initiatives. On the other hand the energy management functionality of power-electronic-based devices as the Smart Transformer needs communication to get information from sensors and send command to actuators and better manage the future dynamical reconfigurable meshed and hybrid grid and its protection. Power electronic can also provide communication functionalities embedding data directly in the Pulse Width Modulation also thanks to Wide Band Gap devices which allows higher switching frequency still with limited losses. This will open a new era for networked systems experiencing hyper-connectivity at different levels but still using the same device, the power electronics converter, where the conversion architecture and the Pulse Width Modulation are now re-thought in a new and exciting perspective bridging two different realms of knowledge: power conversion and communication.

### BIO

Marco Liserre received the MSc and PhD degree in Electrical Engineering from the Bari Polytechnic, respectively in 1998 and 2002. He has been Associate Professor at Bari Polytechnic and from 2012 Professor in reliable power electronics at Aalborg University (Denmark). From 2013 he is Full Professor and he holds the Chair of Power Electronics at Kiel University (Germany). At Kiel University he is leading a team of 25 researchers with a 2 Million Euro annual budget through third-party funded projects, with a Power Electronics Laboratory, a Medium Voltage Laboratory and a Laboratory on Batteries and Energy Conversion, which is one of the very few worldwide interdisciplinary laboratories born as cooperation between material science and power electronics. He has been leading in the last 10 years' third-party projects for more than 25 Million Euro having responsibility role, among the other, within the strategic governmental 10 years' initiative "Copernicus" in Germany for the Energy Change towards 80 % renewable based energy society and in two priority programs of the German research Foundation DFG. He is leading the research group "Electronic Energy Systems" at Fraunhofer ISIT, which will employ 20 researchers. In Fraunhofer ISIT, one of the leading microelectronics institute in Germany, he is also Deputy Director

# Keynote Speakers

Chair:

**Beijing Time** 11:15-11:50 | June 10, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Jian Sun

- Rensselaer Polytechnic Institute, USA
- Vice President of PELS
- IEEE Fellow

### Small-Signal Sequence Immittance Theory and Applications

**Abstract:** As the development of carbon-free electricity becomes a global movement and more and more countries commit to achieving carbon neutrality by 2050-2060, it is clear that future power systems will be based on converters. Developing and operating such a converter-based power system face many challenges, one of which is system stability. The fast control of power electronics introduces high-frequency dynamics and create new stability problems that are not considered in traditional system studies and require new modeling and analysis methods and tools. Small-signal sequence immittance theory is developed to meet this practical need and has seen many successes in solving real-world stability problems. As a result, a large body of knowledge and a wealth of practical experiences have been developed. Immittance-based frequency-domain modeling also enables design engineers to optimize power converter and their control design for stable operation with/in the grid. New immittance-based performance specifications and system study procedures/tools are also being developed to ensure system stability. This talk reviews the status of the theory and application of immittance-based frequency-domain methods, and introduces the latest development for application in large power grids.

### BIO

Dr. Jian Sun joined the faculty at Rensselaer Polytechnic Institute (RPI) in 2002, where he is currently a Professor in the Department of Electrical, Computer and Systems Engineering. He is also Director of the Center for Future Energy Systems (CFES) funded by New York State government. His research interests are in the general area of power electronics and energy conversion. He is credited for creating the small-signal sequence immittance theory and leading/promoting its practical applications in different industries internationally. Dr. Sun received his doctorate from University of Paderborn, Germany. Prior to joining the faculty at RPI, he spent five years at Rockwell Collins working on power electronics for aircraft power systems, and was a Post-Doc Fellow at Georgia Tech from 1996 to 1997. As Director of CFES, he is responsible for the strategic directions and development of the Center's research, industry collaboration, education, and outreach programs. His professional services to the power electronics community included serving as Editor-in-Chief of IEEE Power Electronics Letters from 2008 to 2014, Treasurer of IEEE Power Electronics Society (PELS) from 2013 to 2020, and as PELS Vice President of Conferences since 2021. He works closely with industry in his research and has consulted for a number of international corporations including GE, Rockwell, United Technologies, Facebook, First Solar, China State Grid, and TenneT. Dr. Sun received the IEEE PELS Modeling and Control Technical Achievements Award in 2013 and the R. David Middlebrook Outstanding Achievement Award in 2017. He is a Fellow of IEEE.

# Keynote Speakers

Chair:

**Beijing Time** 08:30-09:05 | June 11, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Jinjun Liu

- Xi'an Jiaotong University, China
- President of China Power Supply Association
- Past Vice President of PELS
- IEEE Fellow

### The Quest for a Fully Autonomous Microgrid Incorporating DERs and a Possible Solution

**Abstract:** For more electronic future power systems, the coordinative control of a microgrid incorporating distributed energy resource (DER) converters is to ensure the system voltage to be within a nominal magnitude/frequency range and adequate output power sharing among all these energy sources, and at the same time to guarantee fast and smooth transfer of the microgrid operation between islanded mode and grid-connected mode. This is very often required to be realized through fully autonomous control where each source converter or the transfer switch is controlled by its own without getting or sensing any information from others or a center controller so that a higher reliability and an easy-to-implement plug-and-play feature could be achieved. The requirement for a fully autonomous grid-organizing framework has been well fulfilled and has made a significant benefit for today's power systems, but will be a really critical challenge for future's more electronic power systems with microgrid being a possible form. A whole-new concept device, Flexible Transfer Converter (FTC), is proposed to enable the fully-autonomous coordinative control of a microgrid. Through the FTC, the interfacing power of the micro-grid with the large grid can also be continuously adjusted; soft transfer can be achieved; and the speed and smoothness of the transfer can be dramatically improved, while all of these can not be realized by existing operation-mode-transfer techniques fundamentally.

### BIO

Jinjun Liu (M'97–SM'10–Fellow'19) received the B.S. and Ph.D. degrees in electrical engineering from Xi'an Jiaotong University (XJTU), Xi'an, China, in 1992 and 1997, respectively.

He then joined the XJTU Electrical Engineering School as a faculty. From late 1999 to early 2002, he was with the Center for Power Electronics Systems, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA, as a Visiting Scholar. In late 2002, he was promoted to a Full Professor and then the Head of the Power Electronics and Renewable Energy Center at XJTU. He is currently a XJTU Distinguished Professor of Power Electronics. His research interests include modeling, control, and design methods for power converters and electrified power systems, power quality control and utility applications of power electronics, and micro-grids for sustainable energy and distributed generation.

Dr. Liu received for many times governmental awards at national level or provincial/ministerial level for scientific research/teaching achievements. He also received the 2006 Delta Scholar Award, the 2014 Chang Jiang Scholar Award, the 2014 Outstanding Sci-Tech Worker of the Nation Award, the 2016 State Council Special Subsidy Award, the IEEE Transactions on Power Electronics 2016 and 2021 Prize Paper Awards, the Nomination Award for the Grand Prize of 2020 Bao Steel Outstanding Teacher Award, and the 2022 Fok Ying Tung Education and Teaching Award. He served as an Associate Editor for the IEEE TRANSACTIONS ON POWER ELECTRONICS since 2006, 2015-2019 Executive Vice President and 2020-2021 Vice President of IEEE PELS. He was the Vice President for International Affairs, China Power Supply Society (CPSS) from 2013 to 2021, and since 2016, the inaugural Editor-in-Chief of CPSS Transactions on Power Electronics and Applications. He was elected the President of CPSS in Nov. 2021. Since 2013, he has been serving as the Vice Chair of the Chinese National Steering Committee for College Electric Power Engineering Programs.

# Keynote Speakers

Chair:

**Beijing Time** 09:05-09:40 | June 11, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Tianwen Yin

- Shanghai Electrical Apparatus Research Institute (Group) Co.,Ltd.
- Rotating President

### Development Direction of New Power Distribution Systems Based on Carbon Peaking and Carbon Neutrality Background

**Abstract:** The report will comprehensively analyze the development opportunities of power distribution systems in the context of China's carbon peaking and carbon neutrality goals. It will examine the challenges faced by current power distribution systems from the perspectives of demand, architecture, technology, and equipment. Furthermore, the report will analyze and provide the development trends, recommendations, and prospects for new power distribution systems.

#### BIO

Mr. Yin Tianwen, Professor engineer and a rotating president of Shanghai Electrical Apparatus Research Institute (Group) co., Ltd. He has been engaged in research of intelligent appliances and systems, intelligent manufacturing and Industrial Internet industry application for a long time, and was responsible for charge of dozens of national and provincial level major scientific research projects, and received many achievements such as the first prize at the provincial and ministerial levels. He also has been a Director of the National Low Voltage Electrical Appliances Standardization Committee, Vice Chairman of the China Electrotechnical Society, and Chairman of the General Low Voltage Electrical Appliances Branch of the China Electrical Industry Association. He received special allowances from the State Council and was awarded titles such as National Model Worker, Leading Talent in Shanghai, Outstanding Discipline Leader in Shanghai, and Model Worker in Shanghai. He is an academician of the China Electrotechnical Society, a member of the 13th Shanghai Municipal Committee of the Chinese People's Political Consultative Conference, and an expert entered into National and local expert database..

# Keynote Speakers

Chair:

**Beijing Time** 10:20-10:55 | June 11, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Yunwei Li

- University of Alberta, Canada
- Vice President of PELS
- IEEE Fellow

### Innovations in Power Electronics Technologies for Distributed Energy Resources

**Abstract:** Today's distributed energy resources (DER) are experiencing a rapid progression, which drives the development of advanced power electronic converter topologies, operational strategies, and the adoption of wide bandgap (WBG) devices for higher efficiency, reliability and smaller footprint. The innovations in power electronics technologies a pivotal role in tackling challenges related to energy management, system reliability, and efficient energy conversion. This presentation will concentrate on recent advancements addressing these challenges, encompassing aspects such as converter topology, design, and advanced control methods. It includes topics like model predictive control and multi-rate-based techniques, as well as explore the creation of innovative topologies and modulation approaches inspired by graph theory-based methodologies. Innovations on power electronics in the above aspects are key enhance the overall performance of DER and grid integration.

### BIO

Dr. Yunwei (Ryan) Li is currently a Professor and Chair with the Department of Electrical and Computer Engineering, University of Alberta, Canada. Dr. Li received the Bachelor degree from Tianjin University and the Ph.D. degree from Nanyang Technological University, Singapore. Dr. Li was a Visiting Scholar with the Aalborg University, Denmark in 2005, and a Postdoctoral Research Fellow at Ryerson University, Canada 2006 - 2007. In 2007, he also worked at Rockwell Automation Canada before joined University of Alberta. His research interests include PWM and control of power electronics in distributed generation, microgrid, renewable energy, and electric motor drives. His research has produced more than 400 papers with over 20,000 citations.

Dr. Li was the Editor-in-Chief for IEEE Transactions on Power Electronics Letters 2019-2023. Prior to that, he was Associate Editor for IEEE Transactions on Power Electronics, IEEE Transactions on Industrial Electronics, IEEE Transactions on Smart Grid, and IEEE Journal of Emerging and Selected Topics in Power Electronics. Dr. Li served as the general chair of IEEE Energy Conversion Congress of Exposition (ECCE) in 2020. He is the Vice President for Products of IEEE Power Electronics Society (PELS) 2022-2024, and AdCom Member at Large for PELS 2021-2023. Dr. Li received the Nagamori Foundation Award in 2022 and the Richard M. Bass Outstanding Young Power Electronics Engineer Award from IEEE PELS in 2013. He is a Fellow of IEEE and recognized as the Clarivate Highly Cited Researcher

# Keynote Speakers

Chair:

**Beijing Time** 10:55-11:30 | June 11, 2023

**Onsite Room** 2F / Grand Ballroom

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Prof. Xinbo Ruan

- Nanjing University of Aeronautics and Astronautics, China
- 2022 PELS Sustainable Achievement Awardee
- IEEE Fellow

### Zero-Voltage-Switching Four-Switch Buck-Boost Converter

**Abstract:** Four-switch buck-boost (FSBB) converter features positive output voltage and low voltage stress of power switches. In this presentation, a pulse width modulation (PWM) plus phase-shift control scheme is proposed to achieve zero-voltage-switching (ZVS) for all the power switches in full input voltage and load range and minimize the inductor current ripple and RMS value. The implementation of the proposed control scheme is given. A prototype of a 500-W FSBB converter is built and tested in the lab, and the experimental results verify the effectiveness of the proposed control scheme.

### BIO

Xinbo Ruan (Fellow, IEEE) received the B.S. and Ph.D. degrees in electrical engineering from Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, China, in 1991 and 1996, respectively. In 1996, he joined the Faculty of Electrical Engineering Teaching and Research Division, NUAA, where he became a Professor in the College of Automation Engineering in 2002. From August to October 2007, he was a Research Fellow in the Department of Electronic and Information Engineering, Hong Kong Polytechnic University, Hong Kong, China. From March 2008 to Sep. 2011, he was also with the School of Electrical and Electronic Engineering, Huazhong University of Science and Technology, China. He is the author or co-author of 13 books and more than 300 technical papers published in journals and conferences. His main research interests include resonant and soft-switching power converters, power converter topologies and control, grid-connected converters and system for renewable energy, modeling and stability of power converters, and envelop tracking power supply. Prof. Ruan was a recipient of Sustainable Energy Systems Technical Achievement Award from IEEE Power Electronics Society in 2022, the Delta Scholarship by the Delta Environment and Education Fund in 2003 and was a recipient of the Special Appointed Professor of the Chang Jiang Scholars Program by the Ministry of Education, China, in 2007. From 2005 to 2013, and since 2017 again, he serves as Vice President of the China Power Supply Society (CPSS). From 2014 to 2016, he served as a Vice Chair of the Technical Committee on Renewable Energy Systems within the IEEE Industrial Electronics Society. Currently, he serves as an Editor for IEEE JOURNAL OF EMERGING AND SELECTED TOPICS ON POWER ELECTRONICS, and an Associate Editor for IEEE TRANSACTIONS ON POWER ELECTRONICS, IEEE Open Journal of the Industrial Electronics Society, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS – II. He was the General Chair of IPEMC-ECCE Asia 2020 and the General Secretary of IPEMC-ECCE Asia 2009, a Technical Program Committee Chair of the IEEE 7th Annual Energy Conversion Congress and Exposition, and a Tutorial Committee Chair of the IEEE 12th Annual Energy Conversion Congress and Exposition.

# Keynote Speakers

Chair:

**Beijing Time** 08:30-09:05 | June 12, 2023

**Onsite Room** 3F / Riverview 1+2

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Dr. Marta Molinas

- Norwegian University of Science and Technology, Norway
- Women in Engineering
- IEEE Fellow

### Networked Impedance Analysis for Power Electronics Stability Diagnosis/Studies: problems, recent advances, and prospects

**Abstract:** Real-world experience on the problems faced by power systems with high power electronics penetration rates has been gathered from around the world over the past decade. And even if near 100% penetration will happen gradually, already today parts of a larger system could operate at near 100% penetration rate. In many systems around the world, oscillations have been reported over a wide range of frequencies and, in many cases, e.g., wind farm HVDC integration, these have been triggered by small changes in parts of the system's conditions. These oscillations threaten system stability which can be anticipated with appropriate diagnostic tools. Impedance network-based analysis offers some flexibility but not without problems. In a complex system, root cause detection can be a difficult task and the success of corrective actions will depend on the accuracy of diagnostic tools, particularly for multi-converter networked systems. This lecture will present recent advances in the field of networked impedance analysis for the diagnosis of stability in power electronic systems, their challenges, and perspectives.

### BIO

Dr. Marta Molinas is currently a Professor with the Department of Engineering Cybernetics, Norwegian University of Science and Technology, Trondheim, Norway. She received the M.E. degree from Ryukyu University, Nishihara, Japan, in 1997, and the D.Eng. degree from the Tokyo Institute of Technology, Tokyo, Japan, in 2000. Dr. Molinas was a Guest Researcher with the University of Padova, Italy, in 1988. From 2004 to 2007, she was a Postdoctoral Researcher with the Norwegian University of Science and Technology (NTNU), Trondheim, Norway, and from 2008 to 2014, a Professor with the Department of Electric Power Engineering with the same university. She has been a visiting scholar at Columbia University in 2014 and invited fellow in Japan with a JSPS Invitational Fellowship in 2008 and in 2022. Her research interests include stability of power electronics systems, harmonics, instantaneous frequency, and nonstationary signals from the human and the machine. Prof. Molinas is an Editor for the IEEE Journal JESTPE, IEEE Trans. Of Energy Conversion, and Advisor to the Board of IEEE Electrification Magazine. She is Associate Editor for the IEEE PELS Transactions, and IEEE JESTIE. She has been an AdCom Member of the IEEE Power Electronics Society from 2009 to 2011. Dr Molinas served as general chair of IEEE COMPEL in 2016. She is a Fellow of IEEE.

