MENGSHUO JIA

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APPOINTMENT

Postdoctoral Researcher 2021 - Now
Power Systems Laboratory, ETH Zürich, Switzerland
Mentor: Prof. Gabriela Hug

EDUCATION

Visiting Ph.D., Electrical Engineering (onsite + online) 2019 - 2021
Power Systems Laboratory, ETH Zürich, Switzerland
Supervisor: Prof. Gabriela Hug

Ph.D., Electrical Engineering 2016 - 2021
Department of Electrical Engineering, Tsinghua University, China
Supervisor: Prof. Chen Shen

B.E., Electrical Engineering (I ranked first in my major for 4 consecutive years) 2012 - 2016
Department of Electrical Engineering, North China Electric Power University, China

GRANTS AS PRINCIPAL INVESTIGATOR

Rethinking Power Systems Computation: Uncovering Linearity Mechanism 2023 - 2024
Granted by Swiss National Science Foundation, No.CRSK-2_221126/1, with me as PI

· Decrease financial costs in power system operation and reduce electricity bills for billions of consumers

PROFESSIONAL SERVICE

Journal Editors

- Associate Editor, IEEE Systems Journal (Impact Factor: 4.802)
- Associate Editor, IET Renewable Power Generation (Impact Factor: 3.034)

Conference Roles

- Serve as an invited chair for the session "Load Flow and Power Quality" in IEEE PowerTech Belgrade 2023
- Participate in the selection of the Basil Papadias Student Paper Award in IEEE PowerTech Belgrade 2023
- Provide continual technical support for editorial and review processes in Power Systems Computation Conference 2024

Peer Reviewers

- IEEE Transactions on Power Systems
- IEEE Transactions on Smart Grid

- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Industrial Application
- IEEE Transactions on Transportation Electrification
- IEEE Power Engineering Letters
- Applied Energy
- Electrical Power System Research
- IET Generation, Transmission & Distribution
- IET Renewable Power Generation
- IET Smart Grid
- Energy Conversion and Economics
- IEEE Power and Energy Society General Meeting
- Power Systems Computation Conference
- IEEE PowerTech Conference
- International Conference on Probabilistic Methods Applied to Power Systems (PMAPS)

Organization Membership

- Member, IEEE
- Member, IEEE Power and Energy Society
- Member, IET

SELECTED PUBLICATIONS

Toolbox

T1. **Mengshuo Jia**, Gabriela Hug. "Daline®: data-driven power flow linearization tools for power systems research and education," https://github.com/JarvisETHZ/DPFL-Master (available upon request).

Monograph in Pipeline

M1. **Mengshuo Jia**, "Uncertainty Modeling, Probabilistic Analysis, and Stochastic Optimization of Multi-ISO-controlled Interconnected Grids", ***funded by Springer Thesis Award***, in preparation, to be published in Springer.

Papers in Pipeline

P1. **Mengshuo Jia**, Gabriela Hug, Ning Zhang, Zhaojian Wang, Yi Wang. "Tutorial on Data-driven Power Flow Linearization - Part I: Challenges and Training Algorithms," 2023, preprint: https://doi.org/10.3929/ethz-b-000606654.

P2. **Mengshuo Jia**, Gabriela Hug, Ning Zhang, Zhaojian Wang, Yi Wang. "Tutorial on Data-driven Power Flow Linearization - Part II: Supportive Techniques and Experiments," 2023, preprint: https://doi.org/10.3929/ethz-b-000606656

P3. Aline Scherrer, Georgia Pierrou, Mengshuo Jia, Marc Hohmann, Gabriela Hug. "Physics-Data-Driven AC Power Flow Linearization Considering Topological Remedial Actions," 2023 (available upon request).

