

XIUQIANG HE

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APPOINTMENT

- **Postdoctoral Researcher** Nov., 2021 – Present
Automatic Control Laboratory (IfA), ETH Zürich, Switzerland
Advisor: Prof. Florian Dörfler

EDUCATION

- **Ph.D. in Control Science and Engineering** Aug., 2016 – Jun., 2021
Department of Automation, Tsinghua University, China
Dissertation: Research on Synchronization Issues in Power Systems with High Penetration of Power Electronics ([link](#))
Advisor: Prof. Hua Geng
- **B.S. in Automation** Aug., 2012 – Jun., 2016
Department of Automation, Tsinghua University, China

RESEARCH INTERESTS

- Renewable-rich dynamic power systems: stability analysis and control
- Grid-forming control and dynamic ancillary services
- Generic modeling of converter-interfaced generation for power system simulation studies

PUBLICATIONS

Topic I: Grid-Forming/-Following Control and Stability

- [1] X. He, L. Huang, I. Subotić, V. Häberle, and F. Dörfler, “Quantitative stability conditions for grid-forming converters with complex droop control,” *IEEE Trans. Power Electron.*, 2024, [↗](#).
- [2] X. He and F. Dörfler, “Passivity and decentralized stability conditions for grid-forming converters,” *IEEE Trans. Power Syst.*, pp. 1–4, 2024, [↗](#).
- [3] X. He, M. A. Desai, L. Huang, and F. Dörfler, “Cross-forming control and fault current limiting for grid-forming inverters,” 2024, to be submitted, [↗](#).
- [4] M. A. Desai, X. He, L. Huang, and F. Dörfler, “Saturation-informed current-limiting control for grid-forming converters,” *Electr. Power Syst. Res.*, 2024, [↗](#).
- [5] X. He, V. Häberle, I. Subotić, and F. Dörfler, “Nonlinear stability of complex droop control in converter-based power systems,” *IEEE Control Syst. Lett.*, vol. 7, pp. 1327–1332, 2023, [↗](#).
- [6] X. He, V. Häberle, and F. Dörfler, “Complex-frequency synchronization of converter-based power systems,” 2022, submitted to *IEEE Trans. Control Netw. Syst.*, [↗](#).
- [7] H. Geng, C. He, Y. Liu, X. He, and M. Li, “Overview on transient synchronization stability of renewable-rich power systems,” *High Voltage Engineering*, vol. 48, no. 9, pp. 3367–3383, 2022, [↗](#). (In Chinese)
- [8] C. He, X. He, H. Geng, H. Sun, and S. Xu, “Transient stability of low-inertia power systems with inverter-based generation,” *IEEE Trans. Energy Convers.*, vol. 37, no. 4, pp. 2903–2912, 2022, [↗](#). (Best Paper for the period 2021-2022)