# Keynote Speakers

Chair:

**Beijing Time** 09:05-09:40 | June 12, 2023

**Onsite Room** 3F / Riverview 1+2

**Zoom ID** 272 702 7927

**Zoom Link** <https://us06web.zoom.us/j/2727027927>



## Mr. Lei Huang

- Sieyuan Electric Co., Ltd.
- Vice Chief Engineer of Central Research Institute

### Power Electronic Based Stabilizing Techniques Applied for Power Grids with High Penetration of Renewable Resources

**Abstract:** To ensure the consumption of renewable resources, this leads to the lack of inertia as well as reactive power in new power systems. When the new power system is disturbed, the frequency transient presents the characteristic of "large slope", which is easy to trigger the shutdown of new energy units and deteriorate the frequency stability. The new power system needs equipment that can provide rapid support capacity to increase the system inertia. At the same time, the new power systems, with the problem of that the lack of reactive power and the "rapidity and accuracy" of reactive power control, needs to address the issue of dynamic reactive power support and the improvement of static voltage stability margin. To address these problems, we propose the use of Modular Multilevel Converter based STATCOM with power intensive energy storage (SSC PLUS). The device achieves decoupled active and reactive power control and is able to provide fast inertia support and reactive power support, while having high economic efficiency and ensuring safe and stable operation of the power system.

#### BIO

Huang Lei received the B.S degree in Wuhan University in electrical engineering in 2007 and M.S. degree in power system from Shanghai Jiao Tong University in 2010. He worked as a power system analysis engineer in East China Electric Power Testing and Research Institute for over 5 years. Now he is the vice chief engineer in central research institute of Sieyuan Electric, focused on the active supporting techniques based on power electronics in power system with high penetrating of inverter based power resources and the corresponding market analysis.

# Tutorials

## Tutorial 01: Modelling, Stability Analysis, and Control of Grid-Connected Wireless Power Transfer System

<b>Beijing Time</b>	10:00-12:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 1
<b>Zoom ID</b>	462 848 5634	<b>Zoom Link</b>	<a href="https://zoom.us/j/4628485634">https://zoom.us/j/4628485634</a>

In order to cope with the challenges caused by the high penetration of renewables, the concepts of grid-to-vehicle (G2V) and vehicle-to-grid (V2G) were proposed. Wireless power transfer is one of the key technologies that facilitate the implementation of these concepts, cut off the last cord, and improve the intelligence of movable objects. Recently, an increasing number of electric vehicles are adopting wireless power transfer for connecting with the power grid. As a result, the wireless power transfer system shall interact with the power grid. The interaction raises new challenges to the stability of the power grid, wireless power transfer system, as well as the electrical system of the vehicle. As a consequence, advanced modelling techniques, analysis tools, and control methods will be required to tackle these challenges. This presentation will start with an overview of the key dimensions of wireless power transfer systems (topologies, modulation strategies, and control methods) along with the advantages and trade-offs of various solutions. Furthermore, we will introduce advanced modelling methods that can characterize the dynamics of the wireless power transfer in various time/frequency scales. Next, based on the advanced model, some instability factors of existing wireless power transfer systems are discussed and analyzed. Moreover, control solutions for system stabilization are presented with theoretical analysis and experimental verification. Finally, conclusions are drawn and prospects are provided for future research and development of wireless power conversion technologies.



### Kerui Li, Nanyang Technological University, Singapore

Kerui Li received the B.Eng. degree from the South China University of Technology, Guangzhou, China, in 2013, the M.Eng. degree from the Sun Yat-sen University, Guangzhou, China, in 2016, and the Ph.D. degree from The University of Hong Kong, Hong Kong, in 2021. Currently, he is a research fellow at Nanyang Technological University, Singapore. His research interests include wireless power transfer and power electronics. He received IEEE Power Electronics Society Ph.D. Thesis Talk Award in 2022.



### Minfan Fu, ShanghaiTech University, China

Dr. Minfan Fu received the B.S., M.S., and Ph.D. degrees in electrical and computer engineering from University of Michigan-Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University, Shanghai, China in 2010, 2013, and 2016. He is currently a Principle Investigator at School of Information Science and Technology (SIST), ShanghaiTech University, Shanghai, China. Between 2016 and 2018, he held a postdoctoral position with the Center for Power Electronics Systems, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA. His research interests include wireless power transfer, applications of wide-band-gap devices, and modeling and control of resonant convertors. He is a senior member of IEEE. He holds seven patents and has published over 100 papers in prestigious IEEE journals and conferences. He is included on an Elsevier list of the top 2% of scientists in their fields for either single-year impact in 2021.

## Tutorial 02: Design and Application of High-Power High-Voltage High-Frequency Transformers (H3Ts)

<b>Beijing Time</b>	10:00-12:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 2
<b>Zoom ID</b>	759 390 6904	<b>Zoom Link</b>	<a href="https://zoom.us/j/7593906904">https://zoom.us/j/7593906904</a>

The solid-state transformer (SST), as a revolutionary technique, has received increasing attention from both industry and academia for emerging scenarios such as smart grid, data centers, renewable generation, and traction systems. The high-power, high-voltage, high-frequency transformers (H3T) is crucial to guarantee galvanic isolation, voltage matching, and power transmission. In this proposal, we aim to introduce both fundamental and advancements of H3T, where we wish to introduce basic analysis tools and solutions for designing and active controlling H3T. The challenges, opportunities and trends for H3T will be involved in this 3-hour tutorial.



### Wu Chen, Southeast University, China

Wu Chen (Senior Member, IEEE) was born in Jiangsu, China, in 1981. He received the B.S., M.S., and Ph.D. degrees in electrical engineering from the Nanjing University of Aeronautics and Astronautics, Nanjing, China, in 2003, 2006, and 2009, respectively. From 2009 to 2010, he was a Senior Research Assistant with the Department of Electronic Engineering, City University of Hong Kong, Hong Kong. In 2010 and 2011, he was a Postdoctoral Researcher with the Future Electric Energy Delivery and Management Systems Center, North Carolina State University, Raleigh, NC, USA. Since September 2011, he has been an Associate Research Fellow with the School of Electrical Engineering, Southeast University, Nanjing, China, where he has been a professor since 2016. His main research interests include soft-switching converters, power delivery, and power electronic system integration. Dr. Chen is an Associate Editor for the IEEE Transactions on Industrial Electronics, Journal of Power Electronics, and CPSS Transactions on Power Electronics and Applications.



### Zhan Shen, Southeast University, China

Zhan Shen (Member, IEEE) received the B.E. degree in electrical engineering and automation from Nanjing University of Aeronautics and Astronautics in 2013 and M.E. degree in electrical engineering from Southeast University in 2016, both in Nanjing, China, and Ph.D. degree in energy technology from Aalborg University, Aalborg, Denmark in 2020. He conducts his research as a Postdoc researcher in Aalborg until 2021 and as an Associate Professor at Southeast University in Nanjing. He was a Visiting Student and pursued his master thesis at the RWTH Aachen University, Aachen, Germany, from Oct. 2014 to Feb. 2016, and a Visiting Scholar with the Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, from Oct. 2018 to Jan. 2019. He was with the ABB Corporate Research Center, Beijing, China, in 2016. His research interests include the electromagnetic-thermal-reliability modeling and design of magnetic components in power electronic converters, and EMI.

Prof. Shen was the recipient of multiple Best Paper and Best Presenter Awards of the IEEE PELS sponsored conferences.



### Hongbo Zhao, Aalborg University, Denmark

Hongbo Zhao (Member, IEEE) received the Ph.D. degree in Power Electronics from Aalborg University, Denmark in 2021. From Jan. 2021- Apr. 2021, he was a visiting student in the University of Texas at Austin. From Jan. 2023- Apr. 2023, he was a visiting scholar in the University of Galway. Currently, he is a Postdoc Researcher with Aalborg University, Aalborg, Denmark. His research interests include high-frequency modeling and analysis of high-power magnetics and filters, as well as medium-voltage converters enabled by wide band-gap power devices. He is a recipient of 2022 Villum Experiment grant.

## Tutorial 03: Recent Advances on High-Power DC/DC Converters for DC Generation, Distribution, and Transmission

<b>Beijing Time</b>	10:00-12:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 3
<b>Zoom ID</b>	528 108 4955	<b>Zoom Link</b>	<a href="https://zoom.us/j/5281084955">https://zoom.us/j/5281084955</a>

With the increasing penetration of renewable energy sources and ubiquitous power electronics apparatus, DC power is making a comeback. In the generation aspect, the PV, wind, and energy storage are inherently DC sources. For transmission, the HVDC has become the feasible solution for transmitting large amounts of power over long distances or submarine cables. For distribution, the MVDC is more capable of accommodating a higher level of renewable energy and friendly to the EV charging stations. Therefore, DC grid is highly expected in both academics and industries.

Nevertheless, just like the role of transformer in AC systems, DC grids also require such a device to exchange power between networks with different voltage levels. As DC circuit does not satisfy the law of Electromagnetic Induction, it is not possible to use magnetic transformers to convert DC voltage but has to rely on power electronics technology. Additionally, with the growing of DC system scale, power flow control in meshed DC grid becomes important. DC current flow is determined by line voltage, thus DC power flow controller should also be designed as a DC voltage converter. Although the DC/DC power-electronic converters have been widely studied and applied at low-power applications and a myriad of topologies exist, most of these topologies are not readily scaled up to tens/hundreds of kilovolts and megawatt power ranges, due to the limitations of loss, cost, dv/dt, and ratings of the semiconductors. To overcome these limitations,

several novel high-power DC/DC converter topologies have been proposed and demonstrated during the last few years. This tutorial will give a systematic review of the latest development in this filed.

The tutorial will start with an introduction of the applications for high-power DC/DC converters, which is followed by a review of the basics and some widely used converter solutions in this filed. Then the first theme is discussion of DC/DC converters for interconnecting LVDC and MVDC systems, including a  $\pm 10\text{kV}/\pm 375\text{V}$  1.5MW solid-state transformer, bipolar/multi-port LVDC distribution, and PV/wind DC collection. The second theme is DC/DC converters for MVDC and HVDC interconnection, which presents a novel converter solution combining the techniques of IGCT-based two-level converter and the MMC, and the converter is further improved for application of all DC offshore wind farms. Furthermore, the third theme will focus on the DC/DC conversion which interconnects HVDC systems with different voltage levels. Particularly, the capacitive energy transfer (CET) principle based DC/DC converters are discussed, which includes a series of new topologies, showing very attractive features of low cost, high efficiency, small footprint, and DC fault-blocking capability. The fourth theme will discuss DC power flow controller, showing its importance to HVDC grid. Finally, summary and outlook are provided. In this tutorial, all these converters and corresponding operation techniques will be explained with simulation or experimental examples.

### Binbin Li, Harbin Institute of Technology, China



Binbin Li received his PhD degree in Electrical Engineering from Harbin Institute of Technology (HIT), China, and is currently Professor in School of Electrical Engineering and Automation, HIT. He has been selected in the Young Elite Scientists Sponsorship Program by China Association for Science and Technology. Currently he is associate editor of IEEE Transactions on Power Electronics, IEEE Open Journal of the Industrial Electronics Society and member of Editorial Board for Journal of Power System Protection and Control. He holds more than 20 patents and has collaborated with the industries developing several mega-watt power converters, such as 1.5MW  $\pm 10\text{kV}/\pm 375\text{V}$  DC solid-state transformers, 3kV/1MW modular multilevel converter, and published more than 40 journal papers in the field of modular high-power converters. He has given a number of tutorials in the conferences such as PEAC2018, IECON2019, IECON2020, and ECCEAsia 2020.

### Yingzong Jiao, Harbin Institute of Technology, China



Yingzong Jiao received his Ph.D. degree in Electrical Engineering from Zhejiang University (ZJU), China, and is currently a postdoc at the School of Electrical Engineering and Automation, Harbin Institute of Technology (HIT). He published more than 10 papers in the field of power electronics and power systems integrated with renewable generations. He received the best paper in the conference of HVDC 2020.

## Tutorial 04: Power Electronics and Control of Photovoltaic Systems as Primary Sources

<b>Beijing Time</b>	10:00-12:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 5
<b>Zoom ID</b>	917 991 2817	<b>Zoom Link</b>	<a href="https://zoom.us/j/9179912817">https://zoom.us/j/9179912817</a>

Solar photovoltaic (PV), one of favorable renewable generation sources, enhances the adoption of futuristic power electronics-based distributed generation systems (PEDGs). However, the high penetration level of power electronics-interfaced PV systems induced various adverse impacts on the PEDGs due to the deficiency of mechanical inertia. Thus, multiple attempts have been investigated to ensure a grid-friendly integration to enhance utility performance and energy harvesting, which mitigates adverse impacts and simultaneously provides smart controllability and flexible manageability. To master and then advance the PV technologies, we are required to comprehend the power conversion process, the potential impact of power electronic-based PV systems on futuristic PEDGs, and the sophisticated controls for addressing the posed challenges, for instance, by grid codes (such the IEEE Std. 1547-2018 and NERC standard BAL-003-1). Accordingly, this tutorial is intended for intermediate and advanced audiences and dedicated to tackling the technological issues of intermittent solar power generation, providing a design particular to grid-friendly PV systems from the modeling to advanced controls. The objective is to develop and enhance the operability of PV systems by introducing advanced controls to guarantee more sustainable, grid-friendly, efficient, and dependable PV systems that comply with grid rules and contribute to reducing energy costs. Here, the tutorial is organized for intermediate and advanced audiences, engineers, and researchers seeking practical solutions for grid-friendly power electronics, particularly PV power conversion systems. Also, researchers and engineers seeking the basic knowledge of PV technology and system

integration are welcomed. The prerequisite is basic power electronics and control.



### Yongheng Yang, Zhejiang University, China

Yongheng Yang received the Ph.D. degree from Aalborg University in 2014. During 2014–2020, he was with the Department of Energy Technology, Aalborg University, where he became a tenured Associate Professor in 2018. He joined Zhejiang University as a ZJU100 Professor in 2021. His research focuses on the grid-integration of photovoltaic systems and control of power converters. Dr. Yang was the Chair of the IEEE Denmark Section during 2019–2020. He was the recipient of the 2018 IET Renewable Power Generation Premium Award, 2021 Richard M. Bass Outstanding Young Power Electronics Engineer Award from the IEEE Power Electronics Society, 2022 Isao Takahashi Power Electronics Award from the Institute of Electrical Engineers of Japan, and two IEEE best paper awards. He is currently a Vice Chair of the IEEE PELS Technical Committee on Sustainable Energy Systems and an Associate Editor for several prestigious journals.



### Qiao Peng, Sichuan University, China

Qiao Peng received the B.Eng. degree in electrical engineering from Sichuan University, Chengdu, China, in 2015, and the Ph.D. degree from the Department of Energy Technology, Aalborg University, Denmark, in 2020. She is currently an Assistant Research Fellow with the College of Electrical Engineering, Sichuan University. Her research interests include stability and control of power electronics-based power systems, grid-integration of renewable energy sources, especially photovoltaic systems, and VSC-HVDC technology.



### Yinxiao Zhu, Zhejiang University, China

Yinxiao Zhu received the M.Sc. degree in sustainable energy technology from the University of Liverpool, Liverpool, U.K., in 2019, where he is currently working toward the Ph.D. degree in electrical and electronic engineering. His research interests include control for photovoltaic systems and power electronics.

## Tutorial 05: Power Qualities and Their Compensators in Distributed Power Generation Systems

<b>Beijing Time</b>	14:00-16:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 1
<b>Zoom ID</b>	462 848 5634	<b>Zoom Link</b>	<a href="https://zoom.us/j/4628485634">https://zoom.us/j/4628485634</a>

With the proliferation and development of voltage-sensitive load equipment in diverse industries such as semiconductor fabrication houses, automatic production lines, large data centers, pharmaceuticals, hospital equipment, and so on, their processes have become much more vulnerable to degradation in the quality of power supply. Power quality (PQ) problems in the form of voltage sag, voltage harmonic, voltage swell, and voltage flicker can cause severe process disruptions, resulting in substantial economic and/or data losses. On the other hand, the increase usage of the power electronics devices and motor loadings (such as: converters, adjustable speed drives, bulk rectifiers, power supplies, elevators, large air conditioning systems, etc.), and also rapid increase in renewable energy generator in power grid, the current quality problems also become more serious, especially for lower power factor, harmonic pollution, unbalanced current, etc., which strongly affects the performance, efficiency and reliability of the power grid. Therefore, implementation of power filters is one of the effective solutions for solving the aforementioned PQ problems. In this presentation, the PQ issues, its impacts and standards to govern different PQ problems will be introduced. The basic principles of series and parallel PQ compensators for mitigating the voltage and current quality problems will be presented. In addition, the design, control and analysis of the series and parallel active PQ compensators will be discussed in details. Then, the advanced control and coordination of LC-coupling hybrid active power filters and the advanced control of the newly developed TCLC-coupling hybrid active power filter will be presented. Finally, the recent research trends of PQ compensators will be introduced.



