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### **RESEARCH INTERESTS**

Modeling, Protection and Resilience of Power Electronics based Power Systems, Renewable Energy Integration, MMC-HVDC Control and Operation, and Machine Learning Applications in Power Electronics based Power Systems.

### **EDUCATION**

- Ph.D. in Electrical Engineering**, University College Dublin, Ireland Feb 2014  
Advisor: Professor Chen-Ching Liu  
Thesis title: *System security and protection coordination of AC grids with wind power integration*
- Master in Electrical Engineering**, Huazhong University Sci & Tech, China Jun 2009  
Advisor: Professor Chengxiong Mao  
Thesis title: *A novel VSC-based excitation system*
- Bachelor in Electrical Engineering**, Huazhong University Sci & Tech, China Jun 2007  
Thesis title: *WAMS-based rotor angle stability detection*

### **QUALIFICATIONS**

#### *13 years' R&D Experience+5 years' International Industry Experience*

- 13 years' R&D experience in renewable energy integration, power electronics and its applications in power systems, wide-area control and protection, PMU, smart grid, and electromagnetic transients
- 5 years' international industrial experience in **leading Utility (SGCC) and Vendor (Siemens AG)**
- Comprehensive knowledge on of power systems, power electronics, and high voltage engineering

### **WORKING EXPERIENCE**

- *Assistant Professor*, University of Illinois at Chicago Jan 2018-Present
- *Senior Consultant*, Siemens PTI, MN, USA Apr 2017-Dec 2017
- *Project Manager and Consultant*, Siemens Headquarter, Erlangen, Germany Aug 2014-Mar 2017
- *Research Scholar*, Washington state University, Pullman, WA, USA Apr 2013-Oct 2013
- *Electrical Engineer*, State Grid Corporation of China, Tianjin, China Jul 2009-Feb 2010

### **MAJOR AWARDS AND HONORS**

- **Best Paper of 2016 IEEE PES General Meeting** (IEEE Power & Energy Society - 2016)
- **Outstanding Reviewer of IEEE Trans. on Power Systems** (IEEE Power & Energy Society - 2014)
- **Outstanding Teaching Assistant** (University College Dublin, School of EECE – 2012/2013)
- **Top Academic Scholarship** (Huazhong University, College of EE - 2004, 2005, 2006, 2007, 2008)
- **NARI ELECTRIC Scholarship** (Huazhong University, 2008)
- **Outstanding Master/Bachelor Thesis** (Huazhong University, College of EE – 2009/2007)

## PATENTS

- [1] Lina He, “Intelligent adaptive relay for protection coordination of hybrid ac/dc microgrids,” filed on April 28<sup>th</sup>, 2020.
- [2] “Paralleled multiple voltage source converter based self-shunt excitation system,” (with C. Mao, et al); **Granted Patent**, Patent Publication No.: ZL200910061371.X (CN101521446 B), filed on Apr. 1<sup>st</sup> 2009, published on Apr. 20<sup>th</sup> 2011.
- [3] “Paralleled multiple current source converter based self-shunt excitation system,” (with C. Mao, et al); **Granted Patent**, Patent Publication No.: ZL200910061370.5 (CN101593982 B), filed on Apr. 1<sup>st</sup> 2009, published on Nov. 30<sup>th</sup> 2011.

## INDUSTRIAL EXPERIENCE

**Senior Consultant at Siemens PTI US, MN, USA**

Apr 2017 – Dec 2017

- Served as a core technical contributor on renewable energy integration, including solar and wind.
- Wind turbine modeling for integration studies with MISO, NYISO and Minnesota Power
- Protection coordination studies with Entergy
- Wind farm interconnection studies with NYISO
- EMTP studies with Scottish Power, including HVDC transformer energization, HVDC feeder transient recovery overvoltage (TRV)

**Project Manager and Consultant at Siemens Headquarter, Erlangen, Germany**

Aug 2014- Mar 2017

- Served as a **Project Manager** and **Technical lead**
- Multi-time-scale offshore/onshore wind turbine generator modeling and simulation
- MMC-HVDC (HVDC PLUS) control, protection and modeling (dynamic and electromagnetic).
- Electromagnetic transient (EMT) modeling and simulation, including DC component analysis, transformer energization, very fast transient overvoltages (VFTOs) of switchgear, CB transient recovery overvoltage, etc.

