XIUQIANG HE (何秀强)

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Central Building 700A, Tsinghua University, 100084 Beijing, China

APPOINTMENT

· **Research Assistant Professor** Jul. 2025 – Present
Department of Automation, Tsinghua University, China

· **Senior Scientist** Nov. 2024 – Jan. 2025
Automatic Control Laboratory (IfA), ETH Zürich, Switzerland

· **Postdoctoral Researcher** Nov. 2021 – Oct. 2024
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

· **Stability:** Modeling, stability analysis, and control of converter-dominated power systems

· **Performance:** Fast frequency and voltage regulation, dynamic virtual power plants, and data-driven control

· **Optimality:** Feedback optimization and game theory in renewable-rich power systems

· **Standardization:** IEC generic modeling of inverter-based generation and next-generation grid codes

PUBLICATIONS

Topic I: Stability in Converters-Dominated Power System

[1] W. Schittek, N. Wiese, C. Hachmann, **X. He**, J. Heid, J. Ferry, and M. Braun, "How to tailor power-electronic inertia to the constraints of its resource," *TechRxiv preprint*, July 2025, [link]

[2] J. Miller, M. A. Desai, **X. He**, R. S. Smith, and G. Hug, "Network-independent incremental passivity conditions for grid-forming inverter control," *arXiv preprint*, 2025, [link]

[3] K. Zhuang, H. Xin, V. Häberle, **X. He**, L. Huang, and F. Dörfler, "Quantifying grid-forming behavior: Bridging device-level dynamics and system-level stability," *arXiv preprint*, 2025, [link]

[4] V. Häberle, **X. He**, L. Huang, F. Dörfler, and S. Low, "Decentralized parametric stability certificates for grid-forming converter control," *arXiv preprint*, 2025, [link]

[5] **X. He**, V. Häberle, and F. Dörfler, "Complex-frequency synchronization of converter-based power systems," *IEEE Trans. Control Netw. Syst.*, vol. 12, no. 1, pp. 787–799, 2025, [link]

[6] **X. He**, M. A. Desai, L. Huang, and F. Dörfler, "Cross-forming control and fault current limiting for grid-forming inverters," *IEEE Trans. Power Electron.*, vol. 40, no. 3, pp. 3980–4007, 2025, [link]

[7] M. A. Desai, **X. He (通讯作者)**, L. Huang, and F. Dörfler, "Saturation-informed current-limiting control for grid-forming converters," *Electr. Power Syst. Res.*, vol. 234, p. 110746, 2024, [link]

[8] **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.*, vol. 39, no. 9, pp. 10 834–10 852, 2024, [link]

[9] **X. He** and F. Dörfler, "Passivity and decentralized stability conditions for grid-forming converters," *IEEE Trans. Power Syst.*, vol. 39, no. 3, pp. 5447–5450, 2024, [link]

[10] **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, [link]

[11] 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, [link] (In Chinese)

[12] 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, [link] (Best Paper for the period 2021–2022)

[13] **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, [link]

[14] **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, [link]

[15] **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, [link]

[16] **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, [link]

[17] **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, [link]

[18] **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, [link]

[19] **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, [link]

[20] **X. He**, H. Geng, and G. Yang, "Reinvestigation of single-phase FLLs," *IEEE Access*, vol. 7, pp. 13 178–13 188, 2019, [link]

[21] **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, [link]

[22] C. He, **X. He**, and H. Geng, "Transient stability of low-inertia power grid with inverter-based generations," in *Proc. 10th Renewable Power Generation Conference (RPG 2021)*, 2021, pp. 91–97, [link]

[23] H. Liu, **X. He**, H. Qing, Y. Chen, and H. Geng, "Stability-constrained gfm/gfl capacity ratio: Modeling and evaluation," in *2025 IEEE Industry Applications Society Annual Meeting (IAS)*, 2025, pp. 1–6, [link]