### Chi-Seng Lam, University of Macau, China

Chi-Seng Lam (Senior Member, IEEE) received the Ph.D. degree in electrical and electronics engineering from the University of Macau (UM), Macao, China, in 2012. He completed the Clare Hall Study Programme at the University of Cambridge, Cambridge, U.K., in 2019. In 2013, he was a Postdoctoral Fellow with The Hong Kong Polytechnic University, Hong Kong, China. He is currently an Associate Professor with the State Key Laboratory of Analog and Mixed-Signal VLSI and the Institute of Microelectronics, UM, and also with the Department of Electrical and Computer Engineering, Faculty of Science and Technology, UM. He has coauthored or co-edited four books and more than 160 technical journals and conference papers. He holds six U.S. and three Chinese patents. His research interests include power quality compensators, renewable energy generation, power management integrated circuits, and wireless power transfer.



### Cheng Gong, University of Macau, China

Cheng Gong (Member, IEEE) received the M.Sc. degree in electrical engineering from the Guangxi University, Nanning, China, in 2017, and Ph.D. degree in electrical and computer engineering from University of Macau (UM), Macao, China, in 2022. Currently, he is a Postdoctoral Fellow in the Institute of Microelectronics of UM. His research interest includes power quality, converter controller design, and power electronic based power systems.



### Wai-Kit Sou, University of Macau, China

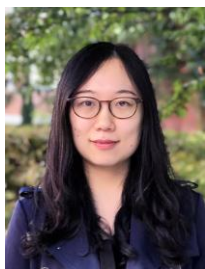
Wai-Kit Sou (Graduate Student Member, IEEE) received the B.Sc. degree in electrical and computer engineering from the University of Macau (UM), Macao, China, in 2019. He is currently working toward the Ph.D. degree in electrical and computer engineering, UM. His current research interests include power electronics, energy saving and power quality compensation. Mr. Sou was the recipient of the Macao Science and Technology Development Fund Postgraduate Award for Ph.D. Student in 2022. He has been a member in the board of supervisors of PES/PELS Joint Chapter in IEEE Macau Section since 2018. From 2020, he is the secretary of IES Chapter under IEEE Macau Section and the member of Power Quality Subcommittee of the IEEE IES PETC.

## Tutorial 06: Advanced Control and Management of DC Microgrids

<b>Beijing Time</b>	14:00-16:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 2
<b>Zoom ID</b>	759 390 6904	<b>Zoom Link</b>	<a href="https://zoom.us/j/7593906904">https://zoom.us/j/7593906904</a>

In recent years, due to the wide utilization of dc power sources, such as solar photovoltaics (PV), fuel cell (FC), and various energy storage systems (ESSs) (e.g., batteries, supercapacitors (SCs), and so on), as well as the high penetration of dc loads, like light-emitting diodes, computation devices, and motor drive systems, DC microgrids are gaining increasing attention. Moreover, DC microgrids do not have the issues of synchronization, reactive power flow, harmonics, etc., as their AC counterparts. DC microgrids have been widely applied in renewable energy systems, remote households, data centers, and electric transports including more electric aircraft, electric vehicles, electric ships, etc. However, there are many challenges to be addressed in DC microgrids, including the critical demand-supply power balance under the intermittent renewable generations, the economic operation under renewable uncertainties and the stability issue emerged from the high penetration of power electronic converters. This tutorial aims to present advanced control, power management and energy management strategies to address the power balance, economic operation and stability issues in DC microgrids. First, this tutorial will present control and power management of DC microgrids to achieve real-time power balance and stable operation, including novel decentralized and distributed control strategies. Second, this tutorial will present advanced control methods for stabilization of DC microgrids. The high penetration of power electronic converters into DC microgrids may cause the constant power load (CPL) stability issues, which could lead to large voltage oscillations or even system collapse. However, most of existing methods utilize linearized small signal models and they can only ensure system stability around the operating points, thus cannot guarantee stability under large signal disturbances. Advanced control technologies will be presented, including sliding mode control, model predictive control, passivity-based control, backstepping, optimal control, etc, to provide advantages of robustness, stability, optimality, flexibility, etc; and thus they can significantly improve the performance and stability margin of DC

microgrids. Third, the tutorial will present advanced energy management strategy of fuel cell vehicles, which are typical DC microgrids. The energy management in fuel cell vehicles (FCVs) is crucial to maintain the economical operation of FCVs and the fuzzy logic control (FLC) is mainly used to manage the energy splitting between the fuel cell and other energy sources. To overcome the limitation of traditional fuzzy logic control (FLC), the dependence on expert knowledge leading to the insufficient energy splitting, this paper proposed strategy optimization based on FLC with driving cycles recognition. Initially, the driving cycles recognition is achieved based on K-means clustering method, and characteristic parameters are extracted and classified. Additionally, with the objective function which is the minimum equivalent hydrogen consumption of four typical driving cycles, the centers and widths of FLC membership function are optimized by genetic algorithm (GA), respectively. Finally, the whole FCV model is established, which includes electrical system, vehicle dynamic system, energy management system. The proposed strategy can effectively smooth the output of fuel cell (FC) and enhance the total fuel economy.



### **Qianwen Xu, KTH Royal Institute of Technology, Sweden**

Qianwen Xu, Assistant Professor at Department of Electric Engineering, KTH Royal Institute of Technology. She received PhD degree from Nanyang Technological University in 2018. Then she worked as postdoc research fellow in Aalborg University in Denmark, a visiting researcher in Imperial College London and a Wallenberg-NTU Presidential Postdoc Fellow in Nanyang Technological University, 2018-2020. Her area of expertise is advanced control, optimization and digitalization of sustainable power systems and microgrids. She has published over 50 technical papers, with 15 first-authored journal papers in top IEEE Transactions. She was awarded Winner of Nordic Energy Challenge 2022, Humboldt Research Fellowship, Excellent Doctorate Research Work, Best paper award in IEEE PEDG 2020, etc. She serves as Vice Chair in IEEE Power and Energy Society & Power Electronics Society, Sweden Chapter, and an Associate Editor for IEEE Transactions on Smart Grid and IEEE Journal of Emerging and Selected Topics in Power Electronics.



### **Benfei Wang, Sun Yat-sen University, China**

Benfei Wang, Associate Professor at School of Intelligent Systems Engineering, Shenzhen Campus of Sun Yat-sen University, Shen Zhen, China. He received the B.Sc. degree in electronic information science and technology from the University of Science and Technology of China, Hefei, China, in 2011, and the Ph.D. degree in electrical and electronic engineering from Nanyang Technological University (NTU), Singapore, in 2017. From 2017 to 2019, he was as a Postdoc Research Fellow with Energy Research Institute, NTU. His research interests include model predictive control, multiport converter, energy storage system, electric vehicles, and microgrids. He has published over 60 technical papers, including 23 journal papers in top IEEE Transactions. He serves as the Technical Program Committee member of IEEE Conference on Industrial Electronics and Applications 2021 & 2022, and section chair in Annual Conference of the IEEE Industrial Electronics Society 2020.



### **Caizhi Zhang, Chongqing University, China**

Dr. Zhang is a Professor in Chongqing University (CQU). He obtained his PhD from Nanyang technological university (NTU) in 2016 and subsequently working as a research associate and research fellow in NTU, Singapore. Now, he is a supervisor of doctoral students and the leader for the hydrogen and fuel cell vehicle lab in the college of mechanical and vehicle engineering @ CQU. He also serves as a researcher in the State Key Laboratory of Mechanical Transmissions and Chongqing Automotive Collaborative Innovation Centre, Chongqing University. He has extensive experience in hydrogen, fuel cell and fuel cell system since Sept. 2008. He has published more 80 papers. He serves as reviewer of several Journals, such as Applied Thermal Engineering, Energy conversion and management, AIP Advances, International journal of hydrogen energy and fuel cells. Dr. Zhang is the outstanding reviewer of Energy, Applied Energy, Energy conversion and management and International Journal of hydrogen Energy. He participated and in charge of more than 10 national, provincial and ministerial-level projects.

## Tutorial 07: Recent Advances on Modular Multilevel Converters

<b>Beijing Time</b>	14:00-16:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 3
<b>Zoom ID</b>	528 108 4955	<b>Zoom Link</b>	<a href="https://zoom.us/j/5281084955">https://zoom.us/j/5281084955</a>

Modular multilevel converters have achieved significant success in the area of high-power applications (high-voltage direct-current, renewable energy conversion, motor drives, power distribution systems, transportation). The purpose of this tutorial is to provide a systematic overview of the multilevel converters in terms of their operation principles, latest achievements, emerging applications, and remaining challenges. The tutorial will start introducing the structure and basic operation principles of the modular multilevel converters. And then, the tutorial will introduce the fault detection of submodules and fault tolerant control scheme. Afterwards, the tutorial will introduce the control of the modular multilevel converter under ac-grid faults, as well as the protection of the modular multilevel converter under dc line short-circuit faults.



### Fujin Deng, Southeast University, China

Dr. Fujin Deng received the Ph.D. degree in Energy Technology from the Department of Energy Technology, Aalborg University, Aalborg, Denmark, in 2012. He joined the Southeast University in 2017 and is currently a Professor in the School of Electrical Engineering and the Head of Department of Power Electronics, Southeast University, Nanjing, China. From 2013 to 2015 and from 2015 to 2017, he was a Postdoctoral Researcher and an Assistant Professor, respectively, in the Department of Energy Technology, Aalborg University, Aalborg, Denmark. He has conducted a number of research projects and published more than 100 journal papers and a book on Modular Multilevel Converter in WILEY-IEEE PRESS. His main research interests include multilevel converters, high-voltage direct-current transmission technology, wind power generation, and offshore wind farm-power systems dynamics.



### Chengkai Liu, Southeast University, China

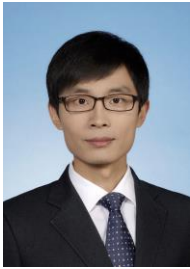
Chengkai Liu received the BEng degree in Electrical Engineering from Chien-Shiung WU College of Southeast University, Nanjing, China, in 2018, where he is currently working toward the Ph.D. degree with the School of Electrical Engineering. He was a guest Ph.D. student in the Department of Energy Technology Aalborg University, Aalborg, Denmark from 2021 to 2022. Mr. Liu has published 17 peer-reviewed journal articles and held 6 issued patents. His main research interests include modular multilevel converter (MMC), condition monitoring, fault detection and DC fault protection.

## Tutorial 08: Modeling, Analysis and Suppression of Wideband Oscillations in Wind Farms Integrated with Ac/DC Transmission

<b>Beijing Time</b>	14:00-16:00   June 9, 2023	<b>Onsite Room</b>	3F / Riverview 5
<b>Zoom ID</b>	917 991 2817	<b>Zoom Link</b>	<a href="https://zoom.us/j/9179912817">https://zoom.us/j/9179912817</a>

With the increasing penetration of wind power generation, the dynamic characteristics of the power system have been witnessed a significant change. When integrating large-scale wind power plants, especially for the offshore wind farms, the high-voltage direct current (HVDC) transmission is preferred and practical projects based on the modular multilevel converter (MMC) for wind farms have been globally put into operation or under construction. In China, several key projects with the capacity of more than 1000 MW are being built. However, the wideband oscillatory phenomena arising from the interactions between the wind farm and the MMC-HVDC system have been frequently observed and reported in practical systems. The issue has become the hot topic and extensive research has been conducted in recent years. This tutorial will discuss how to model, analyze and mitigate the interactive oscillations occurred in the interconnected system of wind farm and AC/DC transmission using the impedance approach. This tutorial will begin with an introduction to the oscillatory phenomena occurred in several practical systems in China. Then, a systematic introduction to the basic theory of impedance modeling and impedance-based method will be given. Afterward, the detailed impedance modeling of the doubly-fed induction generator (DFIG) based and permanent-magnetic synchronous generator (PMSG) based wind energy conversion systems will be elaborated, and the small-signal stability of them with weak AC grids will be analyzed. Next, the impedance modeling of the MMC including internal dynamics and all control loops will be presented using the harmonic state-space (HSS) modeling method. Subsequently, the factors exhibiting significant impacts on the wideband impedance characteristics of the MMC will then be discussed. For interaction analysis, the aggregation modeling of wind

farm for wideband oscillations analysis will be first introduced and discussed. On this basis, the mechanisms of wideband oscillations in the offshore wind farm-MMC interconnected system will then be revealed with special focuses on the discussion of the main influencing factors. Finally, to alleviate the afore-identified oscillation issues, some stabilization control methods for improving the stability of the interconnected system will be discussed.



### **Jing Lyu, Shanghai Jiao Tong University, China**

Jing Lyu was a Postdoctoral Research Fellow with the Department of Engineering Cybernetics, Norwegian University of Science and Technology, Trondheim, Norway, from 2016 to 2017. From 2018 to 2021, he was a tenure-track Assistant Professor with the Department of Electrical Engineering, Shanghai Jiao Tong University, where he is currently a tenure-track Associate Professor. His current research interests include dynamic stability of HVDC connected renewable energy and application of artificial intelligence in power electronic systems.

Dr. Lyu has been closely working with several leading companies in China on the stability and control of MMC-based HVDC systems for wind farms/PV plants, which aims at dealing with the wideband oscillation problems occurred in practical systems. He has published more than 90 technical papers in the field of wind power generation and HVDC transmission. He is the recipient of 2020 Premium Award for Best Paper in IET Generation, Transmission & Distribution.



### **Chen Zhang, Shanghai Jiao Tong University, China**

Chen Zhang received his Ph.D. from Shanghai Jiao Tong University (SJTU), Shanghai, China in March 2018. He was respectively with the Norwegian University of Science and Technology and the Technical University of Denmark in 2018 and 2020 as Postdoc. Since 2021, he is a tenure-track Associate Professor with the Department of Electrical Engineering of SJTU. His main research interest relates to the modelling, analysis and control of inverters-based systems including wind power and battery energy storage systems.

Dr. Zhang have authored and co-authored more than 30 journal papers in the area of impedance analysis of grid-tied converters. Since 2021, he serves as Associate Editor for IEEE Transactions on Energy Conversion.



### **Haoxiang Zong, Shanghai Jiao Tong University, China**

Haoxiang Zong received the B.Eng. degree from the Tianjin University, China, in 2017, and the Ph.D. degree from Shanghai Jiao Tong University, China in 2022. Currently, he is a postdoctoral researcher with the Department of Electrical Engineering, Shanghai Jiao Tong University, Shanghai, China. From 2019 to 2021, he has been a Ph.D. Visiting Scholar at the Department of Engineering Cybernetics, Norwegian University of Science and Technology, Trondheim, Norway. His current research interest is frequency-domain modeling and stability analysis of the power electronics dominated power system with wind farms, MMCs and BESS systems.