Papers under Review

U1. Yufan Zhang, **Mengshuo Jia**, Honglin Wen, Yuanyuan Shi. "Value-oriented Renewable Energy Forecasting for Coordinated Energy Dispatch Problems at Two Stages," submitted to ***European Journal of Operational Research***, 2023, preprint: https://arxiv.org/abs/2309.00803

U2. Zhaojian Wang, Ming Li, **Mengshuo Jia**, Feng Liu, Bo Yang, Xinping Guan"Distributed Control to Steer Dynamical Systems to the Generalized Nash Equilibrium with Operational Constraints", submitted to ***IEEE Transactions on Automatic Control***, 2023 (available upon request).

U3. Yongkai Xie, Zhaojian Wang, John Zhen Fu Pang, **Mengshuo Jia**, Bo Yang, Xinping Guan. "Distributed Online Generalized Nash Equilibrium Tracking with Communication Delays for the Energy Trading Game among Prosumers," submitted to ***Automatica***, 2023 (available upon request).

Journal Paper Publications

J1. **Mengshuo Jia**, Qianni Cao, Chen Shen, Gabriela Hug. "Frequency-Control-Aware Probabilistic Load Flow: An Analytical Method," ***IEEE Transactions on Power Systems***, vol. 38, no. 6, pp. 5170-5187, Nov. 2023, https://doi.org/10.1109/TPWRS.2022.3223884

J2. **Mengshuo Jia**, Gabriela Hug, Yifan Su, Chen Shen. "Chance-constrained OPF: A Distributed Method with Confidentiality Preservation," ***IEEE Transactions on Power Systems***, vol. 38, no. 4, pp. 3373-3387, July 2023, https://doi.org/10.1109/TPWRS.2022.3200941

J3. **Mengshuo Jia**, Gabriela Hug, Chen Shen. "Iterative Decomposition of Joint Chance Constraints in OPF," ***IEEE Transactions on Power Systems***, vol. 36, no. 5, pp. 4836-4839, Sept. 2021, https://doi.org/10.1109/TPWRS.2021.3072541

J4. **Mengshuo Jia**, Yi Wang, Chen Shen, Gabriela Hug. "Privacy-preserving Distributed Clustering for Electrical Load Profiling," ***IEEE Transactions on Smart Grid***, vol. 12, no. 2, pp. 1429-1444, March 2021, https://doi.org/10.1109/TSG.2020.3031007

J5. **Mengshuo Jia**, Yi Wang, Chen Shen, Gabriela Hug. "Privacy-preserving Distributed Probabilistic Load Flow," ***IEEE Transactions on Power Systems***, vol. 36, no. 2, pp. 1616-1627, March 2021, https://doi.org/10.1109/TPWRS.2020.3022476

J6. **Mengshuo Jia**, Chen Shen, Zhiwen Wang. "A Distributed Probabilistic Modeling Algorithm for the Aggregated Power Forecast Error of Multiple Newly Built Wind Farms ," ***IEEE Transactions on Sustainable Energy***, vol. 10, no. 4, pp. 1857-1866, Oct. 2019, https://doi.org/10.1109/TSTE.2018.2873710

J7. **Mengshuo Jia**, Shaowei Huang, Zhiwen Wang, Chen Shen. "Privacy-preserving Distributed Parameter Estimation for Probability Distribution of Wind Power Forecast Error ," ***Renewable Energy***, vol. 163, no. 1, pp. 1857-1866, Jan. 2021, https://doi.org/10.1016/j.renene.2020.06.102

J8. **Mengshuo Jia**, Chen Shen, Zhaojian Wang. "A Distributed Incremental Update Scheme for Probability Distribution of Wind Power Forecast Error ," ***International Journal of Electrical Power and Energy Systems***, vol. 121, no. 1, pp. 106151, Oct. 2020, https://doi.org/10.1016/j.ijepes.2020.106151

J9. **Mengshuo Jia**, Qianni Cao, Sixuan Xu, Hui Cai, Zhenjian Xie, Chen Shen. "Analytical Probabilistic Load Flow Algorithm for Transmission Networks Considering the Constraints of Frequency Regulation Capacity," ***Proceedings of the CSEE***, pp. 1-11, Feb. 2023 (In Chinese), https://kns.cnki.net/kcms/detail/11.2107.TM.20230220.1349.002.html