[24] Z. Sun, S. Jiang, J. Zhang, M. Zhang, **X. He**, and H. Geng, "Decentralized stability analysis and region of attraction estimation for multi-bus dc microgrids," in *2025 IEEE Industry Applications Society Annual Meeting (IAS)*, 2025, pp. 1–6, [link]

[25] J. Li, **X. He**, and H. Geng, "Grid code formulation recommendations on inverter-based generation during asymmetrical grid faults," in *Proc. 10th Renewable Power Generation Conference (RPG 2021)*, 2021, pp. 289–295, [link]

[26] **X. He** and H. Geng, "Synchronization stability analysis and enhancement of grid-tied multi-converter systems," in *Proc. 2020 IEEE Industry Applications Society Annual Meeting*, 2020, pp. 1–8, [link]

[27] **X. He**, H. Geng, and G. Yang, "Synchronization stability analysis of grid-tied power converters under severe grid voltage sags," in *Proc. 2018 IEEE International Power Electronics and Application Conference and Exposition (PEAC)*, 2018, pp. 1–6, [link] (Excellent Paper Award)

Topic II: Dynamic Ancillary Services of Inverter-Based Resources

[28] X. Zhu, H. Geng, H. Qing, G. Ruan, and **X. He**, "Dynamic virtual power plants with robust frequency regulation capability," *IEEE Trans. Ind. Appl.*, pp. 1–12, 2025, [link]

[29] C. Feng, L. Huang, X. He, Y. Wang, F. Dorfler, and C. Kang, "Hybrid oscillation damping and inertia management for distributed energy resources," *IEEE Trans. Power Syst.*, pp. 1–16, 2025, [link]

[30] **X. He**, J. Duarte, V. Häberle, and F. Dörfler, "Aggregate grid-forming control of distributed energy resources for fast ancillary services," *Preprint*, 2025, [link]

[31] V. Häberle, **X. He**, L. Huang, E. Prieto-Araujo, and F. Dörfler, "Optimal dynamic ancillary services provision based on local power grid perception," *IEEE Trans. Power Syst.*, vol. 40, no. 2, pp. 1816–1831, 2025, [link]

[32] R. Domingo-Enrich, **X. He**, V. Häberle, and F. Dörfler, "Dynamic complex-frequency control of grid-forming converters," in *Proc. 2024 Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2024, [link]

[33] V. Häberle, L. Huang, **X. He**, E. Prieto-Araujo, and F. Dörfler, "Dynamic ancillary services: From grid codes to transfer function-based converter control," *Electr. Power Syst. Res.*, vol. 234, p. 110760, 2024, [link]

[34] 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 (CDC)*, 2023, [link]

[35] 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, [link]

[36] J. Xi, H. Geng, and **X. He**, "Adaptive VSG control scheme for large scale wind farms to improve frequency response characteristics," in *Proc. 2019 IEEE Industry Applications Society Annual Meeting*, 2019, pp. 1–7, [link]

Topic III: Modeling of Renewable Energy Generation

[37] **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, [link]

[38] X. Jiao, **X. He**, H. Geng, and B. Ren, "Hybrid average-value modelling of DFIG-based wind energy conversion systems," in *Proc. 10th Renewable Power Generation Conference (RPG 2021)*, 2021, pp. 193–198, [link]

[39] **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, [link]

[40] **X. He**, H. Geng, and G. Yang, "Dynamic equivalent modeling of wind power plants for various timescale small signal stability analyses," in *Proc. 2019 IEEE Power and Energy Society General Meeting (PESGM)*, 2019, pp. 1–5, [link]

[41] **X. He** and H. Geng, "An overview on wind farm modelling for power system stability studies," in *Proc. 8th Renewable Power Generation Conference (RPG 2019)*, 2019, pp. 1–8, [link]

[42] **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, [link]

Topic IV: HVDC Integration of Renewable Energy Generation

[43] S. Zhao, **X. He**, C. Lyu, 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, [link] (In Chinese)