## Industry Sessions

### I01 Power Electronics for Sustainable Sources and Distributed Power System

**Chair(s):** Hong-Je Ryoo, Chung-Ang University & Meiqin Mao, Hefei University of Technology

**Onsite Room:** 3F / Terrace Ballroom 2

**Time:** 13:30-15:30 (Beijing Time) | June 10, 2023

**Zoom ID:** 759 390 6904

13:30-13:50	Invited	<b>Title</b> PV and battery storage system introduction and performance improvement
		<b>Presenter</b> Wenping Zhang, Ginlong Technologies Co.,Ltd.
13:50-14:10	#8859	<b>Paper Title</b> A Novel Operation and Control Framework of Hydrogen-Producing Offshore Wind Turbine
		<b>Author(s)</b> Wenbo Tian (Aalborg University); Yanbo Wang (Aalborg University); Zhe Chen (Aalborg University)
14:10-14:30	#4028	<b>Paper Title</b> The Study on Thermal Performance of Cooling System and Interconnection Layer for High-Temperature SiC Applications
		<b>Author(s)</b> Fengtao Yang (Xi'an Jiaotong University); Wenjie Xu (Xi'an Jiaotong University); Hang Kong (Xi'an Jiaotong University); Mengyu Zhu (Xi'an Jiaotong University); Zizhen Cheng (Xi'an Jiaotong University); Laili Wang (Xi'an Jiaotong University); Lixin Jia (Xi'an Jiaotong University); Kai Gao (State Grid Shanghai Electric Power Research Institute)
14:30-14:50	#370	<b>Paper Title</b> A Nine-Switch AC/AC Current Source Converter
		<b>Author(s)</b> Zijian Wang (Lakehead University); Qiang Wei (Lakehead University)
14:50-15:10	#3820	<b>Paper Title</b> Simplified SVPWM Capacitor Voltage Balancing Control Method for Four-Level Neutral Point Clamped Inverters
		<b>Author(s)</b> Chengzhi Li (Wuhan University); Jianfei Chen (Wuhan University)
15:10-15:30	#8950	<b>Paper Title</b> A Pulsed Current Type Laser Drive for Laser Simultaneous Wireless Information and Power Transfer
		<b>Author(s)</b> Jinhan Shao (Nanjing University of Aeronautics and Astronautics); Weiyang Zhou (Nanjing University of Aeronautics and Astronautics); Xirui Zhu (Aerospace System Engineering Shanghai); Ke Jin (Nanjing University of Aeronautics and Astronautics)

## I02 Real-Time Simulation Technology and Applications in Sustainable Energy System

**Chair(s):** Wenli Yao, Northwestern Polytechnical University & Xinxing Wang, ModelingTech

**Onsite Room:** 3F / Terrace Ballroom 1

**Time:** 13:30-15:30 (Beijing Time) | June 11, 2023

**Zoom ID:** 462 848 5634

13:30-13:50	Invited	<b>Title</b> Switch and Converter Modeling for Power Electronics Real-Time Simulation
		<b>Presenter</b> Xinxing Wang, ModelingTech
13:50-14:10	Invited	<b>Title</b> Real-time simulation technology analysis for power electronic systems
		<b>Presenter</b> Xingwu Yang, Shanghai University of Electric Power
14:10-14:30	Invited	<b>Title</b> Dual Inertia Support for Interlinking Converters in a Islanded Hybrid Microgrid
		<b>Presenter</b> Yan Du, Hefei University of Technology
14:30-14:50	Invited	<b>Title</b> General Equivalent modeling and real-time Simulation methods for cascaded power electronic systems
		<b>Presenter</b> Jin Xu, Keyou Wang, Shanghai Jiao Tong University
14:50-15:10	Invited	<b>Title</b> Synchronization Strategy of Grid-Tied Inverters for Renewable Energy
		<b>Presenter</b> Chuanchuan Hou, Shanghai Jiao Tong University

## Technical Sessions

T01 Distributed Generation Interacting with Power Transmission and Distribution Systems		
<b>Chair(s):</b> Shuo Yan, RMIT University & Xiaofeng Yang, Beijing Jiaotong University		<b>Onsite Room:</b> 3F / Terrace Ballroom 1
<b>Time:</b> 13:30-15:30 (Beijing Time)   June 10, 2023		<b>Zoom ID:</b> 462 848 5634
13:30-13:50	#7699	<b>Paper Title</b> A Hybrid Power Sharing Strategy For Parallel Inverters With Interconnect Lines Fault Ride-through
		<b>Author(s)</b> Kai Yu (Huazhong University of Science and Technology); Li Peng (Huazhong University of Science and Technology); Bowei Lin (Huazhong University of Science and Technology)
13:50-14:10	#129	<b>Paper Title</b> Modeling and Stability Analysis of Islanded AC Microgrids with Virtual Impedance and Line Impedance Compensation Control Loops
		<b>Author(s)</b> Ravi Kumar Gaddala (University of Houston); Kaushik Rajashekara (University of Houston); Jean M.L. Fonseca (Caterpillar Inc.)
14:10-14:30	#1800	<b>Paper Title</b> Research on Multi-Objective Optimization Scheme in Multi-Node Energy-Router-Based Network
		<b>Author(s)</b> Yuxin Liu (Xi'an Jiaotong University); Yijun Wang (Xi'an Jiaotong University); Haotian Deng (Xi'an Jiaotong University); Jiachen Tian (Xi'an Jiaotong University); Feng Wang (Xi'an Jiaotong University); Fang Zhuo (Xi'an Jiaotong University)
14:30-14:50	#8601	<b>Paper Title</b> A multi-objective planning method based on transmission and distribution coordination considering economy and green
		<b>Author(s)</b> Xiaoguang Qi (State Grid Hebei Electric Power Co.,Ltd. Institute of Economics and Technology); Peng Xi (State Grid Hebei Electric Power Co.,Ltd. Institute of Economics and Technology); Lu Liu (Shanghai Jiao Tong University); Ying Wang (State Grid Hebei Electric Power Co.,Ltd. Institute of Economics and Technology); Lijie Zhang (State Grid Hebei Electric Power Co.,Ltd. Institute of Economics and Technology); Aowei Li (Shanghai Jiao Tong University)
14:50-15:10	#721	<b>Paper Title</b> PEDF (Photovoltaics, Energy Storage, Direct Current, Flexibility) Microgrid Cost Optimization Based on Improved Whale Optimization Algorithm
		<b>Author(s)</b> Yijun Wang (Xi'an Jiaotong University); Yuxin Liu (Xi'an Jiaotong University); Kexu Zhao (Xi'an Jiaotong University); Haotian Deng (Xi'an Jiaotong University); Feng Wang (Xi'an Jiaotong University); Fang Zhuo (Xi'an Jiaotong University)
15:10-15:30	#4187	<b>Paper Title</b> Flexibilities of a Voltage Support Control Strategy for Grid-Connected Inverter-Interfaced Distributed Generators During Voltage Sags

		<b>Author(s)</b> Ingrid J. Moreno (Universidad Industrial de Santander); María A. Mantilla (Universidad Industrial de Santander); Astrid Esparza (Universidad Industrial de Santander); Juan M. Rey (Universidad Industrial de Santander) David J. Rincón (Universidad Industrial de Santander)
<b>T02 Energy Storage Systems</b>		
<b>Chair(s):</b> Hongbo Zhao, Aalborg University & Sideng Hu, Zhejiang University		<b>Onsite Room:</b> 3F / Riverview 1
<b>Time:</b> 13:30-15:30 (Beijing Time)   June 10, 2023		<b>Zoom ID:</b> 528 108 4955
<b>13:30-13:50</b>	<b>#8710</b>	<b>Paper Title</b> Optimal Energy Storage Management of Hydro-PV Hybrid Microgeneration
		<b>Author(s)</b> Valdecir Junior De Paris (Federal University of Santa Catarina - UFSC); Fernanda de Moraes Carnielutti (Federal University of Santa Maria - UFSM); Denizar Cruz Martins (Federal University of Santa Catarina - UFSC)
<b>13:50-14:10</b>	<b>#3468</b>	<b>Paper Title</b> Utility Scale Battery Energy Storage Modes of Operation implemented in Dubai
		<b>Author(s)</b> Ali Almarzooqi (Research and Development Centre, Dubai Electricity and Water Authority); Hamad Albeshr (Research and Development Centre, Dubai Electricity and Water Authority); Ali Husnain (Research and Development Centre, Dubai Electricity and Water Authority); Endika Bilbao (Research and Development Centre, Dubai Electricity and Water Authority)
<b>14:10-14:30</b>	<b>#535</b>	<b>Paper Title</b> A No Communication WPT System with Dual Resonant Tank Based on Fundamental and Harmonic Current
		<b>Author(s)</b> Jingchi Wu (Southwest Jiaotong University); Yuhao Deng (Southwest Jiaotong University); Zeliang Shu (Southwest Jiaotong University)
<b>14:30-14:50</b>	<b>#899</b>	<b>Paper Title</b> Comprehensive Analysis on the Current Imbalance in Modular IPOP WPT Systems with LCC Compensated Sub-modules
		<b>Author(s)</b> Zeneng Ning (Nanjing University of Aeronautics and Astronautics); Fuxin Liu (Nanjing University of Aeronautics and Astronautics); Shuci Yu (Nanjing University of Aeronautics and Astronautics); Xuling Chen (Nanjing University of Aeronautics and Astronautics)
<b>14:50-15:10</b>	<b>#6626</b>	<b>Paper Title</b> Online Battery Impedance Identification Based on DC-DC Converter with Low Ripple
		<b>Author(s)</b> Xinyue Liu (Shanghai Jiao Tong University); Rui Li (Shanghai Jiao Tong University)
<b>15:10-15:30</b>	<b>#3800</b>	<b>Paper Title</b> A Decentralized Power Coordination Strategy for Battery/Supercapacitor in DC Microgrids
		<b>Author(s)</b> Yueqian Bai (Xi'an Jiaotong University); Qiru Li (Xi'an Jiaotong University); Xiao Zhang (Xi'an Jiaotong University); Zhenxiong Wang (Xi'an Jiaotong University); Hao Yi (Xi'an Jiaotong University); Yuxin Liu (Xi'an Jiaotong University)

## T03 Emerging Topics on Renewables

**Chair(s):** Hongjie Wang, Utah State University & Binbin Li, Harbin Institute of Technology

**Onsite Room:** 3F / Riverview 2

**Time:** 13:30-15:30 (Beijing Time) | June 10, 2023

**Zoom ID:** 917 991 2817

13:30-13:50	#9561	<b>Paper Title</b> Lightweight stream computing framework based on distributed power terminals
		<b>Author(s)</b> Bin Zhu (Shanghai Jiao Tong University); Dong Liu (Shanghai Jiao Tong University) Tianyuan Liu (Shanghai Jiao Tong University); Fei Chen (Shanghai Jiao Tong University) Ming Cao (Yunnan Power Grid Co.,Ltd); Hongyu Wang (Wiscom System Co., LTD) Siyang Liu (Yunnan Power Grid Co.,Ltd); Yongjie Nie (Yunnan Power Grid Co.,Ltd)
13:50-14:10	#6112	<b>Paper Title</b> An Improved Cauer Model of IGBT Module Considering Chip Solder Degradation
		<b>Author(s)</b> Qian Zhang (Hefei University of Technology); Mingyao Ma (Hefei University of Technology); Weisheng Guo (Hefei University of Technology); Fei Li (Hefei University of Technology); Hanyu Wang (Hefei University of Technology)
14:10-14:30	#7111	<b>Paper Title</b> Online Observation for IGBT Module Loss and Spatial Temperature with Aging Tracking: A Data-driven Method
		<b>Author(s)</b> Fengrui Liang (Chongqing University); Yu Wang (Laboratory of Low frequency Electromagnetic Communication Technology with the WMCRI, CSSC); Jinxiao Wei (Chongqing University); Hao Feng (Chongqing University); Li Ran (University of Warwick)
14:30-14:50	#6463	<b>Paper Title</b> Self-Excited Current Reference for Power- Electronics-Based Electric Machine Emulator
		<b>Author(s)</b> Shihao Xia (Shanghai Jiao Tong University); Ke Ma (Shanghai Jiao Tong University); Aiguo Wang (Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.); Xinqiang Li (Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.); Luhai Zheng (Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.)
14:50-15:10	#8587	<b>Paper Title</b> Tj-Vce Calibration under Self-heating Condition for Online Junction Temperature Monitoring of IGBT Module
		<b>Author(s)</b> Guanyu Lu (Shanghai Jiao Tong University); Aiguo Wang (Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.); Ke Ma (Shanghai Jiao Tong University) Yuli Feng (Shanghai Jiao Tong University); Luhai Zheng (Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.); Xinqiang Li (Shanghai Electrical Apparatus Research Institute (Group) Co., Ltd.)
15:10-15:30	#8735	<b>Paper Title</b> Accurate and Efficient Loss Characterization Method of 3-level NPC Switching Arms Based on H-bridge Testing Circuit
		<b>Author(s)</b> Yuli Feng (Shanghai Jiao Tong University); Yiming Wang (Ginlong Technologies Co., Ltd.); Po Xu (Ginlong Technologies Co., Ltd.); Jiaqi Cao (Ginlong Technologies Co., Ltd.); Guanyu Lu (Shanghai Jiao Tong University); Ke Ma (Shanghai Jiao Tong University)

## T04 DC-DC Conversion and Control Techniques

**Chair(s):** Yuqi Wei, Xi'an Jiaotong University & Minfan Fu, ShanghaiTech University

**Onsite Room:** 3F / Terrace Ballroom 1

**Time:** 15:50-17:50 (Beijing Time) | June 10, 2023

**Zoom ID:** 462 848 5634

15:50-16:10	#8341	<b>Paper Title</b> Bidirectional Modular Multilevel Resonant DC Converter for MVDC and LVDC Application
		<b>Author(s)</b> Boliang Li (Xi'an Jiaotong University); Long Xu (Zhejiang University Hangzhou); Jing Sheng (Zhejiang University Hangzhou); Cong Chen (Zhejiang University Hangzhou); Xin Xiang (Zhejiang University Hangzhou); Xiaotian Zhang (Xi'an Jiaotong University); Wuhua Li (Zhejiang University Hangzhou)
16:10-16:30	#3733	<b>Paper Title</b> Modified Zeta Bidirectional Non-Isolated DC-DC Converter with Wide Voltage Gain for E-mobility
		<b>Author(s)</b> Rakesh Thapliyal (National Institute of Technology); Sourav Bose (National Institute of Technology); Prakash Dwivedi (National Institute of Technology)
16:30-16:50	#5553	<b>Paper Title</b> A Seamless Control Based on the State Follower for the Energy Balance of the Bipolar-Type Modular Solid-State Transformer
		<b>Author(s)</b> Hongming Li (Shanghai Jiao Tong University); Jianqiao Zhou (Shanghai Jiao Tong University); Jianwen Zhang (Shanghai Jiao Tong University); Gang Shi (Shanghai Jiao Tong University); Xu Cai (Shanghai Jiao Tong University); Yong Wang (HVDC Transmission and Power Electronics Business Unit Beijing Sifang Automation CO.,Ltd.); Xiaofeng Dong (Facilities Management Suzhou power supply company); Wei Bao (State Grid Shanghai Municipal Electric Power Company)
16:50-17:10	#8360	<b>Paper Title</b> Optimal Circulant Modulation for Submodule Capacitor Ripple Minimization and Inherent Voltage Balancing in Modular Multilevel DC Converters
		<b>Author(s)</b> Shiyuan Fan (Zhejiang University); Xin Xiang (Zhejiang University); Yunjie Gu (Imperial College London); Huan Yang (Zhejiang University); Wuhua Li (Zhejiang University); Rongxiang Zhao (Zhejiang University); Xiangning He (Zhejiang University); Timothy C. Green (Imperial College London)
17:10-17:30	#8519	<b>Paper Title</b> Wide Voltage Range Dual Active Bridge DC-DC Converter and Control Strategy Implementation
		<b>Author(s)</b> Xiaofeng Yang (Beijing Jiaotong University); Rui Zhao (Beijing Jiaotong University); Lixin Liao (Beijing Jiaotong University); Yan Liu (Beijing Jiaotong University); Renbiao Nong (Beijing Jiaotong University)
17:30-17:50	#3695	<b>Paper Title</b> MHz Level Two-Stage ZVS DC-DC Converter with Wide Input and Output Voltage Ranges
		<b>Author(s)</b> Xinlong Huang (Zhejiang University); Guangcan Li (Zhejiang University); Lin Tian (Zhejiang University); Xinke Wu (Zhejiang University)