J10. Yi Wang, **Mengshuo Jia**, Ning Gao, Leandro Von Krannichfeldt, Mingyang Sun, Gabriela Hug, "Federated Clustering for Electricity Consumption Pattern Extraction," ***IEEE Transactions on Smart Grid***,

vol. 13, no. 3, pp. 2425-2439, May 2022, https://doi.org/10.1109/TSG.2022.3146489

J11. Qianni Cao, **Mengshuo Jia**, Chen Shen. "A Fault Detection Scheme for PV Modules in Large Scale PV Stations With Complex Installation Conditions," ***Proceedings of the CSEE***, pp. 1917-1925, May 2022 (In Chinese), https://kns.cnki.net/kcms/detail/11.2107.tm.20210916.1438.010.html

J12. Cao Qianni, **Jia Mengshuo**, Boda Li,Shen Chen, Xiaodai Xue. "Decisions of a By-product Hydrogen Supply Chain for a Business Model of Large-scale Hydrogen Storage," ***Journal of Tsinghua University (Science and Technology)***, pp. 1-14, May 2023 (In Chinese), https://kns.cnki.net/kcms/detail/10.16511/j.cnki.qhdxxb.2023.25.039.html

J13. Chen Shen, **Mengshuo Jia**, Ying Chen, Shaowei Huang, Yue Xiang. "Digital Twin of the Energy Internet and Its Application," ***Journal of Global Energy Interconnection***, vol. 3, no. 1, pp. 1-13, 2020 (In Chinese), https://kns.cnki.net/kcms/detail/10.19705/j.cnki.issn2096-5125.2020.01.001.html

J14. Shen Chen, Cao Qianni, **Jia Mengshuo**, Chen Ying, Huang Shaowei."Concepts, Characteristics and Prospects of Application of Digital Twin in Power System," ***Proceedings of the CSEE***, vol. 42, no. 2, pp. 487-499, 2022 (In Chinese), https://kns.cnki.net/kcms/detail/10.13334/j.0258-8013.pcsee.211594.html

J15. Yifan Su, Zhaojian Wang, Ming Cao, **Mengshuo Jia**, Feng Liu. "Convergence Analysis of Dual Decomposition Algorithm in Distributed Optimization: Asynchrony and Inexactness," ***IEEE Transactions on Automatic Control***, vol. 68, no. 8, pp. 4767-4782, Aug. 2023, https://doi.org/10.1109/TAC.2022.3213608

J16. Zhaojian Wang, Feng Liu, Zhiyuan Ma, Yue Chen, **Mengshuo Jia**, Wei Wei, Qiuwei Wu. "Distributed Generalized Nash Equilibrium Seeking for Energy Sharing Games in Prosumers," ***IEEE Transactions on Power Systems***, vol. 36, no. 5, pp. 3973-3986, Sept. 2021, https://doi.org/10.1109/TPWRS.2021.3058675

J17. Chuanyang Li, Yang Yang, Guoqiang Xu, Yao Zhou, **Mengshuo Jia**, Shaolong Zhong, Yu Gao, Chanyeop Park, Qiang Liu, Yalin Wang, Shakeel Akram, Xiaoliang Zeng, Yi Li, Fangwei Liang, Bin Cui, Junpeng Fang, Lingling Tang, Yulin Zeng, Xingtao Hu, Jiachen Gao, Giovanni Mazzanti, Jinliang He, Jianxiao Wang, Davide Fabiani, Gilbert Teyssedre, Yang Cao, Feipeng Wang, Yunlong Zi. "Insulating materials for realising carbon neutrality: Opportunities, remaining issues and challenges." ***High Voltage***, vol. 7, no. 4, pp. 610-632, July 2022, https://doi.org/10.1049/hve2.12232

J18. Chenyu Liu, Xuemin Zhang, Zhao Zhen, Shengwei Mei, **Mengshuo Jia**. "Multi-source Numerical Weather Prediction in Adaptive Wind Power Forecasting: Rank Bayesian Ensemble and Fluctuation Awareness," ***Applied Energy***, vol. 313, no. 1, pp. 118769, May 2022, https://doi.org/10.1016/j.apenergy.2022.118769