[44] 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. Power Syst.*, vol. 43, no. 9, pp. 99–107, 2019, [link] (In Chinese)

[45] **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, [link]

[46] **X. He**, H. Geng, G. Yang, and X. Zou, "VSG control for DFIG-based islanded wind farm with LCC-HVDC integration," in *Proc. 2018 IEEE Power and Energy Society General Meeting (PESGM)*, 2018, pp. 1–5, [link]

AWARDS

- **First Prize of Science and Technology Progress Award of China Electrotechnical Society**
  Awarded by the China Electrotechnical Society — Dec. 2024
- **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
- **Best Paper of IEEE Transactions on Energy Conversion**
  Awarded by the IEEE Transactions on Energy Conversion Editorial Broad — Dec. 2022
- **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 Dec. 2013
- **HAGE Scholarship**
  Awarded by the Department of Automation, Tsinghua University May 2013

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:** POwering 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: Grid code validation of cross-forming controlled converters under current limitation**, Ramona Stoll, co-supervised with Maitraya Desai, Fall 2024.
- **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 Zürich.
- **Control Systems I** (Prof. Florian Dörfler), Teaching Assistant (Spring Semester 2022), ETH Zürich.

· **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

· IECON 2024, *Dynamic complex-frequency control of grid-forming converters*, Nov. 2024, Chicago, USA.

· Invited talk at EirGrid, *Grid-forming, grid-following, and cross-forming controls*, Aug. 2024, remote.

· The Third Champéry Power Conference, *Stability guarantees for grid-forming complex droop control*, Feb. 2024, Champéry, Switzerland.

· Invited talk at the 9th Workshop of Power Electronics Emerging Technologies, *Multivariable grid-forming control and nonlinear stability analysis*, Oct. 2023, Nanjing, remote talk.

· ETH IFA coffee talk, *Multivariable stability of converter-based power systems: centralized and decentralized methods*, Apr. 2023, ETH Zürich.

· Invited session talk in 2022 4th International Conference on Smart Power & Internet Energy Systems (SPIES 2022), *Complex-frequency synchronization and multivariable stability analysis*, Dec. 2022, remote.

· Tutorial at the 47th Annual Conference of the IEEE Industrial Electronics Society (IECON 2021), *Transient stability of power electronics-dominated power networks: principle and application*, Oct. 2021, remote.

· IAS Annual Meeting 2020, *Synchronization stability analysis and enhancement of grid-tied multi-converter systems*, Oct. 2020, remote.

· PESGM 2020, *Transient stability analysis and enhancement of renewable energy conversion system during LVRT*, Aug. 2020, remote.

· IEC SC 8A ahG 3 Meeting, *Modeling of inverter-based generation for power system stability studies*, Oct. 2019, Nanjing, China.

· PESGM 2019, *Modeling recommendation of wind turbine/farm for power system stability studies*, Aug. 2019, Atlanta, USA.

· PESGM 2019 (on behalf of Prof. GENG), *Hardware-in-the-loop (HIL) tools for power engineering education*, Aug. 2019, Atlanta, USA.

· PESGM 2019, *Dynamic equivalent modeling of wind power plants for various timescale small signal stability analyses*, Aug. 2019, Atlanta, USA.

· IEEE PEAC 2018, *Synchronization stability analysis of grid-tied power converters under severe grid voltage sags*, 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*

· **Tutorial Session Chair**, IECON 2021

· **Invited Session Chair**, the 10th International Conference on Renewable Power Generation (RPG 2021)

- **Reviewer**

  Power Systems Journals: IEEE TPWRS / TSTE / TSG / TEC / TPWRD / OAJPE / PESL / PEM, CSEE JPES, IJEPES, IET GTD / ESI

  Power Electronics Journals: IEEE TPEL / TIE / JESTPE

  Control Journals: IEEE TCNS, Automatica, Control Engineering Practice

  Interdisciplinary Journals: IEEE TIA / TII / JETCAS / Access

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