### T05 Power Electronics Devices and Components

**Chair(s):** Takanori Isobe, University of Tsukuba & Qian Xiao, Tianjin University

**Onsite Room:** 3F / Riverview 1

**Time:** 13:30-15:30 (Beijing Time) | June 11, 2023

**Zoom ID:** 528 108 4955

13:30-13:50	#8718	<b>Paper Title</b> Performance Evaluations of Reducing Switching Noise DC-DC Converter Adopting An Alternative Modulation Scheme
		<b>Author(s)</b> Atsushi Hirota (Akashi College)
13:50-14:10	#5055	<b>Paper Title</b> GaN-Based Active Clamp Flyback Converter Realizing Soft-Switching Over Wide Voltage Range Through Auxiliary Leakage Inductor
		<b>Author(s)</b> Lunbo Deng (Southwest Jiaotong University); Guohua Zhou (Southwest Jiaotong University); Yanglong Li (Southwest Jiaotong University); Haikun Yu (Sichuan Shenghua Power Technology Co., Ltd.)
14:10-14:30	#5083	<b>Paper Title</b> A Soft-switching Solid-State Transformer Module
		<b>Author(s)</b> Xufu Ren (Zhejiang University); Yongshan Jiang (Zhejiang University); Haoyuan Weng (Zhejiang University); Teng Long (University of Cambridge); Dehong Xu (Zhejiang University)
14:30-14:50	#9360	<b>Paper Title</b> A Self-clamping Non-synchronous Duty Cycle Control Strategy for Hybrid Clamping Three-level Buck Converter with GaN Devices
		<b>Author(s)</b> Shiyu Zhu (Zhejiang University); Wending Zhao (Zhejiang University); Xinke Wu (Zhejiang University)
14:50-15:10	#7237	<b>Paper Title</b> A Plug-and-Play Active Impedance Module with Variable Impedance Control
		<b>Author(s)</b> Zhihao Lin (Aalborg University); Bo Yao (Aalborg University); Huai Wang (Aalborg University)
15:10-15:30	#4700	<b>Paper Title</b> A Double-sided 650 V GaN Power Device using Flexible Buffers with Low Parasitic Inductance
		<b>Author(s)</b> Siqi Liu (Tianjin University); Longnv Li (Tiangong University); Yun-Hui Mei (Tiangong University)

### T06 DC-AC Conversion and Control Techniques

**Chair(s):** Yajuan Guan, Aalborg University & Li Zhang, Hohai University

**Onsite Room:** 3F / Riverview 3+5

**Time:** 13:30-15:30 (Beijing Time) | June 11, 2023

**Zoom ID:** 272 702 7927

13:30-13:50	#1229	<b>Paper Title</b> A New 5-Level Current Source Inverter with Inherent Balancing
-------------	-------	---

		<b>Author(s)</b> Ling Xing (University of Alberta); Qiang Wei (Lakehead University); Yunwei Li (University of Alberta)
13:50-14:10	#7259	<b>Paper Title</b> An Improved Neutral-Point Voltage Control Method for Ten-Switch Three-Phase Three-Level Inverter Using Virtual Space Vector Modulation  <b>Author(s)</b> Xiaojun Deng (Hunan University); Hongliang Wang (Hunan University); Wei Tang (Hunan University); Di Kang (Hunan University); Yang Jiang (Hunan University); Xiumei Yue (Hunan University); An Luo (Hunan University)
14:10-14:30	#5334	<b>Paper Title</b> A Novel Cascaded Multilevel Inverter Topology and its Control Strategy for Medium-Voltage Direct- Mounted Photovoltaic Grid-Connected System  <b>Author(s)</b> Mengze Wu (Hefei University of Technology); Xing Zhang (Hefei University of Technology); Mingda Wang (Hefei University of Technology); Shucheng Wang (Hefei University of Technology)
14:30-14:50	#7773	<b>Paper Title</b> A New Current Source Converter-based Topology for Wind Energy Conversion Systems  <b>Author(s)</b> Zijian Wang (Lakehead University); Qiang Wei (Lakehead University)
14:50-15:10	#6556	<b>Paper Title</b> A Switching Frequency Variation Detecting based Adaptive and Sensorless Synchronous Rectification Strategy for LLC Converter  <b>Author(s)</b> Ziang Li (Xi'an Jiaotong University); Yuqi Wei (Xi'an Jiaotong University); Jinjun Liu (Xi'an Jiaotong University)
15:10-15:30	#7349	<b>Paper Title</b> Multi-port Full-duplex Simultaneous Wireless InformationPower Transfer Method Based on 4PAM Modulation Scheme with 1.25Mbps Data Rate  <b>Author(s)</b> Ping Luo (Nanjing University of Aeronautics and Astronautics); Fuxin Liu (Nanjing University of Aeronautics and Astronautics); Xuling Chen (Nanjing University of Aeronautics and Astronautics)
<b>T07 Dynamic Performance Evaluation and Improvement of DC-DC/DC-AC Converters</b>		
<b>Chair(s):</b> Chi-Seng Lam, University of Macau & Jing Lyu, Shanghai Jiao Tong University		<b>Onsite Room:</b> 3F / Terrace Ballroom 1
<b>Time:</b> 15:50-17:50 (Beijing Time)   June 11, 2023		<b>Zoom ID:</b> 462 848 5634
15:50-16:10	#3173	<b>Paper Title</b> Auxiliary Droop Frequency and Voltage Control for Grid-Forming Applied to Unbalanced Current Compensation  <b>Author(s)</b> Ana Marin-Hurtado (Universidad Tecnológica de Pereira); Walter Gil-González (Universidad Tecnológica de Pereira); Andrés Escobar-Mejía (Universidad Tecnológica de Pereira)

16:10-16:30	#9722	<b>Paper Title</b> Transient Response Optimization of Bidirectional Dual-Active-Bridge DC/DC Converters Based on Dual-Phase-Shift  <b>Author(s)</b> Lei Luo (Shenzhen University); Yitao Liu (Shenzhen University); Li Kang (Dongguan University of Technology); Xiaochao He (Shenzhen University); Yun Wang (Shenzhen University); Jian Yin (Shenzhen University)
16:30-16:50	#7702	<b>Paper Title</b> Minimum Peak Current Optimization Scheme Based on Genetic Algorithm for Three-Level ANPC-DAB Converter with All Switches ZVS  <b>Author(s)</b> Haotian Deng (Xi'an Jiaotong University); Jiachen Tian (Xi'an Jiaotong University); Yuxin Liu (Xi'an Jiaotong University); Yijun Wang (Xi'an Jiaotong University); Feng Wang (Xi'an Jiaotong University); Fang Zhuo (Xi'an Jiaotong University)
16:50-17:10	#9305	<b>Paper Title</b> Impact of Voltage Phase Jump on Transient Reactive Power of PV Inverter in LVRT  <b>Author(s)</b> Zhuang Liu (Tsinghua University); Jinghong Zheng (Tsinghua University); Yiyun Gou (Tsinghua University); Yusheng Ding (Tsinghua University)
17:10-17:30	#2166	<b>Paper Title</b> Analysis and Control of A Full-Bridge Three-Level CLLC Resonant Converter  <b>Author(s)</b> Mingmin Ding (Southeast University); Jianzhong Zhang (Southeast University)
17:30-17:50	#6687	<b>Paper Title</b> Optimized Parameter Tuning Method for ADR-based Phase-Locked Loop  <b>Author(s)</b> Qi Liu (Hohai University); Li Zhang (Hohai University)
<b>T08 Control and Protection of Emerging Multi-port Converters for Interconnected Renewable Systems</b>		
<b>Chair(s):</b> Yenan Chen, Zhejiang University & Chen Zhang, Shanghai Jiao Tong University		<b>Onsite Room:</b> 3F / Riverview 2
<b>Time:</b> 15:50-17:50 (Beijing Time)   June 11, 2023		<b>Zoom ID:</b> 917 991 2817
15:50-16:10	#1490	<b>Paper Title</b> Parallel Virtual Impedance Based Fluctuation Power Delivery Strategy For MMC Based SST  <b>Author(s)</b> Jiayi Li (Donghua University); Jianqiao Zhou (Shanghai Jiao Tong University); Jianwen Zhang (Shanghai Jiao Tong University); Gang Shi (Shanghai Jiao Tong University); Xu Cai (Shanghai Jiao Tong University); Yong Wang (HVDC Transmission and Power Electronics Business Unit Beijing Sifang Automation CO.,Ltd.); Xiaofeng Dong (Facilities Management Suzhou power supply company); Wei Bao (Shanghai Electrical Apparatus Research Institute Group CO.,Ltd.)
16:10-16:30	#7350	<b>Paper Title</b> A Structure-Integrated Partially-Isolated Three-Port DC-DC Converter for Renewable Power Systems

		<b>Author(s)</b> Xianbin Qi (Harbin Institute of Technology (Shenzhen)); Yi Wang (Harbin Institute of Technology (Shenzhen)); Mingzhu Fang (Harbin Institute of Technology (Shenzhen)); Hong Wang (Harbin Institute of Technology (Shenzhen)); Yanbo Wang (Aalborg University); Zhe Chen (Aalborg University)
16:30-16:50	#1683	<b>Paper Title</b> Fast Frequency Control of MTDC System Integrated Offshore Wind Farms Based on Short-Term Power Overshoot <b>Author(s)</b> Yue Xin (Sichuan University); Qiao Peng (Sichuan University); Tianqi Liu (Sichuan University); Tingyun Gu (Electric Power Research Institute Guizhou Power Grid Co., Ltd.); Huachun Han (State Grid Jiangsu Electric Power Research Institute)
16:50-17:10	#2167	<b>Paper Title</b> Coordinated Converter Control with Current Differential Protection under Unbalanced AC Fault in Offshore Wind Farm <b>Author(s)</b> Guoqing Gao (Aalborg University); Frede Blaabjerg (Aalborg University); Zhe Chen (Aalborg University); Yanbo Wang (Aalborg University)
17:10-17:30	#3985	<b>Paper Title</b> Islanding Detection With Zero Non-detection Zone for DC Microgrids Based on Current Disturbance of Adaptive Resonant Frequency <b>Author(s)</b> Tianling Shi (Shanghai University); Boxin Liu (Zhejiang University); Jintao Lei (Zhejiang University); Fei Wang (Shanghai University); Xin Xiang (Zhejiang University); Wuhua Li (Zhejiang University)
17:30-17:50	#9045	<b>Paper Title</b> A Black Start Strategy Based on Multiport Interlinking Converters for DC Microgrids <b>Author(s)</b> Hanwen Zhang (Aalborg University); Yanbo Wang (Aalborg University); Haoyuan Yu (Aalborg University); Zhe Chen (Aalborg University)
<b>T09 Stability and Reliability Assessment of Power Electronics for Distributed Generation Systems</b>		
<b>Chair(s):</b> Weihua Zhou, Monash University & Haoxiang Zong, Shanghai Jiao Tong University		<b>Onsite Room:</b> 3F / Riverview 1
<b>Time:</b> 10:15-12:15 (Beijing Time)   June 12, 2023		<b>Zoom ID:</b> 462 848 5634
10:15-10:35	#3972	<b>Paper Title</b> Thermal Stress Emulation of Power Devices Subject to DFIG Wind Power Converter <b>Author(s)</b> Xinming Yu (Aalborg University); Francesco Iannuzzo (Aalborg University); Dao Zhou (Aalborg University)
10:35-10:55	#8104	<b>Paper Title</b> Absolute Stability Improvement of Single-Phase Grid-Connected Inverters with Open-Loop Synchronization Based on Grid Current Feedforward <b>Author(s)</b> Lingjuan Tan (Nanjing University of Aeronautics and Astronautics); Cheng Cheng (Nanjing University of Aeronautics and Astronautics); Ziwen Yang (Nanjing University of Aeronautics and Astronautics); Shaojun Xie (Nanjing University of Aeronautics and Astronautics); Jinming Xu (Nanjing University of Aeronautics and Astronautics)

10:55-11:15	#1987	<b>Paper Title</b> Reliability Assessment of NPC inverters in PV Systems Under Power Degradation and Over-Temperature Derating Operation
		<b>Author(s)</b> Meng Chen (Aalborg University); Ariya Sangwongwanich (Aalborg University); Dao Zhou (Aalborg University); Frede Blaabjerg (Aalborg University)
11:15-11:35	#604	<b>Paper Title</b> Reliability Modelling of Series Modular Multilevel Converters for MVDC Applications
		<b>Author(s)</b> Yumeng Tian (UNSW Sydney); Georgios Konstantinou (UNSW Sydney)
11:35-11:55	#486	<b>Paper Title</b> Analysis and Reliability Assessment for a Bidirectional Single-Stage DAB-Based AC/DC converter
		<b>Author(s)</b> Guangyu Wang (Xi'an Jiaotong Liverpool University); Huiqing Wen (Xi'an Jiaotong Liverpool University)
11:55-12:15	#6005	<b>Paper Title</b> Stability Analysis of Triple Active Bridge Converter with Hybrid loads and Different Control Strategies
		<b>Author(s)</b> Haoyuan Yu (Aalborg University); Hanwen Zhang (Aalborg University); Yanbo Wang (Aalborg University); Zian Qin (Delft University of Technology); Zhe Chen (Aalborg University); Pavol Bauer (Delft University of Technology)

## Special Sessions

S01 Modeling and Control of Grid Forming Converters in Modern Power System		
<b>Chair(s):</b> Heng Wu, Aalborg University & Chao Wu, Shanghai Jiao Tong University		<b>Onsite Room:</b> 3F / Terrace Ballroom 2
<b>Time:</b> 15:50-17:50 (Beijing Time)   June 10, 2023		<b>Zoom ID:</b> 759 390 6904
15:50-16:10	#4094	<b>Paper Title</b> A Consensus-based Droop Control with Adaptive Virtual Impedance of Grid-Forming Converters
		<b>Author(s)</b> Shuo YAN (RMIT University); Shing Tin TANG (RMIT University); Man Hon CHOW (Hong Kong Institute of Vocational Education); Shek Ho WONG (Hong Kong Institute of Vocational Education)
16:10-16:30	#577	<b>Paper Title</b> Frequency Support Analysis in Heterogeneous Multi-machine System and Enhancement Frequency Control of The Grid-Forming Converter
		<b>Author(s)</b> Yu Zhang (Shanghai Jiao Tong University); Chen Zhang (Shanghai Jiao Tong University); Yongzheng Yu (Contemporary Amperex Technology Co., Limited (CATL)); Liliyuan Liang (Contemporary Amperex Technology Co., Limited (CATL)); Xu Cai (Shanghai Jiao Tong University)
16:30-16:50	#1237	<b>Paper Title</b> Stability Comparison of Grid-Forming Converters with Different Power Calculation Strategies
		<b>Author(s)</b> Ziqi Zhou (Kiel University); Sante Pugliese (Kiel University); Marco Liserre (Kiel University)
16:50-17:10	#5327	<b>Paper Title</b> A Micro Switch Based Modeling Method for LCC-HVDC System
		<b>Author(s)</b> Lin Zhu (State Grid Smart Grid Research Institute Co. LTD); Huaiguang Gu (State Grid Smart Grid Research Institute Co. LTD); Shujing Li (State Grid Beijing Electric Power Company); Mingcheng Yang (Northeast Electric Power University); Qi Liu (State Grid Smart Grid Research Institute Co. LTD); Chen Jia (Liaoning Electric Power Academy of State Grid); Luyu Yang (Liaoning Electric Power Academy of State Grid)
17:10-17:30	#1995	<b>Paper Title</b> Identification of Voltage and Current Dynamic-Induced Impedance Contributions for Insights into VSG Low-Frequency Instability
		<b>Author(s)</b> Weihua Zhou (Monash University); Nabil Mohammed (Monash University); Behrooz Bahrani (Monash University)
17:30-17:50	#1331	<b>Paper Title</b> Influence of the Reactive Power Control Loop on Network Frequency Perturbation Plot
		<b>Author(s)</b> Anuradha Mudalige (Kiel University); Heng Wu (Aalborg University); Xiongfei Wang (KTH Royal Institute of Technology); Marius Langwasser (Kiel University); Marco Liserre (Kiel University)

