Zhekai Li

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EDUCATION

- **Shanghai Jiao Tong University (SJTU)** — Shanghai, China
  Master of Engineering in Electrical Engineering — *Sept. 2022 - Jan. 2025* (expected)
  - *GPA: 3.94/4.0 (2/114)*
  - *Core Courses: Nonlinear Control Theory and Application (A+), Numerical Analysis (A), Power System Steady-state Analysis/Optimal Power Flow and Convex Optimization (A-)*
  - *Advisor: Prof. Ruihao Zhu from Cornell SC Johnson College of Business*
    Prof. Hua Cheng from Antai College of Economics Management at SJTU

- **Huazhong University of Science and Technology (HUST)** — Wuhan, China
  Bachelor of Engineering in Electrical Engineering — *Sept. 2018 - June. 2022*
  - *GPA: 3.94/4.0 (Top 1%)*
  - *Core Courses: Mathematical Analysis I/II (97), Probability Theory and Statistics (97), Mathematical Physics Equation (99), Complex Function (94), Introduction to Management (98), Principles of Economics (92)*

RESEARCH FIELD

- Multi-armed Bandits (MABs) and online learning, with a particular focus on their integration into various healthcare challenges

- Renewable Energy, MMC-based HVDC System with Wind Farm Integration, Grid Forming (GFM) Converter

PUBLICATIONS AND PATENTS

- **Publications**
  - **Z. Li**, K. Han, X. Cai, R. Yang, H. Yu, P. Xia, L. Liu, "Frequency-Reactive Power Optimization Strategy of Grid-forming Offshore Wind Farm Using DRU-HVDC Transmission." Accepted by the 2023 IEEE Conference on Energy Internet and Energy System Integration (EI^2). [Paper]
  - **Z. Li**, L. Liang, R. Yang, and X. Cai, "The Virtual Admittance Control of Sending End Converter for Offshore Wind Farm Integration," in 2023 IEEE 14th International Symposium on Power Electronics for Distributed Generation Systems (PEDG), Jun. 2023, pp. 133–136. doi: 10.1109/PEDG56097.2023.10215304. [Paper]
  - X. Sun, Z. Liu, **Z. Li**, Q. Sun, A. Li, and D. Jiang, "Three-phase Motor Drive Topology with the Fault-tolerant Capability of Open-circuit on the Multiplexing Bridge," in 2021 IEEE Energy Conversion Congress and Exposition (ECCE), Oct. 2021, pp. 5043–5047. doi: 10.1109/ECCE47101.2021.9595370. [Paper]
  - **Z. Li**, H. Yu, Z. Fang, X. Cai, R. Yang, "Research on Commutation Mechanism and Harmonic Suppression of Offshore Wind Farm Integration With DRU-VSC Hybrid Transmission System." Proceedings of the CSEE, submitted.

- **Issued Patents**
  - X. Sun, Z. Wang, **Z. Li**, et al. A Multi-Rotor UAV and Its Power System With Fault-Tolerant Capability[P]. Hubei Province: CN214799254U, 2021-11-19.
  - X. Sun, Z. Wang, **Z. Li**, et al. Topology and Modulation Method of Six-Phase Seven-Bridge Arm Series Winding Circuit with Reverse Winding[P]. Hubei Province: CN113078839A, 2021-07-06.
  - X. Sun, Z. Wang, **Z. Li**, et al. Phase Sequence and Modulation of Series Multiphase Winding With Minimum Current Stress of Bridge Arm[P]. Hubei Province: CN112910144B, 2022-02-15.

ACADEMIC PROJECTS

- **Pure Exploration in Linear Bandit for Drug Discovery.** — Shanghai, China
  Advised by Professor Ruihao Zhu and Professor Cheng Hua — *Oct. 2023 - Present*
  - Concentrating on AI-Drug Discovery, expanded the All-ε Identification Problem, a fundamental pure exploration challenge, from the stochastic bandit framework to a linear setting. For the first time, establish the lower bound for the All-ε task with this linear context.
  - Based on the setting mentioned above, introduced two innovative algorithms for the linear bandit in the framework of experiment design and provided theoretical guarantees for their upper bounds.

- Conducted experiment study using Python, implemented both classic Gaussian Process-based algorithms with a Knowledge Gradient acquisition function and newly proposed experiment design algorithms.
- Working in progress.

- **Key Technologies of Combined Offshore Wind Power Generation With Directly Coupled VSC-HVDC and Energy Storage - Contemporary Amperex Technology Co., Ltd.** Shanghai, China
  Advised by Professor Xu Cai of SJTU *Apr. 2022 - July 2023*
  - Modeled and simulated the VSC-HVDC transmission system for offshore wind power using PSCAD/EMTDC and MATLAB/Simulink. Established the offline simulation model library.
  - Conducted state-space modeling, parameter design, and small-signal stability analysis. The analysis demonstrated that the system could maintain a good dynamic response without instability under the value of 0.3 p.u. for virtual reactance and 0.1 p.u. for virtual resistance.
  - To address the issue of requiring significant resources and computational time for the simulation, developed a second-order MMC fast simulation model with energy storage interface using Fortran based on PSCAD.
  - Conducted hardware-in-the-loop (HIL) experiment on the RT-Lab platform to test the voltage and current stress of the system, effectively assisting the enterprise in relevant system design.