- [9] X. He, S. Pan, and H. Geng, “Transient stability of hybrid power systems dominated by different types of grid-forming devices,” *IEEE Trans. Energy Convers.*, vol. 37, no. 2, pp. 868–879, 2022, [↗](#).
- [10] X. He, C. He, S. Pan, H. Geng, and F. Liu, “Synchronization instability of inverter-based generation during asymmetrical grid faults,” *IEEE Trans. Power Syst.*, vol. 37, no. 2, pp. 1018–1031, 2022, [↗](#).
- [11] X. He and H. Geng, “PLL synchronization stability of grid-connected multiconverter systems,” *IEEE Trans. Ind. Appl.*, vol. 58, no. 1, pp. 830–842, 2022, [↗](#).
- [12] X. He, H. Geng, J. Xi, and J. M. Guerrero, “Resynchronization analysis and improvement of grid-connected VSCs during grid faults,” *IEEE J. Emerg. Sel. Top. Power Electron.*, vol. 9, no. 1, pp. 438–450, 2021, [↗](#).
- [13] X. He and H. Geng, “Transient stability of power systems integrated with inverter-based generation,” *IEEE Trans. Power Syst.*, vol. 36, no. 1, pp. 553–556, 2021, [↗](#).
- [14] X. He, H. Geng, R. Li, and B. C. Pal, “Transient stability analysis and enhancement of renewable energy conversion system during LVRT,” *IEEE Trans. Sustain. Energy*, vol. 11, no. 3, pp. 1612–1623, 2020, [↗](#).
- [15] X. He, H. Geng, and S. Ma, “Transient stability analysis of grid-tied converters considering PLL’s nonlinearity,” *CPSS Trans. Power Electron. Appl.*, vol. 4, no. 1, pp. 40–49, 2019, [↗](#).
- [16] X. He, H. Geng, and G. Yang, “Reinvestigation of single-phase FLLs,” *IEEE Access*, vol. 7, pp. 13 178–13 188, 2019, [↗](#).
- [17] X. He, H. Geng, and G. Yang, “A generalized design framework of notch filter based frequency-locked loop for three-phase grid voltage,” *IEEE Trans. Ind. Electron.*, vol. 65, no. 9, pp. 7072–7084, 2018, [↗](#).
- [18] C. He, X. He, and H. Geng, “Transient stability of low-inertia power grid with inverter-based generations,” in *The 10th Renewable Power Generation Conference (RPG 2021)*, vol. 2021, 2021, pp. 91–97, [↗](#).
- [19] J. Li, X. He, and H. Geng, “Grid code formulation recommendations on inverter-based generation during asymmetrical grid faults,” in *The 10th Renewable Power Generation Conference (RPG 2021)*, vol. 2021, 2021, pp. 289–295, [↗](#).
- [20] X. He and H. Geng, “Synchronization stability analysis and enhancement of grid-tied multi-converter systems,” in *2020 IEEE Industry Applications Society Annual Meeting*, 2020, pp. 1–8, [↗](#).
- [21] X. He, H. Geng, and G. Yang, “Synchronization stability analysis of grid-tied power converters under severe grid voltage sags,” in *2018 IEEE International Power Electronics and Application Conference and Exposition (PEAC)*, 2018, pp. 1–6, [↗](#). (Excellent Paper Award)

Topic II: Dynamic Ancillary Services of Inverter-Based Resources

- [22] V. Häberle, X. He, L. Huang, E. Prieto-Araujo, and F. Dörfler, “Optimal dynamic ancillary services provision based on local power grid perception,” 2023, submitted to *IEEE Trans. Power Syst.*, [↗](#).
- [23] R. Domingo-Enrich, X. He, V. Häberle, and F. Dörfler, “Dynamic complex-frequency control of grid-forming converters,” 2024, submitted to IECON 2024, [↗](#).
- [24] V. Häberle, L. Huang, X. He, E. Prieto-Araujo, and F. Dörfler, “Dynamic ancillary services: From grid codes to transfer function-based converter control,” 2023, accepted by *Electr. Power Syst. Res.*, [↗](#).

- [25] V. Häberle, L. Huang, X. He, R. S. Smith, and F. Dörfler, “MIMO grid impedance identification of three-phase power systems: Parametric vs. nonparametric approaches,” in *Proc. 62nd IEEE Conference on Decision and Control*, 2023, [↗](#).
- [26] V. Häberle, A. Tayyebi, X. He, E. Prieto-Araujo, and F. Dörfler, “Grid-forming and spatially distributed control design of dynamic virtual power plants,” *IEEE Trans. Smart Grid*, vol. 15, no. 2, pp. 1761–1777, 2024, [↗](#).
- [27] C. Feng, L. Huang, X. He, Y. Wang, F. Dörfler, and Q. Chen, “Joint oscillation damping and inertia provision service for converter-interfaced generation,” 2023, [↗](#).
- [28] J. Xi, H. Geng, and X. He, “Adaptive VSG control scheme for large scale wind farms to improve frequency response characteristics,” in *2019 IEEE Industry Applications Society Annual Meeting*, 2019, pp. 1–7, [↗](#).