Conference Paper Publications

C1. **Mengshuo Jia**, Gabriela Hug. "Overview of Data-driven Power Flow Linearization," ***IEEE PowerTech Conference***, Belgrade, Serbia, pp. 01-06, 2023, https://doi.org/10.1109/PowerTech55446.2023.10202779

C2. **Jia Mengshuo**, Huang Shaowei, Tang Kexuan, Shen Chen. "An Investigation on the Applicability of

the Integrated Method for Multi-Carrier Energy Flow Analysis," ***IEEE Power and Energy Society General Meeting***, Portland, OR, USA, pp. 1-5, 2018, https://doi.org/10.1109/PESGM.2018.8585831

C3. Qianni Cao, Xuzhu Dong, Chen Shen, **Jia Mengshuo**. "Detection of Abnormal Status of PV Modules at PV Stations with Complex Installation Conditions," ***IEEE Conference on Energy Internet and Energy System Integration***, Wuhan, China, pp. 1801-1806, 2020, https://doi.org/10.1109/EI250167.2020.9347229

C4. Yifan Su, Zhaojian Wang, Feng Liu, Peng Yang, Yunfan Zhang, **Jia Mengshuo**. "Hierarchical decomposition based distributed energy management of distribution networks," ***Renewable Power Generation Conference***, Shanghai, China, pp. 1-7, 2019, https://doi.org/10.1049/cp.2019.0536

TEACHING

Lecture 1: Optimization in Energy Systems 2022-Now

With Prof. Gabriela Hug, 32 hours, Spring Semester

· As the guest lecturer, I teach 2 primary lectures:

i. Programming for Optimization

ii. Multi-time Step Optimization & Unit Commitment

· As the teaching assistant, I teach 3 exercise lectures:

i. Unconstrained and Equality Constrained Optimization

ii. Inequality Constrained Optimization

iii. Solution methods for optimization problems - Interior point & Newton Raphson

Lecture 2: Power System Analysis 2021-Now

With Prof. Gabriela Hug, 32 hours, Autumn Semester

· As the teaching assistant, I design and teach 7 exercise lectures:

i. Unbalanced Load Flow Computations I

ii. Unbalanced Load Flow Computations II

iii. Unbalanced Load Flow Computations III & Synchronous Machine I

iv. Synchronous Machine II

v. Power Swings I

vi. Power Swings II

vii. Voltage Stability

SUPERVISING

Master Students 2019-Now

· I am supervising or supervised 4 master students

- **Wen Yi Chan**, Manual development for Daline®: data-driven power flow linearization tools for power systems research and education, **Research Assistant**, ETH Zürich, 2023
- **Deniz Tepe**, Privacy-preserving Distributed Framework for Load Pattern Recognition, **Master thesis**, ETH Zürich & Technical University of Munich, 2023
- **Jacopo Saracco**, Stochastic risk assessment of power grids via cascading failure simulations, **Master thesis**, ETH Zürich, 2022
- **Aoife Henry**, Online Electric Load Pattern Recognition, **Master thesis**, ETH Zürich, 2019
- **Wen Yi Chan**, Numerical evaluation of data-driven power flow linearisation methods, **Semester thesis**, ETH Zürich, 2023

Bachelor Students 2021-Now

· I am supervising or supervised 3 bachelor students

- **Aline Scherrer**, Linearization of AC Models in the context of Remedial Action Optimization, **Bachelor thesis**, ETH Zürich, 2023
- **Grace Lynch**, The burden of proof: a comprehensive review of the feasibility of 100% renewable-electricity systems, **Projects & Seminars thesis**, ETH Zürich, 2023
- **Miriam Ensslin**, Understanding and comparing Demand Response models, **Projects & Seminars thesis**, ETH Zürich, 2021