## S02 Wide Bandgap Devices and Their Applications in Renewables

**Chair(s):** Takanori Isobe, University of Tsukuba & Yunhui Mei, Tiangong University

**Onsite Room:** 3F / Riverview 1

**Time:** 15:50-17:50 (Beijing Time) | June 10, 2023

**Zoom ID:** 528 108 4955

15:50-16:10	#1425	<b>Paper Title</b> Analysis of Mutual Inductance Between Parallel Branches for ANPC Laminated Busbar
		<b>Author(s)</b> Sideng Hu (Zhejiang University); Mustafa Tahir (Zhejiang University); Jianfeng Niu (Zhejiang University); Naoto Fujishima (Zhejiang University); Yun Lei (Technology Strategy and Planning Office, Corporate R&D Headquarters, Fuji Electric Co., Ltd.); Xiangning He (Zhejiang University)
16:10-16:30	#3747	<b>Paper Title</b> Characteristics of SiC Power Diodes under Extreme Temperatures
		<b>Author(s)</b> Mengyu Zhu (Xi'an Jiaotong University); Zizhen Cheng (Xi'an Jiaotong University); Fengtao Yang (Xi'an Jiaotong University); Laili Wang (Xi'an Jiaotong University); Hongchang Cui (Xi'an Jiaotong University); Kai Gao (State Grid Shanghai Electric Power Research Institute Shanghai)
16:30-16:50	#9520	<b>Paper Title</b> Modeling and Simulation of 1.7kV SiC MOSFET Power Module
		<b>Author(s)</b> Qingping Li (Beijing North China University of Technology); Jinghua Zhou (Beijing North China University of Technology); Weiguo Li (Power Electronics Department State Grid Smart Research Institute Co., Ltd.); Zhipeng Weng (Beijing North China University of Technology)
16:50-17:10	#7040	<b>Paper Title</b> Understanding the Thermal Characteristics of SiC Power MOSFET Device for Power Modules Design
		<b>Author(s)</b> Hongchang Cui (Xi'an Jiaotong University); Bingyang Li (Xi'an Jiaotong University); Hang Kong (Xi'an Jiaotong University); Fengtao Yang (Xi'an Jiaotong University); Feng Wang (Xi'an Jiaotong University); Laili Wang (Xi'an Jiaotong University); Kai Gao (Xi'an Jiaotong University)
17:10-17:30	#8612	<b>Paper Title</b> A Novel Dual-Feedforward Strategy for Both the Inverter-Control and Rectifier-Control of LLC Converters Based on Time-Domain Model
		<b>Author(s)</b> Long Pei (Xi'an Jiaotong University); Lixin Jia (Xi'an Jiaotong University); Laili Wang (Xi'an Jiaotong University); Lie Zhao (Xi'an Jiaotong University); Zhixiang Li (Xi'an Jiaotong University); Wei Cao (Xi'an Jiaotong University); Yunqing Pei (Xi'an Jiaotong University)
17:30-17:50	#2906	<b>Paper Title</b> Suppression on Crosstalk Voltages of Paralleled SiC MOSFETs With Optimized Gate Configurations and Additional SiC SBDs
		<b>Author(s)</b> Cheng Zhao (Xi'an Jiaotong University); Laili Wang (Xi'an Jiaotong University); Juhui Yang (Xi'an Jiaotong University); Shijie Wu (Xi'an Jiaotong University); Yongmei Gan (Xi'an Jiaotong University); Hongchang Cui (Xi'an Jiaotong University)

S03 Real-Time and Hardware-In-The-Loop Simulations for Power Electronics in Distributed Generation Systems		
<b>Chair(s):</b> Hao Bai, Northwestern Polytechnical University & Jin Xu, Shanghai Jiao Tong University & Yangbin Zeng, Tsinghua University		<b>Onsite Room:</b> 3F / Riverview 2
<b>Time:</b> 15:50-17:50 (Beijing Time)   June 10, 2023		<b>Zoom ID:</b> 917 991 2817
15:50-16:10	#2142	<b>Paper Title</b> Neutral-Point Voltage Balancing for Mission Profile Emulator of Three-Level T-type PV Inverter Using Extra Bridge
		<b>Author(s)</b> Siyu Cao (Shanghai Jiao Tong University); Ke Ma (Shanghai Jiao Tong University); Qing Yan (Sungrow Power Supply Co., Ltd.); Yuqing Sheng (Sungrow Power Supply Co., Ltd.); Yangjun Deng (Sungrow Power Supply Co., Ltd.)
16:10-16:30	#7679	<b>Paper Title</b> Parallel Electromagnetic Transient Simulation Method for MMC-based SST Based on Diakoptics
		<b>Author(s)</b> Yiming Yang (Shanghai Jiao Tong University); Jin Xu (Shanghai Jiao Tong University); Zirun Li (Shanghai Jiao Tong University); Keyou Wang (Shanghai Jiao Tong University); Guojie Li (Shanghai Jiao Tong University); Pan Wu (Shanghai Jiao Tong University)
16:30-16:50	#8335	<b>Paper Title</b> Hybrid Time and Event Co-simulation Framework for Power Electronics Systems
		<b>Author(s)</b> Weicheng Liu (Tsinghua University); Zhengming Zhao (Tsinghua University); Bochen Shi (Tsinghua University); Yangbin Zeng (Tsinghua University); Jialin Zheng (Tsinghua University); Han Xu (Tsinghua University); Di Mou (Tsinghua University); Haoyu Wang (Tsinghua University)
16:50-17:10	#8561	<b>Paper Title</b> Harmonic Space-State Based Analytical Modeling of Modular Multilevel Converters for Fast Simulation
		<b>Author(s)</b> Songkai Huang (Shanghai Jiao Tong University); Jin Xu (Shanghai Jiao Tong University); Keyou Wang (Shanghai Jiao Tong University); Guojie Li (Shanghai Jiao Tong University); Facai Xing (State Grid Shandong Power Company Electric Power Research Institute)
17:10-17:30	#7533	<b>Paper Title</b> Topology-aware Iterative Method for Large-scale Power Electronic Systems with Stray Parameters
		<b>Author(s)</b> Han Xu (Tsinghua University); Zhengming Zhao (Tsinghua University); Bochen Shi (Tsinghua University); Yangbin Zeng (Tsinghua University); Jialin Zheng (Tsinghua University); Weicheng Liu (Tsinghua University); Di Mou (Tsinghua University); Haoyu Wang (Tsinghua University)
17:30-17:50	#7950	<b>Paper Title</b> A Submodule Test Method for Modular Multilevel Converter Based on Hardware-in-the-Loop System
		<b>Author(s)</b> Linjie Han (Harbin Institute of Technology); Binbin Li (Harbin Institute of Technology); Yanjun Shen (Harbin Institute of Technology); Zeheng Sun (Harbin Institute of Technology); Yuchao Liu (Harbin Engineering University); Dianguo Xu (Harbin Institute of Technology)

### S04 Power Conversion, Energy Management, And Multi-Energy Complementarity in Microgrid I

**Chair(s):** Lijun Zhang, Shanghai University of Electric Power & Xu Chen, Shanghai University & Queena Qi, ITECH

**Onsite Room:** 3F / Terrace Ballroom 2

**Time:** 13:30-15:30 (Beijing Time) | June 11, 2023

**Zoom ID:** 759 390 6904

13:30-14:10	Invited	<b>Title</b> Turn-key Test Solution for PV Battery Storage System
		<b>Presenter</b> Queena Qi, ITECH
14:10-14:30	#7889	<b>Paper Title</b> Extended Tolerance of Capacitance Drifting for LCL#Interfaced Energy System Converter
		<b>Author(s)</b> Da Kang (Northwestern Polytechnical University); Yantao Xu (Northwestern Polytechnical University); Xikui Yu (Shenyang Aircraft Design and Research Institute); Yanfei Mao (Northwestern Polytechnical University); Wenli Yao (Northwestern Polytechnical University)
14:30-14:50	#3589	<b>Paper Title</b> Interharmonic Compensation and Voltage Flicker Suppression with Cascaded STATCOM in Renewable Energy Based Weak Grid
		<b>Author(s)</b> Kevin Liu (Shanghai University); Chen Xu (Shanghai University); Fei Wang (Shanghai University)
14:50-15:10	#1574	<b>Paper Title</b> Large-Signal Stability Analysis of DC Microgrid with State Variable Constraint
		<b>Author(s)</b> Yuxin Zhu (Shanghai University); Fei Wang (Shanghai University); Zhengyu Lin (Loughborough University); James Fleming (Loughborough University)
15:10-15:30	#5429	<b>Paper Title</b> Dynamic Optimization for Shunt Active Power Filter with Vector Discrete Fourier Transform
		<b>Author(s)</b> Han Cai (Huazhong University of Science and Technology); Xinyan Yu (Huazhong University of Science and Technology); Pengfei Jin (Huazhong University of Science and Technology); Bingyuan Yang (Huazhong University of Science and Technology); Ke Dai (Huazhong University of Science and Technology)

### S05 Design, Modeling and Control of Power Electronic Converters for Pulsed Power Applications

**Chair(s):** Longlong Zhang, China University of Petroleum (East China) & Ping Yang, Southwest Jiaotong University

**Onsite Room:** 3F / Riverview 2

**Time:** 13:30-15:30 (Beijing Time) | June 11, 2023

**Zoom ID:** 917 991 2817

13:30-13:50	#3050	<b>Paper Title</b> Direct Torque Control Based Modelling of three phase S3 Inverter for Induction Motor Control
-------------	-------	--

		<b>Author(s)</b> Akhilesh Sharma (North Eastern Regional Institute of Science and Technology); Sarsing Gao (North Eastern Regional Institute of Science and Technology)
13:50-14:10	#855	<b>Paper Title</b> Cooperative Control of DC Microgrid Cluster with Different Voltage Levels
		<b>Author(s)</b> Jiawang Qin (Shandong University); Zongjun Xin (Shandong Lukong Power Equipment Co., Ltd.); Zheng Dong (Shandong University); Hongzheng Liu (Shandong Lukong Power Equipment Co., Ltd.)
14:10-14:30	#5033	<b>Paper Title</b> Black-Box Stability Analysis Method for Dual Parallel Pulse Power Load
		<b>Author(s)</b> Xu Chen (Southwest Jiaotong University); Jianping Xu (Southwest Jiaotong University); Ping Yang (Southwest Jiaotong University); Zhengge Chen (Southwest Jiaotong University); Jin Qi (Southwest Jiaotong University); Xi Tang (Southwest Jiaotong University)
14:30-14:50	#6130	<b>Paper Title</b> Fast Step Control for Active Capacitor Converter With Pulse Loads
		<b>Author(s)</b> Fuping Hu (Southwest Jiaotong University); Xi Chen (Southwest Jiaotong University); Jinfeng Wang (Southwest Jiaotong University); Ping Yang (Southwest Jiaotong University)
14:50-15:10	#6863	<b>Paper Title</b> Research on Pulsed Power Decoupling Topology and Its Control Strategy Using Dual-Inductance Active Capacitor Unit
		<b>Author(s)</b> Linyan Zhang (Southwest Jiaotong University); Ping Yang (Southwest Jiaotong University); Wenrong Wu (Southwest Jiaotong University); Xingjiang Shen (Southwest Jiaotong University); Xi Chen (Southwest Jiaotong University)
15:10-15:30	#9696	<b>Paper Title</b> Event-Triggered MPC for Current-Source-Mode Single-Inductor Multiple-Port DC-DC Converter
		<b>Author(s)</b> Chenxuan Liang (Shandong University); Zheng Dong (Shandong University); Qiaoge Zhang (CRRC TANGSHAN CO., LTD.); Tongli Cao (Shandong Lulun Digital Technology Co.); Xianjin Gao (Shandong Lulun Digital Technology Co.); Ning Wang (Shandong Electric Times Energy Technology Co., Ltd.); Zhenbin Zhang (Shandong University)
S06 Power Conversion, Energy Management, And Multi-Energy Complementarity in Microgrid II		
Chair(s): Jia Liu, Xi'an Jiaotong University & Fei Gao, Shanghai Jiao Tong University		Onsite Room: 3F / Terrace Ballroom 2
Time: 15:50-17:50 (Beijing Time)   June 11, 2023		Zoom ID: 759 390 6904
15:50-16:10	#1488	<b>Paper Title</b> Oberver-based Attack Detection and Mitigation in DC Microgrid Systems
		<b>Author(s)</b> Hamidreza Shafei (University of Technology Sydney); Li Li (University of Technology Sydney); Ricardo P. Aguilera (University of Technology Sydney)

16:10-16:30	#5112	<b>Paper Title</b> A Dynamic Time-Domain Based Accurate Small Signal Model for LLC Converter
		<b>Author(s)</b> Shuo Zhang (Tianjin University); Yuqi Wei (Xi'an Jiaotong University); Jinjun Liu (Xi'an Jiaotong University)
16:30-16:50	#8983	<b>Paper Title</b> A New Single-Switch Step-Up DC-DC Converter with High Gain, Reduced Voltage Stress, and Continuous Input Current
		<b>Author(s)</b> Maysam Abbasi (University of Technology Sydney); Li Li (University of Technology Sydney); Ricardo P. Aguilera (University of Technology Sydney); Dylan Lu (University of Technology Sydney); Fei Wang (Shanghai University)
16:50-17:10	#9411	<b>Paper Title</b> Operation optimization strategy of cooperative stackelberg wind-farm cluster based on Kriging metamodel
		<b>Author(s)</b> Fei Feng (Shanghai University); Qiang Si (Changzhou Vocational Institute of Engineering); Xin Du (Shanghai University)
17:10-17:30	#960	<b>Paper Title</b> A Novel Asymmetric Modulation of Three Phase Buck Rectifier without Current Distortion at Sector Switching Point
		<b>Author(s)</b> Xin Chen (Southwest Jiaotong University); Jianping Xu (Southwest Jiaotong University); Xia Guo (Southwest Jiaotong University); Fei Xie (Southwest Jiaotong University)
17:30-17:50	#9467	<b>Paper Title</b> Quasi-SoC Balancing Control for Networked Ad-hoc Microgrids Against Natural Disasters
		<b>Author(s)</b> Yajuan Guan (Aalborg University); Wenfa Kang (Aalborg University); Juan C. Vasquez (Aalborg University); Francisco Danang Wijaya (Universitas Gadjah Mada); Niken Arumdati (Ministry of Energy and Mineral Resources Nusa Tenggara Barat (MEMR-NTB)); Adam Priyo Perdana (Induk Wilayah Nusa Tenggara BaratPerusahaan Listrik Negara-PLN); Josep M. Guerrero (Aalborg University)

### S07 Magnetic Components for Next-generation Power Electronics

<b>Chair(s):</b> Zhan Shen, Southeast University, Jingxin Hu, Nanjing University of Aeronautics and Astronautics		<b>Onsite Room:</b> 3F / Riverview 1
<b>Time:</b> 15:50-17:50 (Beijing Time)   June 11, 2023		<b>Zoom ID:</b> 528 108 4955
15:50-16:10	#2060	<b>Paper Title</b> Optimal design of planar inductor in forward converter
		<b>Author(s)</b> Yujie Wu (Nanjing University of Aeronautics and Astronautics); Yin Zheng (Nanjing University of Aeronautics and Astronautics); Lin Xu (Nanjing University of Aeronautics and Astronautics); Shishan Wang (Nanjing University of Aeronautics and Astronautics); Zhan Shen (Southeast University)
16:10-16:30	#326	<b>Paper Title</b> Construction of a Planar Transformer With Low Common-Mode Capacitance for Medium-Voltage Isolated Gate-Driver Power Supply

		<b>Author(s)</b> Zhixing Yan (Aalborg University); Shaokang Luan (Aalborg University); Dipen Narendra Dalal (Aalborg University); Jannick Kjær Jørgensen (Aalborg University); Rui Wang (Aalborg University); Gao Liu (Aalborg University); Bjørn Rannestad (KK Wind Solution); Stig Munk-Nielsen (Aalborg University); Hongbo Zhao (Aalborg University)
16:30-16:50	#7024	<b>Paper Title</b> Trade-Off Design of AC Resistance and Parasitic Capacitance in Planar Transformer  <b>Author(s)</b> Shaokang Luan (Aalborg University); Hongbo Zhao (Aalborg University)
16:50-17:10	#2969	<b>Paper Title</b> Optimal design of the planar transformer based on its multi-physics field coupling characteristics  <b>Author(s)</b> Yin Zheng (Nanjing University Of Aeronautics And Astronautics); Yujie Wu (Nanjing University Of Aeronautics And Astronautics); Shishan Wang (Nanjing University Of Aeronautics And Astronautics); Zhan Shen (Southeast University)
17:10-17:30	#7081	<b>Paper Title</b> Scalability of harmonic emission generated by single-phase photovoltaic inverters  <b>Author(s)</b> Elias Kaufhold (TU Dresden); Sascha Müller (TU Dresden); Jan Meyer (TU Dresden); Johanna Myrzik (Uni Bremen); Peter Schegner (TU Dresden)
17:30-17:50	#7062	<b>Paper Title</b> Distribution Bus Voltages as a Metric for Grid Health Considering Widespread Public EV Charging  <b>Author(s)</b> Levi Miller (Utah State University); Jackson Morgan (Utah State University); Regan Zane (Utah State University); Hongjie Wang (Utah State University)
<b>S08 Integration of PV Power into Distribution Grids: Advanced Topologies and Control Strategies</b>		
<b>Chair(s):</b> Yushan Liu, Beihang University & Yongheng Yang, Zhejiang University		<b>Onsite Room:</b> 3F / Riverview 3+5
<b>Time:</b> 15:50-17:50 (Beijing Time)   June 11, 2023		<b>Zoom ID:</b> 272 702 7927
15:50-16:10	#3565	<b>Paper Title</b> Study on secondary frequency regulation method of VSG based on Active Disturbance Rejection Control  <b>Author(s)</b> Jian Luo (Nanjing Normal University); Shuye Ding (Nanjing Normal University); Xingshuo Li (Nanjing Normal University); Ying Zhu (Nanjing Normal University); Tongsen Zhu (Nanjing Normal University)
16:10-16:30	#5207	<b>Paper Title</b> High-Performance Global Maximum Power Point Tracking for Partial Shaded Photovoltaic Systems  <b>Author(s)</b> Yinxiao Zhu (Zhejiang University); Yongheng Yang (Zhejiang University)
16:30-16:50	#1507	<b>Paper Title</b> VOC-Based Active Power Decoupling for Single-Phase Photovoltaic Inverter  <b>Author(s)</b> Wei Cheng (Photovoltaic System Engineering Research Center, Ministry of Education,