**Electrical Engineer in State Grid Corporation of China (SGCC), Tianjin**

Jul 2009-Feb 2010

- Renewable energy integration (including wind and photovoltaics).
- Transmission planning, including power flow calculation, N-1 contingency analysis, transient stability analysis, and small-signal stability analysis;

## ACADEMIC EXPERIENCE

UNIVERSITY OF ILLINOIS AT CHICAGO, Chicago, IL, USA

Jan 2018-Present

*Assistant Professor*

*I have established the **Power Energy Innovation (PEI) Lab** in the ECE department at UIC, which supports a **strategic multidisciplinary program** in the areas of power systems and power electronics to achieve a smarter, securer, more efficient, and more resilient power grid.*

The active research in my Lab includes:

- **Intelligent online modeling of power electronics based power systems with renewable energy integration**

- **Integration strategies of renewable energy (PV and wind), including protection and control**
- **Resilience of power systems with inverter based DER integration**
- **Wide-area protection and cybersecurity of power electronics based power systems**

WASHINGTON STATE UNIVERSITY, Pullman, WA, USA

Apr 2013- Oct 2013

*Research Scholar, collaborated with Prof. Chen-Ching Liu*

- Developed a centralized load shedding scheme to achieve wide-area voltage protection;

UNIVERSITY COLLEGE DUBLIN, Dublin, Ireland

Jan 2010-Feb 2014

*Research Assistant, served as a technical lead on the "TWENTIES" Project (total budget: €56.8 Million) sponsored by EU FP-7, in collaboration with University of Strathclyde (UK), Siemens (Germany), RTE (France), Alstom (UK), etc;*

#### **Wide-area voltage protection of AC grids with large-scale offshore wind power integration**

- Proposed a **PMU-based HVDC model** that can be applied in **AC/DC systems** on respects of online stability detection, fault location, load shedding determination, etc;
- Applied the developed HVDC model to online **detect voltage instability** of an AC grid with HVDC connected wind generators using Thevenin impedance matching;
- Developed a **load shedding algorithm** based on Zbus approach to determine minimum load shedding amount for voltage instability mitigation.

#### **Protection Coordination of AC grids with large-scale offshore wind power integration**

- Presented an **apparent impedance calculation algorithm** based on Zbus approach, to identify potential mis-coordinated distance relays on AC grids with HVDC connected offshore wind generators;
- Identified **protective device settings** on an AC grid that need to be adjusted due to **HVDC control** of offshore wind generators.

#### **Impact of DFIG LVRT capability on distance protection of AC grids**

- Modeled DFIG LVRT capability based on FERC order 661;
- Demonstrated **mis-coordinated operation of distance relays** on AC grids due to **reactive power characteristic** of DFIGs during crowbar connection.

#### **System restoration using HVDC connected offshore wind generators as a blackstart unit**

- Explored black-start control strategies of HVDC connected DFIGs during major outages;
- Validated effectiveness of **VSC-HVDC control** in alleviating steady-state and transient overvoltages during system restoration.

HUAZHONG UNIVERSITY OF SCIENCE & TECHNOLOGY, Wuhan, China

Sep 2007-Jun 2009

*Research Assistant, served as a major contributor to the feasibility study of the "EHV" (1000 kV) connection from Central China to North China, in collaboration with State Grid Corporation of China;*

- Proposed a **novel excitation system based on VSC technology** to achieve fast and wide-ranging excitation regulation;
- Conducted small-signal stability analysis for interconnected system to identify system low frequency oscillation modes;