SELECTED HONORS AND AWARDS

- **First Prize of High-influence Papers**,
  Awarded by Chinese Society for Electrical Engineering, High Voltage Committee — April 2023
- **Springer Thesis Award**,
  Awarded by Springer — April 2022
- **Tsinghua Outstanding Ph.D. Graduate (only 2 winners in the department)**,
  Awarded by Tsinghua University — June 2021
- **Tsinghua Outstanding Ph.D. Thesis (only 6 winners in the department)**,
  Awarded by Tsinghua University — June 2021
- **Beijing Outstanding Ph.D. Graduate (only 6 winners in the department)**,
  Awarded by Beijing Ministry of Education — June 2021
- **First Prize Scholarship**,
  Awarded by Tsinghua University — November 2020
- **Excellent Administrative Assistant**,
  Awarded by Tsinghua University — December 2018
- **Excellent Student Leader**,
  Awarded by Tsinghua University — October 2017
- **Outstanding Graduates of Hebei Province, China**,
  Awarded by Hebei Ministry of Education, China — March 2016
- **Principal Scholarship (highest honor, only 10 winners in the university, undergrad + grad)**,
  Awarded by North China Electric Power University — December 2015

- **National Scholarship**,
  Awarded by the Chinese Ministry of Education — November 2015
- **UHV Power Grid Scholarship**,
  Awarded by UHV Scholarship Fund — October 2015
- **Meritorious Winner**,
  Awarded by the Consortium for Mathematics and Its Application, the U.S. — June 2015
- **National Scholarship**,
  Awarded by the Chinese Ministry of Education — November 2014
- **National Scholarship**,
  Awarded by the Chinese Ministry of Education — November 2013

GRANTS AS PRINCIPAL PARTICIPANT

NCCR Automation — 2023 - Now
Granted by Swiss National Science Foundation

· Investigate AI-powered pathfinders for fundamental challenges in power systems
· Develop an AI-powered open-source toolbox that supports more than 50 linearizaion methods

An interconnected energy systems modeling platform: Nexus-e — 2021 - 2023
Granted by Swiss Federal Office of Energy

· Propose data-driven power flow linearization methods for transmission and distribution grids
· Develop a stochastic risk assessment method for power grids via cascading failure simulations

Power grid planning method considering large scale offshore wind power integration — 2021 - 2021
Granted by State Grid Corporation of China

· Propose a control-aware probabilistic load flow algorithm given large scale offshore wind power
· Design a capacity evaluation method for power grids with offshore wind power

Autonomous control and operation of distributed generation clusters — 2018 - 2021
Granted by National Natural Science Foundation of China

· Propose two distributed probability modelling algorithms for distributed energy resources
· Propose a distributed computing method for probabilistic load flow
· Propose a distributed solution framework for chance-constrained OPF

Gaussian mixture model for uncertainty of distributed energy system — 2018 - 2018
Granted by Siemens AG

· Develop a data-driven fault-screening technique for PV panels
· Develop a Gaussian-mixture-model-based toolbox for PV fault diagnosis

Voltage stability and dynamic reactive power compensation optimization — 2016 – 2017
Granted by State Grid Corporation of China

· Implement small signal stability analysis for distribution grids
· Recognize weak zones in terms of voltage stability
· Identify optimal locations for reactive power compensations

Structure evolution mechanism of future transmission network 2014 – 2016

Granted by State Grid Corporation of China

- Design evaluation indicators for transmission network planning based on complex network theory
- Develop an evolution model for future transmission network

RESEARCH INTEREST

Smarter Gird, AI4Science, Data-driven Modeling, Probabilistic Analysis, Stochastic Optimization, Distributed Computing, Privacy Preservation

REFERENCES

R1. Prof. Gabriela Hug, Power Systems Laboratory (PSL), Department of Information Technology & Electrical Engineering, ETH Zürich. Email: hug@eeh.ee.ethz.ch

R2. Prof. Chen Shen, Digital Power System Laboratory (DPSL), Department of Electrical Engineering, Tsinghua University. Email: shenchen@mail.tsinghua.edu.cn

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