		Hefei University of Technology); Meiqin Mao (Photovoltaic System Engineering Research Center, Ministry of Education, Hefei University of Technology); Liuchen Chang (University of New Brunswick); Jiang Xun (Photovoltaic System Engineering Research Center, Ministry of Education, Hefei University of Technology)
16:50-17:10	#6727	<b>Paper Title</b> Modeling Analysis and Decoupling Control of Three-Port SEPIC Converter
		<b>Author(s)</b> Lu Lai (Southwest Jiaotong University); Guohua Zhou (Southwest Jiaotong University); Nengmou Xu (Southwest Jiaotong University); Xiaolong Ji (Siwei Power Electronic Technology Co., Ltd.)
17:10-17:30	#6878	<b>Paper Title</b> A Full-Bridge Boost LCL-Type DC/AC/DC Converter
		<b>Author(s)</b> Yuming Zhou (Anhui University of Technology); Yuheng Zhu (Anhui University of Technology); Yimian Du (Anhui University of Technology); QiuSheng Zhang (Anhui University of Technology)
17:30-17:50	#4966	<b>Paper Title</b> Coordinated Control Method for Low Voltage Ride Through and Anti-Islanding Protection of Distributed PV Generation based on Interharmonic Impedance
		<b>Author(s)</b> Zhenhao Song (State Grid Shanghai Energy Internet Research Institute); Zhipeng Lv (State Grid Shanghai Energy Internet Research Institute); Huaidong Yan (Yancheng Power Supply Branch of Jiangsu Electric Power Co., Ltd); Jingjing Bai (Yancheng Power Supply Branch of Jiangsu Electric Power Co., Ltd); Shan Zhou (State Grid Shanghai Energy Internet Research Institute)

### S09 Hydrogen Systems for On-board and Off-board Applications

Chair(s): Hengzhao Yang, ShanghaiTech University & Qian Xun, Fraunhofer Institute for Silicon Technology		<b>Onsite Room:</b> 3F / Riverview 2
<b>Time:</b> 10:15-11:55 (Beijing Time)   June 12, 2023		<b>Zoom ID:</b> 759 390 6904
10:15-10:35	#3992	<b>Paper Title</b> A Hierarchical Energy Management Framework for Power and Hydrogen Flows in Photovoltaic Microgrids with Hybrid Energy Storage Systems
		<b>Author(s)</b> Yuzhen Tang (ShanghaiTech University); Hengzhao Yang (ShanghaiTech University)
10:35-10:55	#5099	<b>Paper Title</b> Model Predictive Control with Gaussian Process Regression Compensation for Power Management in Fuel Cell Hybrid Electric Buses
		<b>Author(s)</b> Qiuyu Li (ShanghaiTech University); Hengzhao Yang (ShanghaiTech University)
10:55-11:15	#7649	<b>Paper Title</b> Optimal Sizing and Energy Management of Smart-Transformer-based Energy Storage Systems for Residential Communities
		<b>Author(s)</b> Qian Xun (Fraunhofer Institute for Silicon Technology); Marius Langwasser (Kiel University); Fei Gao (University of Technology of Belfort-Montbéliard); Marco Liserre (Kiel University)

11:15-11:35	#7196	<b>Paper Title</b> Research on Power Control Method of Fuel Cell UAV DC System with Constant Power Load
		<b>Author(s)</b> Shuhao Deng (Northwestern Polytechnical University); Tao Lei (Northwestern Polytechnical University); Xianqiu Jin (Northwestern Polytechnical University); Haoliang Yu (Northwestern Polytechnical University); Xingyu Zhang (Key laboratory of Aircraft Ministry of Industry and Information Technology of China); Xiaobin Zhang (Key laboratory of Aircraft Ministry of Industry and Information Technology of China)
11:35-11:55	#7294	<b>Paper Title</b> Optimal sizing for grid-connected microgrid with hydrogen energy storage considering ladder-type carbon trading and source-load interaction
		<b>Author(s)</b> Yiwen Chen (Shanghai University of Electric Power); Jinbin Zhao (Shanghai University of Electric Power); Junzhou Li (Shanghai University of Electric Power); Ling Mao (Shanghai University of Electric Power); Keqing Qu (Shanghai University of Electric Power)

## Poster Sessions

P01		P02	
<b>Chair(s)</b> Chao Wu, Shanghai Jiao Tong University Chen Zhang, Shanghai Jiao Tong University		<b>Chair(s)</b> Rui Li, Shanghai Jiao Tong University Yanan Chen, Zhejiang University	
<b>Time:</b> June 10, 2023 10:00-10:40 (Beijing Time)	<b>Venue:</b> 2F / Foyer	<b>Time:</b> June 11, 2023 09:40-10:20 (Beijing Time)	<b>Venue:</b> 2F / Foyer
168	3192	5743	7978
529	3236	6101	8314
783	3247	6107	8365
925	3308	6182	8372
996	3607	6216	8461
1041	3683	6339	8583
1135	3839	6744	8680
1382	3885	6853	8738
1409	3924	6955	9019
1480	4064	7132	9120
1512	4222	7159	9156
1570	4273	7243	9183
2053	4480	7275	9237
2117	4486	7443	9328
2260	4922	7575	9335
2553	4997	7656	9405
2576	5119	7666	9414
2924	5381	7876	9548
2930	5457	7887	9688
3005	5555	7933	9707
3111	5653	7956	9861
3175	5693	7961	9945
	8299	7223	

## P01

- #168 Title:** Submodeling Method-Based Thermal Investigation of the Battery Energy Storage System Integrated in a 450 kW EV Charger  
**Author(s):** Heshi Guan, Yang Wu, Zian Qin, Pavol Bauer
- #529 Title:** Study on Virtual Oscillator-Based Grid Synchronization Technology in Grid-Following Inverters  
**Author(s):** Lin Tu, Lingjuan Tan, Cheng Cheng, Shaojun Xie, Jingming Xu
- #783 Title:** Wide Frequency Domain Control Strategy of Large Capacity Modular Multilevel Wind Power Converter  
**Author(s):** Wenting Pu, Gang Yao, Lidan Zhou, Canbing Li, Dongdong Li
- #925 Title:** Power Loss Investigation of Switch Configurations Using Wide Bandgap Devices in 10kW Current Source Inverters for Solar Applications  
**Author(s):** Mitchell Davidson, Qiang Wei, Zijian Wang
- #996 Title:** Small-Signal Stability Analysis of Consensus Algorithm-Based Distributed Control for DC Microgrids Under Multiple Time Delays  
**Author(s):** Hongqin Yin, Fei Gao, Qipeng Zheng
- #1041 Title:** Repetitive Controller with Low N-Value for the MLCL-Type Grid-Connected Inverter  
**Author(s):** Hongwei Zhou, Xu Yang, Jiansong Zhang, Dapeng Lu
- #1135 Title:** Applying Hybrid Energy Storage Systems for Smoothing Renewable Power Fluctuation  
**Author(s):** Ran Ding, Guoyan Wang, Heyu Luo, Feng Li, Lujie Yu, Hao Zhang, Yiming Yao, Wei Qiu
- #1382 Title:** GaN-based MHz-LLC Resonant Converter with High Voltage Gain for Solar Energy Integration  
**Author(s):** McKay Waite, Conner Sabin, Dakota Goodrich, Tucker Skinner, Aditya Zade, Sanat Poddar, Hongjie Wang
- #1409 Title:** Smooth Switching Control Strategy of Parallel-type Power Conversion System Off-grid  
**Author(s):** Hao He, Jingyuan Xu, Hongyang Qing, Chunjiang Zhang
- #1480 Title:** Stochastic Real-time Model of Power Electronic System based on Generalized Polynomial Chaos  
**Author(s):** Shinan Wang, Xizheng Guo, Zonghui Sun, Yule Wang, Yueqing Chen
- #1512 Title:** Simplified Distributed Secondary Control Based on Diffusion Algorithm in Isolated AC Microgrids  
**Author(s):** Yawen Ding, Fei Gao, Jiahao Yu, Qipeng Zheng
- #1570 Title:** Segmentation optimization strategy of energy storage system for frequency regulation requirements of regional grid  
**Author(s):** Xiaohan Duan, Dan Sun, Heng Nian
- #2053 Title:** A Novel Energy-Type SVG with Grid Forming Control for Grid Voltage and Inertial Support  
**Author(s):** Jiawei Zhang, Chen Zhang, Xianqiang Shi, Lei Huang, Xiaobing Li, Xu Cai
- #2117 Title:** Output power analysis of grid-connected battery energy storage systems providing different frequency modulation services  
**Author(s):** Yiheng Liu, Qiao Peng, Tianqi Liu, Jinhao Meng, Xueyang Zeng, Gang Chen
- #2260 Title:** Small-Signal Model of LCC Compensated IPT System with Phase Shift Modulation  
**Author(s):** Tianqi Li, Guangce Zheng, Xinlin Wang, Chaoqun Qi, Minfan Fu
- #2553 Title:** Research on control strategy of energy storage system based on day-ahead energy prediction  
**Author(s):** Muchao XIANG, Zaixun LING, Linjie ZHU, Yiming GU, Zhe ZHANG, Liang HUANG
- #2576 Title:** Frequency Stability of Renewable Energy Integrated Low-Inertia Power Systems During Grid Faults  
**Author(s):** Changjun He, Hua Geng
- #2924 Title:** A Digital Generic Multi-cell Network Control for LCL-filtered Inverters With Different Delay  
**Author(s):** Ke Hu, Li Peng
- #2930 Title:** Smooth Closed-loop Control Strategy Design for Dual-Active Bridge Converters Using Optimized TPS Modulation  
**Author(s):** Zongxin Ye, Jiatao Yang, Qiang Gao, Rui Li
- #3005 Title:** Grid Connected Photovoltaic using Modular Multilevel Converter as Shunt Active Power Filter  
**Author(s):** Ashish Maithani, Prakash Dwivedi and Sourav Bose
- #3111 Title:** Analysis and Improvement of the AC-Voltage Control of GFM MMC to Improve the Voltage Stability of AC/DC Hybrid Power Grid  
**Author(s):** Chengbin Chi, Shan Liu, Qi Liu, Fan Li
- #3175 Title:** Capacitor Voltage Control For T-type Alternate Arm Multilevel Converter  
**Author(s):** Yinzhou Wang, Heya Yang, Ping Zeng, Shiyuan Fan, Xiaotian Zhang, Xin Xiang
- #3192 Title:** Coupling Capacitor Structure Model of Underwater Capacitive Wireless Power Transfer System  
**Author(s):** Lei Yang, Xinze Chen, Shuman Miao, Yuanqi Zhang, Baoxiang Feng, Zirong Cheng, Aimin Zhang and Ting Yang

<b>#3236 Title:</b> Intelligent Sensing Terminal Distributed Computing Architecture of IoT for EMS <b>Author(s):</b> Lidan Zhou, Xiuhan Song, Gang Yao, Hongyu Wang, Jian Li, Siyang Liu, Yongjie Nie
<b>#3247 Title:</b> Symmetric Harmonic Virtual Admittance Stabilization Method for Harmonic Compensation Oscillation in SAPF System <b>Author(s):</b> Zhilong Zhang, Hao Yi, Yuguo Li, Xin Jiang, Zhenxiong Wang, Fang Zhuo
<b>#3308 Title:</b> A Converter-Based Hybrid Transformer for Regulating the Voltage of Distribution System <b>Author(s):</b> Wei Li, Yongzheng Qu, Peinan Xu, Yifang Du, Yanbing Zhang, Yinghu Liu
<b>#3607 Title:</b> A Control-Oriented Voltage Tracking Design for Grid-forming Based Modular Multilevel Converter <b>Author(s):</b> Wentao Liu, Tamas Kerekes, Remus Teodorescu
<b>#3683 Title:</b> Modular Multiport Converter based Offshore Grid Architecture for Integrating Renewables and HVDC Grid <b>Author(s):</b> Amur Karbozov, Harish S. Krishnamoorthy, Kaushik Rajashekara
<b>#3839 Title:</b> The Virtual Admittance Control of Sending End Converter for Offshore Wind Farm Integration <b>Author(s):</b> Zhekai Li, Liliyuan Liang, Renxin Yang, Xu Cai
<b>#3885 Title:</b> Implementation of Close-loop Control for Interleaved CrM Totem-Pole PFC Converters with GaN Devices <b>Author(s):</b> Jingjin Li, Zijian Chen, Siliang Zhang, Xinke Wu
<b>#3924 Title:</b> A Full Comparison Between Droop Control and Virtual Synchronous Generator Control Considering Reactive Power Dynamics in Grid-forming Inverters <b>Author(s):</b> Jiazhi Wang, Zeng Liu, Yidong Shi, Jinjun Liu
<b>#4064 Title:</b> Optimal design for hybrid energy storage systems considering system aging and costs <b>Author(s):</b> S.Masoom Maroufi, Giovanni De Carne
<b>#4222 Title:</b> Four-Quadrant Power Control with Frequency Modulation of Bidirectional Dual-Active-Bridge DC/DC Converters in Distributed Generation Systems <b>Author(s):</b> Xiaochao He, Yitao Liu, Jian Yin
<b>#4273 Title:</b> A Real-time Fault Detection Technique based on MPPE in Photovoltaic Systems <b>Author(s):</b> Qianun Xu, Xingshuo Li, Xuening Yin, Chunmei Feng
<b>#4480 Title:</b> Grid-Forming Control of an MMC STATCOM Using Submodule Capacitors to Emulate Inertia <b>Author(s):</b> Dorothea Wiemann, Tayssir Hassan, Sibylle Dieckerhoff
<b>#4486 Title:</b> Cause analysis of thermal runaway failure in LFP battery energy storage system under overheating condition <b>Author(s):</b> Aiguo Wang, Sicong Chen, Xinqiang Li
<b>#4922 Title:</b> A Buck-Boost Common Ground Bridgeless PFC Rectifier with Power Decoupling Ability <b>Author(s):</b> Jiangpeng Yang, Yang Li, Zeliang Shu
<b>#4997 Title:</b> Fault-Tolerant Control Strategy of Single-Phase Cascaded DVR Under Different Voltage Sag Depth <b>Author(s):</b> Ruitao Zhang, Yuanhao Liu, Hao Yi, Fang Zhuo, Zhenxiong Wang, Xiao Zhang
<b>#5119 Title:</b> Single-Inductor Dual-Input Buck Converter Without Leakage Current for PV Power Optimizer Applications <b>Author(s):</b> Meng Song, Long She, Yan Xing, Hongfei Wu
<b>#5381 Title:</b> Oscillation Mode Identification of Self-synchronized Voltage Source Doubly-fed Wind Turbine Based on Continuous Wavelet Transform <b>Author(s):</b> Siying Xu, Yunfeng Cao, Han Wang, Wei Wang, Dongmei Yang, Xu Cai
<b>#5457 Title:</b> A Combined Model for Ultra-short-term PV Forecasting Based on SOM Clustering <b>Author(s):</b> Yijie Xu, Jinhua Dong, Yixin Zhu, Mengyao Guan, Ziyao Wang
<b>#5555 Title:</b> Stability Analysis and Parameter Optimization for DRU Connected Grid-forming Offshore Wind Turbines <b>Author(s):</b> Haotian Yu, Li Liu, Renxin Yang, Xu Cai
<b>#5653 Title:</b> Multi-scenario capacity allocation method of independent power supply microgrid <b>Author(s):</b> Jin Li, Zhengdong Zhan, Yifei Sun, Jihao Gao
<b>#5693 Title:</b> Comparison and analysis of HVRT/LVRT of energy storage system <b>Author(s):</b> Chen Fang, Jiahao Xu, Xinchu Wei, Jie Yao, Yu Zhang, Luhai Zheng, Shanshan Shi
<b>#8299 Title:</b> Common Mode Voltage Elimination of Dual Three-Phase Motor Driven by Paralleled Three-Level Inverters <b>Author(s):</b> Yafei Ma, Dong Jiang, Zicheng Liu