**PUBLICATIONS**

**Journals**

- [1] S. Wang, L. Du, J. Ye and **L. He**, “Noncooperative social welfare optimization with resiliency against network anomaly,” *IEEE Transactions on Industrial Informatics*, vol. 16, no. 4, Apr. 2020.
- [2] **L. He** and C.-C. Liu, “Parameter identification with PMUs for instability detection in power systems with HVDC integrated offshore wind energy,” *IEEE Transactions on Power Systems*, vol. 29, no. 2, Mar. 2014.
- [3] **L. He**, C.-C. Liu, A. Pitto, and D. Cirio, “Distance protection of AC grid with HVDC connected offshore wind generators,” *IEEE Transactions on Power Delivery*, vol. 29, no. 2, Apr. 2014.
- [4] **L. He**, C. Mao, J. Lu, and D. Wang, “Novel excitation system using high power electronics full-controlled device rectifier,” *High Voltage Engineering*, vol. 35, no. 7, pp. 1711-1717, 2009.
- [5] **L. He**, C. Mao, J. Lu, and D. Wang, “The new scheme of direct measurement of hydro power generator speed and power angle,” *Water Resources and Power*, vol. 26, no. 3, pp. 156-159, 2008.
- [6] J. Wu, **L. He**, C. Mao, J. Lu, and D. Wang, “Novel excitation system of the synchronous generator,” *Journal of Electric Power Science and Technology*, vol. 24, no. 1, pp.12-18, 2009.
- [7] Y. Luo, Y. Wang, W. Wan, B. Zhang, H. Cai, G. Liu, H. Li, **L. He**, and Y. Yi, “Fault chain model of cascading failure in AC grids,” *Automation of Electric Power Systems*, vol. 33, no. 24, pp.1-5, 2009.

**Conferences**

- [8] S. Rong, and **L. He**, “Impact of photovoltaic generation integration on protection of distribution systems,” *2020 “MIT A+B” Applied Energy Symposium*, Massachusetts Institute of Technology, USA, 2020. (Accepted)
- [9] **L. He**, S. Rong, and C. Liu, “Intelligent overcurrent protection algorithm of distribution systems with integration of PV generation,” *2020 IEEE Energy Conversion Congress & Expo*. (Accepted)
- [10] S. Rong, and **L. He**, “A joint faster RCNN and stereovision algorithm for vegetation encroachment detection in power line corridors,” *2020 IEEE PES General Meeting*.
- [11] **L. He**, “Bypassing transients of pre-insertion resistor during energization of MMC-HVDC,” *2018 IEEE Power and Energy Conference at Illinois (PECI)*, Chicago, IL, Feb. 2018.
- [12] **L. He**, “Effects of pre-insertion resistor on energization of MMC-HVDC stations,” *2017 IEEE PES General Meeting*, Chicago, IL, Jul. 2017.
- [13] **L. He** and R. Voelzke, “Effects of pre-insertion resistor on energization of compensated Lines,” *2016 IEEE PES General Meeting*, Boston, MA, Jul. 2016. **(Best Paper, Top 5%)**
- [14] **L. He** and C.-C. Liu, “Effects of HVDC connection for offshore wind turbines on AC grid protection,” *2013 IEEE PES General Meeting*, Vancouver, BC, Canada, Jul. 2013.
- [15] **L. He** and C.-C. Liu, “Impact of LVRT capability of wind turbines on distance protection of AC grids,” *2013 IEEE PES Innovative Smart Grid Technologies (ISGT)*, Washington DC, Feb. 2013.
- [16] **L. He** and C.-C. Liu, “Protection coordination between a HVDC offshore wind system and AC grid,” *2011 CIGRE Symposium “The Electric Power System of the Future”*, Bologna, Italy, Sep. 2011.
- [17] E. Ciapessoni, D. Cirio, A. Gatti, A. Pitto, A.M. Denis, **L. He**, C.-C. Liu, C. Moreira, and B. Silva, “Impact of HVDC grid on AC system stability and operation,” *2014 CIGRE*, Paris, France, Aug. 2014.