Topic III: Modeling of Renewable Energy Generation

- [29] X. He, H. Geng, and G. Mu, “Modeling of wind turbine generators for power system stability studies: A review,” *Renew. Sust. Energ. Rev.*, vol. 143, p. 110865, 2021, [↗](#).
- [30] X. Jiao, X. He, H. Geng, and B. Ren, “Hybrid average-value modelling of DFIG-based wind energy conversion systems,” in *The 10th Renewable Power Generation Conference (RPG 2021)*, vol. 2021, 2021, pp. 193–198, [↗](#).
- [31] X. He, H. Geng, and G. Yang, “Mode clustering based dynamic equivalent modeling of wind farm for small-signal stability analysis,” *arXiv preprint arXiv:2109.08383*, 2021, [↗](#).
- [32] X. He, H. Geng, and G. Yang, “Dynamic equivalent modeling of wind power plants for various timescale small signal stability analyses,” in *2019 IEEE Power and Energy Society General Meeting (PESGM)*, 2019, pp. 1–5, [↗](#).
- [33] X. He and H. Geng, “An overview on wind farm modelling for power system stability studies,” in *8th Renewable Power Generation Conference (RPG 2019)*, 2019, pp. 1–8, [↗](#).
- [34] X. He, H. Geng, G. Yang, X. Zou, and Y. Li, “Equivalent modelling of wind farm for small-signal stability analysis in weak power system,” *J. Eng.*, vol. 2017, no. 13, pp. 1388–1393, 2017, [↗](#).

Topic IV: HVDC Integration of Renewable Energy Generation

- [35] S. Zhao, X. He, C. Lv, Y. Zhou, S. Xu, X. Liu, and H. Geng, “Black start-up and coordinated control strategy of standalone doubly-fed wind farms connected to LCC-HVDC,” *Power System and Clean Energy*, vol. 37, no. 7, pp. 87–96, 135, 2021, [↗](#). (In Chinese)
- [36] X. He, G. Hua, Y. Geng, and Z. Xin, “Startup and integration control strategy of DFIG based isolated wind farm connected with LCC-HVDC,” *Autom. of Elec. PowerSyst*, vol. 43, no. 9, pp. 99–107, 2019, [↗](#). (In Chinese)
- [37] X. He, H. Geng, G. Yang, and X. Zou, “Coordinated control for large-scale wind farms with LCC-HVDC integration,” *Energies*, vol. 11, no. 9, 2018, [↗](#).
- [38] X. He, H. Geng, G. Yang, and X. Zou, “VSG control for DFIG-based islanded wind farm with LCC-HVDC integration,” in *2018 IEEE Power and Energy Society General Meeting (PESGM)*, 2018, pp. 1–5, [↗](#).

AWARDS

- **First Prize of Science and Technology Progress Award of China Power Supply Society**
Awarded by the China Power Supply Society Nov. 2023

- **Outstanding Doctoral Dissertation (Nomination) of China Power Supply Society**
Awarded by the China Power Supply Society Apr. 2023
- **Star Reviewer of IEEE Transactions on Energy Conversion**
Awarded by the IEEE Transactions on Energy Conversion Editorial Broad Dec. 2021
- **Tsinghua University Outstanding Doctoral Dissertation**
Top 10%, awarded by Tsinghua University Jun. 2021
- **Beijing Outstanding Graduates**
Top 5%, awarded by the Beijing Ministry of Education Jun. 2021
- **China National Scholarship**
Awarded by the Chinese Ministry of Education Dec. 2019
- **Outstanding Reviewer of IEEE Transactions on Sustainable Energy**
Awarded by the IEEE Transactions on Sustainable Energy Editorial Broad Feb. 2019
- **The Second Prize, the First Beijing's Universities AI Academic Forum Award**
Awarded by the Beijing's Universities AI Academic Forum Committee Mar. 2019
- **The First Class Fellowship of Tsinghua University Graduate Student Professional Practice**
Awarded by the Graduate School of Tsinghua University Dec. 2018
- **China National Scholarship**
Awarded by the Chinese Ministry of Education Nov. 2018
- **IEEE PEAC Conference Excellent Paper**
Awarded by the IEEE PEAC Committee Nov. 2018
- **IEEE PEAC Conference Best Presenter**
Awarded by the IEEE PEAC Committee Nov. 2018
- **The 22nd CPSS Annual Conference Excellent Paper**
Awarded by the China Power Supply Society Nov. 2017
- **The 22nd CPSS Annual Conference Best Presenter**
Awarded by the China Power Supply Society Nov. 2017
- **The Third Prize, Tsinghua University Student Laboratory Construction Award**
Awarded by the Laboratory and Equipment Department, Tsinghua University Mar. 2017
- **Tsinghua University Academic Scholarship**
Awarded by Tsinghua University Oct. 2014
- **HAGE Scholarship**
Awarded by the Department of Automation, Tsinghua University Oct. 2014