## P02

**#5743 Title:** An Adaptive Voltage-Droop Gain Tuning Method for Optimizing VSC's Power Output Capability in Weak Grids

**Author(s):** Yuyang Wang, Chen Zhang, Yu Zhang, Yiming Wang, Po Xu, Xu Cai

**#6101 Title:** Closed-Loop Control for Cascaded Bidirectional Buck+Boost Converter with A Low-Loss Modulation Strategy

**Author(s):** Jianhua Lei, Hongsheng Jiang

**#6107 Title:** Short-circuit Current Improvement Control of Grid-forming Controlled Wind Turbines

**Author(s):** Zhenyan Deng, Han Wang, Yao Qin, Yunfeng Cao, Xu Cai

**#6182 Title:** Comparative Study of Coupling Characteristics between Machine- and Grid-side Subsystems of PMSG-based WTGs under Different Control Modes

**Author(s):** Yiming Rao, Jing Lyu, Han Wang, Xu Cai

**#6216 Title:** Optimal configuration strategy of APF in micro-grid under dual-carbon target

**Author(s):** Qun Yu, Yongkang Yuan

**#6339 Title:** Comparative Analysis of Inductor Loss for High-Frequency DCM Grid-Tied Inverters with Modulations Strategies Achieving ZVS

**Author(s):** Cheng Huang, Tomoyuki Mannen, Takanori Isobe

**#6744 Title:** Research on Multi-port Power Electronic Transformer With Battery Energy Storage System

**Author(s):** Xin Li, Kexu Zhao, Sheng Wang, Wei Jiang, Hao Yi, Fang Zhuo

**#6853 Title:** DC-Link Voltage Suppression and Dynamic Improvement of Battery Charging and Discharging System with Feedforward Compensation

**Author(s):** Zheng Yang, Jingang Han, Xinhe Zhou, Tianhao Tang

**#6955 Title:** DC-Link Current Reduction for Current Source Converter-Based Wind Energy Conversion System

**Author(s):** Ling Xing, Qiang Wei, Ryan (Yunwei) Li

**#7132 Title:** Loss optimized modulation of Three-Phase DAB for cascaded battery energy storage system

**Author(s):** Zhicheng Zhu, Jinfeng Song, Xinyue Liu, Rui Li

**#7159 Title:** Research on control Strategy of new energy storage Railway Power Regulator

**Author(s):** Pei Luo, Xusheng Chen

**#7243 Title:** General Equivalent Modeling Method of DAB under Different Cascaded Modes

**Author(s):** Bofeng Wang, Jin Xu, Keyou Wang, Zirun Li, Chenxiang Gao, Pan Wu

**#7275 Title:** Simultaneous Voltage and Current Harmonic Control of Grid-forming Converters Based on Unified Harmonic Voltage-Current Droop

**Author(s):** Yixuan Li, Jia Liu, Jinjun Liu

**#7443 Title:** Beat Frequency Oscillation Analysis for a DC microgrid with Multiple Boost Converters

**Author(s):** Haoge Xu, Yuxin Zhu, Zhengyu Lin

**#7575 Title:** Electricity Price-Prioritized Droop Control Strategy of Grid-friendly Vehicle-to-Grid Integrated Microgrid

**Author(s):** Yuyang Wan, Yanbo Wang, Zhe Chen

**#7656 Title:** A High-Efficiency Multiple Output Flyback Converter Based on Variable Width Winding Planar Magnetics

**Author(s):** Yixuan Xu, Shaoliang An, Shaogang An, Yuhao Wu, Qing Wu, Qi Zhang

**#7666 Title:** Maximum Power Point Tracking Control Strategy Based on the Hydrodynamic Model of the Pendulum Wave Energy Generation System

**Author(s):** Feng Dong, Shangzhi Pan, Jinwu Gong

**#7876 Title:** A Novel Isolated DC-DC Converter with Configurable Structure for Wide Output Voltage Range Operation

**Author(s):** Wei Li, Yongzheng Qu, Yifang Du, Yanbing Zhang, Yinghu Liu

**#7887 Title:** Research on an active damping method under weak grid condition with adaptive impedance ability

**Author(s):** Chaoran Zhuo, Weizhang Song, Xiong Zhang

**#7933 Title:** Design of Magnetic Structure for Zero Input Current Ripple in DC-DC Converter with Multi-winding Coupled Inductor

**Author(s):** Hongwan Shen, Shangzhi Pan, Qiyuan Hu, Zisen Lin, Jinwu Gong, Xiaoming Zha

**#7956 Title:** RC Snubber Design by Multi-objective Particle Swarm Optimization for SiC-MOSFET Switching Oscillation

**Author(s):** Han Yang, Xinyan Yu, Ziheng Xu, Hui Luo, Kuan He, Han Cai, Pengfei Jin, Ke Dai

**#7961 Title:** Dual-mode MPPT control algorithm of natural gas differential pressure power generation system

**Author(s):** Xiaowen Yao, Lidan Zhou, Wei Liu, Gang Yao

<b>#7223 Title:</b> Passive Components Investigation for Series-Connected Current Source Inverters <b>Author(s):</b> Xiaoyi Xia, Zijian Wang, Qiang Wei
<b>#7978 Title:</b> An Optimized Voltage Support Strategy for PMSG-Based Wind Turbines Under Unbalanced Grid Fault <b>Author(s):</b> Haoning Cheng, Min Huang, Yu Zhang, Weimin Wu
<b>#8314 Title:</b> Survey on DC breaking technologies for protection of grid-connected energy storage systems <b>Author(s):</b> Haofeng Bai, Zichi Zhang, Andrew Tuckey, Lexuan Meng, Akif Zia Khan, Alekssandr Viatkin, Shi-feng Chou, Jan R. Svensson
<b>#8365 Title:</b> Chopper Controlled Impedance Conditioner Based on Direct AC/AC Conversion for Optimizing the Distribution Feeders Performance <b>Author(s):</b> Heng An, Dongbo Guo, Zhongchen Pei, Chuang Liu
<b>#8372 Title:</b> Time Domain Modelling of LLC Converter <b>Author(s):</b> Sumbul Bashir, Dr. Xuanlyu Wu
<b>#8461 Title:</b> All-solid-state High-voltage Marx Pulse Generator Based on Magnetic Isolated Drive Circuit <b>Author(s):</b> Qingqing Liu, Ruitian Wang, Xin Li
<b>#8583 Title:</b> An On-Line Selective Harmonic Elimination Modulation Scheme for High-Power Medium-Voltage Current Source Converters <b>Author(s):</b> Martti Muzyka, Qiang Wei, Zijian Wang, Navid Zargari
<b>#8680 Title:</b> A Dual-Mode Fast Charger Employing Continuous and Fine-Tuned Pulse Currents for Supercapacitors <b>Author(s):</b> Yang Chen, Hengzhao Yang
<b>#8738 Title:</b> High Step-up DC/DC Converter Based on Switched Inductor and Switched Capacitor Unit <b>Author(s):</b> Longlong Zhang, Feiling Zheng, Jingcheng Zhao, Xiao Qin, Rui Li, Qingzeng Yan, Rende Zhao, Yansong Wang
<b>#9019 Title:</b> Online Estimation of Lithium Battery SOH Based on Incremental LS-SVR Algorithm <b>Author(s):</b> Pengfei Xie, Lidan Zhou, Gang Yao, Hui Liu
<b>#9120 Title:</b> Optimal Configuration Scheme for BES Considering Multiple Market Segment Revenues and Degradation Cost <b>Author(s):</b> Shengqi Zhang, Yuyan Chen, Fei Wang
<b>#9156 Title:</b> Free Piston Generator System Based on Model Predictive Control <b>Author(s):</b> Junxiang Zhang, Haifeng Lu, Jianyun Chai, Yongdong Li
<b>#9183 Title:</b> A Joint Power Supply Scheme of Energy Storage System and Utility Grid <b>Author(s):</b> Keshun Hou, Qi Liu, Li Zhang
<b>#9237 Title:</b> An economic assessment of the terminal electrification for the logistics company <b>Author(s):</b> Huan Li, Mats Alaküla
<b>#9328 Title:</b> Research on Equivalent Delay of Grid-connected Inverter System with High Switching Frequency and Low Control Frequency <b>Author(s):</b> Fei Li, Qiang Feng, Jiafei Kang, Xing Zhang, Mingyao Ma, Hanyu Wang
<b>#9335 Title:</b> An Isolated Bidirectional DC-DC Converter with Configurable Structure and Wide Voltage Gain Range <b>Author(s):</b> Xianbin Qi, Yi Wang, Mingzhu Fang, Hong Wang, Yanbo Wang, Zhe Chen
<b>#9405 Title:</b> Coordinated Control Strategy of Grid-Forming Wind Power Generation System with Energy Storage System for Primary Frequency Regulation <b>Author(s):</b> Zeyu Zhang, Dan Sun, Heng Nian, Libin Yang, Tingxiang Liu, Chunmeng Chen
<b>#9414 Title:</b> Common-mode Voltage Suppression Method for MMC under Submodule Unified Pulse Width Modulation <b>Author(s):</b> Bolun Pan, Canfeng Chen, Jiancheng Jiao, Mengwei Li, Kai Zhang, Qiang Dong
<b>#9548 Title:</b> Accuracy comparison of state-of-health estimation for lithium-ion battery based on forklift aging profile <b>Author(s):</b> Xingjun Li, Dan Yu, Søren Byg Vilsen, Daniel-Ioan Store
<b>#9688 Title:</b> Electrothermal Comprehensive Optimization Design Considerations of GaN Power Module <b>Author(s):</b> Hang Kong, Fengtao Yang, HongChang Cui, Zhiyuan Qi, Laili Wang, Lixin Jia
<b>#9707 Title:</b> The Research on Cluster DC Voltage Balancing of Star-connected Cascaded H-bridge STATCOM <b>Author(s):</b> Kai Hu, Guoliang Zhao, Zhengang Lu, Hongyang Yu, Weiguo Li, Chaobo Dai
<b>#9861 Title:</b> Coordinated Virtual Inertia Control of Grid-Connected Photovoltaic-Battery Energy Storage System Considering Power Reserve and Fluctuation Smoothing <b>Author(s):</b> Yulong Shi, Qiao Peng, Tianqi Liu, Jinhao Meng, Xueyang Zeng, Gang Chen
<b>#9945 Title:</b> Quantitative Transient Synchronization Stability Margin Analysis of PLL-based VSC Considering LVRT Control Strategy <b>Author(s):</b> Zhaofang Lv, Chen Zhang, Yu Zhang, Dawei Sun, Siqi Yu



Fuji Electric

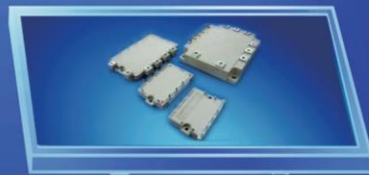
先进技术的象征  
为环保与节能贡献力量



HPM



PrimePACK™



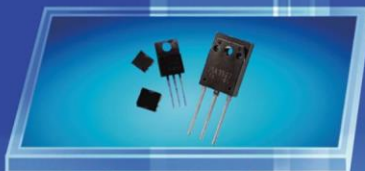
IGBT IPM



Standard 2-pack



小容量PIM



功率MOSFET



小容量IPM



二极管系列

富士电机作为跨国企业，通过提供丰富的节能技术和相关设备，极大地减轻了环境负荷。  
象征富士电机的先进技术，以自己的优质产品和服务，不断推动社会的前进与发展。

富士电机（中国）有限公司  
上海市普陀区凯旋北路1188号环球港8座26楼  
电话：+86-021-5496-1177 传真：+86-021-5496-0189

富士电机（香港）有限公司  
香港九龙尖沙咀海港城港威大厦第六座19字楼1911-13室  
电话：+852-3518-3111（直线） / +852-2664-8699（总机）  
传真：+852-2664-8040

富士电机（中国）有限公司北京代表处  
北京市朝阳区曙光西里甲5号院凤凰置地广场A座写字楼2007室  
电话：+86-10-5939-2250 传真：+86-10-5939-2251

富士电机（中国）有限公司深圳代表处  
深圳市南山区桃园路田厦金牛广场A座3008-3010单元  
电话：0755-8363-2248 传真：0755-8362-9785

象征富士电机的先进技术，以自己的优质产品和服务，不断推动社会的前进与发展。  
<http://www.fujielectric.com/products/semiconductor/>

# 锦浪:做最专业的储能和 光伏逆变器制造商

服务热线: **400-101-6600**

网址: [www.ginlong.com](http://www.ginlong.com) / A股代码: 300763.SZ



- 国家企业技术中心
- 国家技术创新示范企业
- 国家智能光伏试点示范企业
- 国家级单项冠军示范企业
- 国家CNAS认证实验室资质



在全球权威第三方DNV-GL  
测试中锦浪逆变器寿命预测接近于金字塔顶端

## NO.3

IHS权威发布2021年度锦浪科技  
位居全球光伏逆变器出货第三

上海远宽能源科技有限公司成立于2011年，专注于电力、新能源、电气化交通等行业中的实时仿真和控制器快速原型应用，公司自成立起就持续进行电力电子仿真技术的自主研发；于2013年发布了基于CPU的StarSim实时仿真器，于2016年发布了基于FPGA的StarSim实时仿真器，于2020年发布了基于自研硬件的实时仿真产品，能够支持任意电力电子拓扑在1us量级步长实时仿真，已经达到国际领先的小步长仿真技术水平。公司目前服务了国内上百家单位，包含正泰电源、禾望电气、固德威等新能源相关企业，中国电科院、各省网公司电科院等电力科研院所以及清华、上交、华北电力等国内知名高校；产品成功帮助客户解决逆变器入网测试、设备故障检测、多逆变器协调控制等实际科研与工程问题，深受行业好评！

## 核心产品 PRODUCT INTRODUCTION > MT 8020

远宽能源作为掌握实时仿真前沿核心技术的中国企业，在原有产品技术基础上进一步迭代升级和探索，成功研发出基于高性能的Intel Xeon CPU和 Xilinx UltraScale FPGA的电力超算平台MT 8020实时仿真器，助力新能源逆变器、多电平变流器、电机驱动系统和微网等电力与电力电子系统的仿真测试应用。

上海远宽能源科技有限公司  
ModelingTech Energy Technology Co., Ltd.

网址: [www.modeling-tech.com](http://www.modeling-tech.com)

联系我们

电话: 021-65011357

邮箱: [info@modeling-tech.com](mailto:info@modeling-tech.com)



关注公众号  
获取更多产品和案例详情



**ITECH**  
YOUR POWER TESTING SOLUTION

# Bidirectional and Regenerative Power Test Solution



ITECH Web

## 南京研旭电气主营产品，欢迎新老客户订购

- YXSPACE系列快速原型控制-模型一键生成代码，快速评估算法
- YXPHM系列开放式功率硬件两电平 / 三电平 / DAB / SIC、GAN
- 永磁同步 \ 异步电机 \ 同步电机 \ 磁阻电机 \ 双馈电机 电机对拖平台
- 开放式新能源实验平台、多端口能量路由器，实施案例丰富
- 风、光、储、柴新能源微电网动模、抽水蓄能动模、虚拟电厂动模
- 电池模拟器 \ 光伏模拟器 \ 电网模拟器 \ RLC真实负载 \ 交、直流电子负载
- 基于模型设计的新工科电力电子、电机控制、电力拖动实验平台



产品案例详情扫二维码

激 流 勇 进

合 作 共 赢

## 案例分享



# Typhoon HIL, Inc.

TYPHOON HIL IS

TEST SOLUTION PROVIDER

CORE  
COMPETENCE

HIGH FIDELITY, REAL TIME EMULATION OF ELECTRICAL SYSTEMS

COUPLED WITH MECHANICAL, THERMAL AND SIGNAL DOMAINS

PRIME  
APPLICATION

TESTING CONTROL SYSTEMS

MODEL BASED, FUNCTIONAL AND PERFORMANCE TESTING AND TEST AUTOMATION.

EXTENDED  
APPLICATION  
SCOPE

CONFIGURATION MANAGEMENT  
RETROFITS AND OPERATIONAL SUPPORT  
PRODUCT PLACEMENT  
COMMISSIONING AND VIRTUAL SYSTEM INTEGRATION

METHODOLOGY

C-HIL (Controller Hardware-In-the-Loop)

SIL (Software-In-the-Loop), P-HIL (Power Hardware-In-the-Loop)

KNOWN FOR

1 $\mu$ s

HIL FOR POWER  
ELECTRONICS

USED BY SEGMENTS



[illegible]