- [18] E. Ciapessoni, D. Cirio, A. Gatti, A. Pitto, A.M. Denis, O. Despuys, **L. He**, C.-C. Liu, et al, “Dynamics and control of multi-terminal HVDC networks for integration of large offshore wind parks into AC grids,” *2012 CIGRE*, Paris, France, Aug. 2012.
- [19] K. Bell, D. Cirio, A.M. Denis, **L. He**, C.-C. Liu, C. Moreira, and P. Panciatici, “Economic and technical criteria for designing future offshore HVDC grids,” *2010 Europe IEEE Innovative Smart Grid Technologies (ISGT Europe)*, Sweden, Oct. 2010.

### **Technical Reports**

- [20] C.-C. Liu, **L. He**, S. Finney, G. P. Adam, J.-B. Curis, O. Despuys, et al, “Preliminary analysis of HVDC networks for off-Shore wind farms and their coordinated protection,” TWENTIES WP5 Deliverable No. 5.1, European Commission, Mar. 2011.
- [21] E. Ciapessoni, D. Cirio, A. Gatti, A. Pitto, C. Moreira, B. Silva, Y. Phulpin, F. Resende, A.-M. Denis, O. Despuys, T. Prevost, C.-C. Liu, and **L. He**, “Principles of an optimal operation of the AC/DC interconnected power systems – Specification of the requirements for the HVDC grid (DCG) injections to the AC grid,” TWENTIES WP5 Deliverable No. 5.2-b, European Commission, Dec. 2011.
- [22] A.-M. Denis, O. Despuys, D. Cirio, A. Pitto, C. Moreira, B. Silva, F. Resende, H. Vasconcelos, C.-C. Liu, **L. He**, et al, “Advanced results of simulations of control and protection of HVDC networks: behavior and optimization,” TWENTIES WP5 Deliverable No. 5.3, European Commission, Mar. 2013.
- [23] K. Bell, A.-M. Denis, O. Despuys, S. Nguéfeu, J. Tazine, L. Violleau, J. Curis, W. Grieshaber, D. Cirio, A. Pitto, G. Migliavacca, R. Calisti, C. Moreira, B. Silva, C.-C. Liu, **L. He**, et al, “DC grids: motivation, feasibility and outstanding issues,” TWENTIES WP5 Deliverable No. 5.4, European Commission, Sep. 2013

### **INVITED TALKS**

- [1] 2019 Academic Seminar at Pacific Northwest National Laboratory, “Protection, security and restoration of power electronics based power systems,” Richland, WA, Nov. 2019.
- [2] 2019 Academic Seminar at Siemens Corporation, “Security and protection of power electronics based power systems,” Princeton, NY, Oct. 2019.
- [3] 2019 GE Symposium, “Non-blackbox data-driven online modeling of power electronics for real-time security detection,” Niskayuna, NY, Sep. 2019.
- [4] 2018 Academic Seminar at Illinois Institute of Technology, “Security of Future Power Grid with Renewable Energy Integration,” Chicago, IL, Sep. 2018.
- [5] 2018 Academic Seminar in SC&C company, “Security of Future Power Grid with Renewable Energy Integration,” Chicago, IL, Sep. 2018.
- [6] 2018 Academic Seminar at North China Electric Power University, “Security of Future Power Grid with Renewable Energy Integration,” Beijing, China, Jun. 2018.
- [7] 2018 Academic Seminar at Wuhan University, “Security of Future Power Grid with Renewable Energy Integration,” Wuhan, Hubei, China, May 2018.
- [8] 2018 Academic Seminar at Huazhong University of Science and Technology, “Security of Future Power Grid with Renewable Energy Integration,” Wuhan, Hubei, China, May 2018.
- [9] 2018 Integrated Energy and Smart Micro-grid Technology, “Smart Grid - Offshore Wind Power Integration,” Baoding, Hebei, China, May 2018.