RESEARCH EXPERIENCE

- **Horizon Europe AGISTIN project:** Advanced Grid Interfaces for innovative STorage INtegration (AGISTIN), <https://www.agistin.eu/>
(Supported by the European Union's Horizon 2020) Jan. 2023 – Present
Main Participant
Investigate Task 3.5 (Development of optimization and control methods for real-time AGI operation) in WP 3.
- **Horizon Europe POSYTYF project:** POvering SYstem flexibiliTY in the Future (POSYTYF) through Renewable Energy Sources <https://posytyf-h2020.eu/>
(Supported by the European Union's Horizon 2020) Nov. 2021 – Present

Main Participant

Investigate Task 4.2 (Novel stability and assessment in future power systems) in WP 4.

- **IEC TS 63406 ED1: Generic RMS Simulation Models of Converter-Based Generating Units for Power System Dynamic Analysis** [link to the IEC Website](#)
(Led by IEC SC 8A) Apr. 2018 – Present

Member, Technical Secretary of the IEC SC 8A WG 8

Worked with the convener Prof. Hua GENG, accomplished a modeling evaluation task and prepared a technical report to review the existing generic modeling for converter-based generation by IEC, WECC, CIGRE, IEEE, and CEPRI, and also identify the gaps remaining in the standardized modeling. A technical specification (IEC TS 63406 ED1) is being developed to address converter-based generating unit generic models.

- **Equivalence and Simulation Modeling of Large-Capacity Wind Farms** (Supported by the State Grid) Jun. 2016 – Dec. 2019

Main Participant

Conducted the EMT simulation modeling of wind turbines, PV generation systems, SVC, STATCOM in PSCAD/EMTDC and also the equivalent aggregated modeling of wind farms. The models were used in the transient response analysis of the sending-end system of China Jiu-Hu ± 800 kV HVDC and Qing-Yu ± 800 kV HVDC projects.

- **Flexible Grid-Connection Control and Application of Wind Power Generation Systems** (Supported by the NSFC) Jan. 2018 – Dec. 2020

Main Participant

Proposed a generalized framework of frequency-locked loop (FLL) synchronization approaches; Proposed a grid-connection control strategy for isolated wind farms with LCC-HVDC integration. The proposed strategy was considered as a potential scheme for 100% renewables integrated with the Qing-Yu HVDC.

- **Large-Disturbance Stability and Cascading Failure Evolution in Power Systems with High Penetration of Power Electronics** (Supported by the NSFC) Jan. 2021 – Present

Main Participant

Conducted transient synchronization stability modeling, analysis, and control for grid-connected converters and for hybrid power systems with converters and generators.

- **Multi-Device Joint Real-Time Simulation Platform and Power Hardware-in-the-Loop Experimental Platform** Jun. 2020 – Present

Main Contributor

Involved in the design and establishment of a real-time simulation platform (composed of RT-LAB, Typhoon HIL, and dSPACE) and the design of a power hardware-in-the-loop experiment platform.