- **A High-Reliability Unmanned Aerial Vehicle (UAV) Power System with Fault-Tolerant Capability - "Challenge Cup" Extracurricular Academic Science and Technology Contest** Wuhan, China
  Advised by Professor Dong Jiang of HUST *Oct. 2020 - Nov. 2021*
  - Developed a motor drive topology based on the series winding structure and the matched fault-tolerant algorithm for optimization. The constructed topology and algorithm increased the power density by more than 50%, and the five-phase motor was tested to operate stably even when two phases were lost.
  - Designed, modeled, and version iterated the motor base, the electronic speed controller (ESC) mounting fixture, and the motor test stand using SOLIDWORKS, to customize the design of batteries, the ESC, and the electronic control unit (ECU) for the UAV power system.

- **A Power-Signal Wireless Transmission Device for CT Equipment - "Challenge Cup" Extracurricular Academic Science and Technology Contest** Wuhan, China
  Advised by Professor Dong Jiang of HUST *Mar. 2020 - Sept. 2020*
  - Designed a power-signal wireless transmission system for CT equipment to achieve efficient wireless transmission of both signal and power, considering the magnetic circuit structure and the DSP-based high-frequency inverter.
  - Accomplished the circuit design of the signal modulation and demodulation unit based on the carrier modulation to achieve synchronous transmission of medical information.
  - Simulated the wireless transmission device using Ansoft Maxwell and JMAG. The impact of air gap size on the device's electromagnetic performance was studied, and the parameters were optimized. The effect of the parameter optimization was evaluated by the previously-built simulation model.

- **Overhead Transmission Line Vibration Monitoring and Self-Powering Integrated System - College Students' Innovative Entrepreneurial Training Program** Wuhan, China
  Advised by Professor Han Peng of HUST *Dec. 2019 - Apr. 2020*
  - Proposed an integrated system for the monitoring and the self-powering of overhead transmission lines.
  - Designed and modeled the vibration monitoring and vibration energy harvesting device using SOLIDWORKS. Completed the structural modeling and assembly design of multiple components.
  - Performed electromagnetic simulation during device operation and the multiphysics simulation considering the coupling between electromagnetic characteristics and mechanical motion using Ansoft Maxwell and COMSOL.
  - Set up the experimental platform, verified the collection of vibration energy and monitored the vibration state of the overhead transmission line.

COMPETITION

- **Operation Data Analysis and Equivalent Modeling of High-speed rail traction power supply system - The Electrician Mathematical Contest in Modeling**   Wuhan, China
  Team Leader   *May. 2021*
  - Conducted spectral analysis on a substantial amount of measured three-phase voltage and current data from a traction substation. Analyzed the impact of the substation on the power grid during the entire period.
  - Designed two regeneration braking energy schemes and built system simulation models in MATLAB/Simulink. Conducted detailed modeling and quantitative analysis of the two schemes from economics, safety, and energy storage utilization. Calculated the system cost and full life cycle benefits of each scheme.
  - Used a sliding window-based load detection algorithm to extract and analyze characteristics of dynamic traction load waveforms based on time series. Established a dynamic traction load database using linear regression for prediction.

- **Post-Disaster Response to Australian Wildfires Based on Drone Monitoring and Situational Awareness - MCM/ICM**   Wuhan, China
  Team Leader   *Feb. 2021*
  - Built an economic model and a safety function to establish the comprehensive evaluation index. Employed Monte Carlo analysis to conduct 150,000 random fire experiments and the optimal drone procurement plan was obtained.
  - Utilized the grey prediction model to analyze the correlation between fire conditions and various factors. Predicted future fire conditions using historical data, showing that the established model had outstanding adaptability.
  - Established a grid model based on cellular automata. Proposed a relay drone cruising strategy based on the grid model to reduce the number of required drones, and introduced a credibility index to measure the time lag of information.

SKILLS

- **Language:** Mandarin (native speaker), English (fluent, TOEFL: 97)

- **Programming:** C++, Python, Fortran, LaTeX, Markdown, HTML

- **Modeling and Simulation:** MATLAB/Simulink, PSCAD, Multisim, PSIM, Ansoft Maxwell, JMAG, COMSOL, SOLIDWORKS, AutoCAD, Inventor

- **Software Development:** CCS, Keil, Altium Designer, GitHub, Personal Web Development

- **Others:** Photoshop (PS), Premiere (PR), MS Office Suite

- **Certificates:** National Computer Rank Examination Level 2: C++ Language Programming, National Computer Rank Examination Level 4: Network Engineer

AWARDS

- **Scholarships and Honors**
  - National Scholarship (Top 0.2% highest scholarship from Ministry of Education of China)   *2019* & 2021
  - NR Electric Co., Ltd. Scholarship (Top 1%)   *2021*
  - Tellhow Sci-tech Co., Ltd. Scholarship (Top 1%)   *2020*
  - Outstanding Academic Performance Award (Top 1%)   *2019*

- **Competitions**
  - First Prize in the 17th "Challenge Cup" National College Students' Extracurricular Academic Science
    and Technology Competition (the most valuable college competition in China)   *2021*
  - First Prize in the Electrician Mathematical Contest in Modeling (Top 3%)   *2021*
  - Honorable Mention in MCM/ICM   *2021*
  - Second Prize in National Mathematics Competition for College Students   *2019*

EXTRACURRICULAR EXPERIENCE

- Volleyball (HUST men's volleyball team), Soccer (qualification of athletes for the national level), Badminton (7 years of professional training), Go (third place in the national competition, first dan), Fitness and Ultimate Frisbee (amateur interest)

- Conducted field research on new energy generation in Gansu province through government and corporate site visits, serving as the team leader for the project