- [10] 2018 Academic Seminar at Virginia Tech, “Security of Future Power Grid with Renewable Energy Integration,” Blacksburg, VA, Mar. 2018.
- [11] 2018 IEEE Power and Energy Conference Illinois (PECI), “Bypassing transients of pre-insertion resistor during energization of MMC-HVDC,” Urbana, IL, Feb. 2018.
- [12] 2017 TechX Talk at Siemens DG Headquarter, “Voltage security of the future power grid with renewable energy integration,” Minnetonka, MN, Oct. 2017.
- [13] The 5<sup>th</sup> East Lake International Forum, “System security and protection coordination of AC grids with wind power integration,” Wuhan, China, Dec. 2016.
- [14] 2016 Summer Seminar at Arizona State University, “Offshore wind power integration,” Tempe, AZ, Jul. 2016.
- [15] 2016 IEEE PES General Meeting on Best Paper Session of Power System Modeling and Analysis, “Effects of pre-insertion resistor on energization of compensated Lines,” Boston, MA, Jul. 2016.
- [16] 2013 IEEE PES General Meeting, “Effects of HVDC connection for offshore wind turbines on AC distance protection,” Vancouver, BC, Canada, Jul. 2013;
- [17] 2013 IEEE PES Innovative Smart Grid Technologies (ISGT), “Impact of LVRT capability of wind turbines on distance protection of AC grids,” Washington DC, Feb. 2013.
- [18] 2013 BOC Symposium at University College Dublin, “Challenges of offshore wind integration for the Irish grid,” Dublin, Ireland, Feb. 2013.
- [19] 2011 CIGRE Symposium “The Electric Power System of the Future”, “Protection coordination between a HVDC offshore wind system and AC grid,” Bologna, Italy, Sep. 2011
- [20] 2011 IEEE PES General Meeting, “Impact of AC grid faults on VSC-HVDC offshore wind network,” Detroit, MI, Jul. 2011.

### **TEACHING EXPERIENCE**

- ECE 491 Fundamentals of Power Systems
- ECE 491 Power System Analysis
- ECE 594 Modern Distributed Power Systems

### **PROFESSIONAL SERVICE**

#### **IEEE Society Service**

- **Secretary**, IEEE PES Distribution System Operation and Planning Subcommittee, 2019 – present

#### **Referee Service**

- **Associate Editor**, IEEE Open Journal of Power Electronics, 2019 - present
- Reviewer of top journals and leading conferences, including *IEEE Transactions on Power Systems*, *IEEE Transactions on Power Delivery*, *IEEE Transactions on Smart Grid*, *IEEE Transactions on Industrial Electronics*, *Journal of Modern Power Systems and Clean Energy*, *IET Generation, Transmission & Distribution*, *IET Renewable Power Generation*, *International Transactions on Electrical Energy Systems*, *CPSS Transactions on Power Electronics and Applications*, *2020 IEEE PES General Meeting*, *2018 IEEE Energy Conversion Congress and Exposition (ECCE)*, *IEEE PES PowerTech 2017*.

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## **Conference Service**

- Session Chair, 2020 IEEE PES General Meeting, “Managing Power Electronic based Power Systems”, Montreal, Canada, Aug. 2020.
- Session Chair, 2020 IEEE Innovative Smart Grid Technologies (ISGT), “Physical and Cyber Security of Power Electronic based Power Systems”, Washington DC, Feb. 2020.
- Topic Chair, 2018 IEEE Energy Conversion Congress and Exposition (ECCE), "Sustainable Energy Systems", Portland, OR, Sep. 2018.
- Session Chair, 2018 Integrated Energy and Smart Micro-grid Technology, “Renewable Energy Forecasting”, Baoding, Hebei, China, May 2018.

## **PROFESSIONAL ORGANIZATION**

- Member of Institute of Electrical and Electronics Engineers (*IEEE*)
- Member of Power Energy Society (*PES*)
- Member of Power Electronics Society (*PELS*)

## **PHD ADVISOR**

- Dr. Chen-Ching Liu (Member of National Academy of Engineering, IEEE Fellow)  
American Electric Power Professor  
Director, Power and Energy Center  
The Bradley Department of Electrical and Computer Engineering  
Virginia Tech  
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