SUPERVISION

- **PhD Project: Control of dynamic virtual power plants**, Verena Häberle, co-supervised with Dr. Linbin Huang, Prof. Eduardo Prieto-Araujo, and Prof. Florian Dörfler, 2022 – present.
- **Master Project: Complex frequency control of dynamic virtual power plants**, Roger Domingo-Enrich, co-supervised with Verena Häberle, Spring 2023.
- **Semester Project: Aggregated modeling of grid-forming converters with complex droop control**, Martin Pedersen, co-supervised with Verena Häberle, Spring 2023.
- **Semester Project: Stable current-limiting control for grid-forming converters**, Maitraya Avadhut Desai, co-supervised with Linbin Huang, Fall 2022.

TEACHING EXPERIENCE

- **Control Systems** (Prof. Florian Dörfler), Teaching Assistant (Fall Semester 2022, Spring Semester 2023, Fall Semester 2023, Spring Semester 2024), ETH Zurich.
- **Control Systems I** (Prof. Florian Dörfler), Teaching Assistant (Spring Semester 2022), ETH Zurich.
- **Fundamentals of Analog Electronics Technology** (Prof. Hua GENG), Teaching Assistant (for three semesters), Tsinghua University.
- **Electric Drive and Motion Control** (Prof. Geng YANG), Teaching Assistant (for two semesters), Tsinghua University.

TALKS

- *Stability guarantees for grid-forming complex droop control*, talk at the Third Champéry Power Conference, Feb. 2024, Champéry, Switzerland.
- *Multivariable grid-forming control and nonlinear stability analysis*, invited talk at the 9th Workshop of Power Electronics Emerging Technologies, Oct. 2023, Nanjing, remote talk.
- *Multivariable stability of converter-based power systems: centralized and decentralized methods*, IFA coffee talk, Apr. 2023, ETH Zurich.
- *Complex-frequency synchronization and multivariable stability analysis*, invited session talk in 2022 4th International Conference on Smart Power & Internet Energy Systems (SPIES 2022), Dec. 2022, remote.
- *Transient stability of power electronics-dominated power networks: principle and application*, tutorial of the 47th Annual Conference of the IEEE Industrial Electronics Society (IECON 2021), remote.
- *Synchronization stability analysis and enhancement of grid-tied multi-converter systems*, in 2020 IAS Annual Meeting, Oct. 2020, remote.
- *Transient stability analysis and enhancement of renewable energy conversion system during LVRT*, in PESGM 2020, Aug. 2020, remote.
- *Modeling of inverter-based generation for power system stability studies*, in IEC SC 8A ahG 3 Meeting, Oct. 2019, Nanjing, China.
- *Modeling recommendation of wind turbine/farm for power system stability studies*, in PESGM 2019, Aug. 2019, Atlanta, USA.
- *Hardware-in-loop tools for power engineering education*, in PESGM 2019 (on behalf of Prof. GENG), Aug. 2019, Atlanta, USA.
- *Dynamic equivalent modeling of wind power plants for various timescale small signal stability analyses*, in PESGM 2019, Aug. 2019, Atlanta, USA.
- *Synchronization stability analysis of grid-tied power converters under severe grid voltage sags*, in IEEE PEAC 2018, Nov. 2018, Shenzhen, China. (Best Presenter Award)

ACADEMIC SERVICES

- **Member, Technical Secretary**, IEC SC 8A WG 8 *Modeling of Renewable Energy Generation for Power System Dynamic Analysis*
- **Invited Session Chair**, the 10th International Conference on Renewable Power Generation (RPG 2021)

- **Reviewer**, IEEE TPWRS, TSTE, TSG, TEC, TPWRD, TIE, TII, TPEL, TIA, JESTPE, JET-CAS, and Automatica, etc.

MEMBERSHIP

- Member, IEEE
- Member, IEEE Power and Energy Society
- Member, China Power Supply Society
- Member, Chinese Association of Automation

SKILLS

- **Simulation Tools:** MATLAB/Simulink, PSCAD/EMTDC, RT-LAB, Typhoon HIL, dSPACE
- **Programming Languages:** C/C++, C#, MATLAB, LaTeX

Updated in April 2024.