

## EDUCATION

- **Shanghai Jiao Tong University** Shanghai, China  
• **Master of Engineering in Electrical Engineering** Sept 2022 - Jan 2025 (expected)
  - **GPA: 4.0/4.0**
  - **Core Courses:** Numerical Analysis (A), Nonlinear Control Theory and Application (A+), Power System Steady-state Analysis/Optimal Power Flow and Convex Optimization (in study)
- **Huazhong University of Science and Technology** Wuhan, China  
• **Bachelor of Engineering in Electrical Engineering** Sept 2018 - June 2022
  - **GPA: 3.94/4.0 (Top 1%)**
  - **Core Courses:** Mathematical Analysis I (92), Mathematical Analysis II (97), Linear Algebra (83), Probability Theory and Statistics (97), Mathematical Physics Equation (99), Complex Function and Integral Transform (94), Fundamentals of Computer Programming (89), Introduction to Management (98), Principles of Economics (92)

## RESEARCH FIELD

- MMC-based HVDC System with Wind Farm Integration, Grid Forming (GFM) Converter, VSC-HVDC Based Segmented System with Large Capacity Renewable Energy Integration

## PUBLICATIONS AND PATENTS

- **Publications**
  - **Z. Li**, L. Liang, R. Yang, X. Cai, "The Virtual Admittance Control of Sending End Converter for Offshore Wind Farm Integration." Accepted by the 2023 IEEE Power Electronics for Distributed Generation Systems (PEDG).
  - 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.
  - **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.
  - **Z. Li**, R. Yang, X. Cai, "Research on Virtual Admittance Control Strategy for Sending End Converter in VSC-HVDC system with Offshore Wind Farm Integration." Electric Power, 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

- **Delta Electronics Project: Research on Transient Frequency Support of Wind Farm and Multi-Terminal Flexible DC system** Shanghai, China  
Major Principal; Advisor: Professor Xu Cai of Shanghai Jiao Tong University Apr 2023 - Current
  - To address the outer loop coupling problem and the feedforward deficiency arising from the absence of the AC filter capacitor in traditional dual closed-loop control, the optimized control strategy based on the virtual admittance principle was proposed to resolve the control instability problem and achieve the adaptive current limitation.
  - Conducted state-space modeling of the system, completed parameter design and small-signal stability analysis. The analysis showed 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.

- Published a paper as the first author at the international conference PEDG (Power Electronics for Distributed Generation Systems).

- **CATL Project: Key Technologies of Combined Offshore Wind Power Generation With Directly Coupled VSC-HVDC and Energy Storage** Shanghai, China

*Major Principal; Advisor: Professor Xu Cai of Shanghai Jiao Tong University*

*Apr 2022 - Current*

- Modeled and simulated the VSC-HVDC transmission system for offshore wind power using PSCAD/EMTDC and MATLAB/Simulink. Established the offline simulation model library.
- To solve the problem of large-scale power system simulation requiring significant computer resources and running time, using Fortran and scripting language, based on PSCAD, innovatively designed and established a custom second-order MMC fast simulation model with energy storage interface.

- **China Electric Power Research Institute Project: Research and Application of Key Technologies in the Hybrid Converter for the Offshore Wind Power Grid Connection** Shanghai, China

*Major Principal; Advisor: Professor Xu Cai of Shanghai Jiao Tong University*

*Oct 2022 - Apr 2023*

- Studied the topology and operating mechanism of the DRU-HVDC-based offshore wind power hybrid delivery system.
- Conducted hardware-in-the-loop (HIL) experiment on the RT-Lab platform to test the voltage and current stress of the system, which effectively assisted the enterprise in relevant system design.
- Conducted harmonic analysis on the DRU-HVDC-based offshore wind power hybrid delivery system. To solve the voltage harmonic phenomenon in simulation and engineering practice, a universal model based on the assumption of AC current source for uncontrolled rectifier mechanism analysis was proposed for the first time, and the corresponding harmonic voltage suppression strategy was proposed.
- Authored and submitted a paper as the first author to Proceedings of the CSEE.

- **“Challenge Cup” Project: A High-Reliability Unmanned Aerial Vehicle (UAV) Power System with Fault-Tolerant Capability** Wuhan, China

*Third in Charge; Advisor: Professor Dong Jiang of HUST*

*Oct 2020 - Nov 2021*

- To achieve comprehensive optimization of the UAV power system, the customized high-voltage lithium battery, the motor drive topology based on series winding structure, and the matched optimization fault-tolerant algorithm were adopted. The constructed topology increased the power density by more than 50%, and the five-phase motor was tested to operate stably even when two phases were lost.
- To customize the design of batteries, the electronic speed controllers (ESC), and the electronic control unit (ECU) for the UAV power system, independent design, modeling, and version iteration of the motor base, the ESC mounting fixture, and the motor test stand, were completed by SOLIDWORKS.
- Published the international conference paper at ECCE (Energy Conversion Congress and Exposition) as the third author and obtained three authorized patents as the main inventor.

- **“Challenge Cup” Project: A Power-Signal Wireless Transmission Device for CT Equipment** Wuhan, China

*Second in Charge; Advisor: Professor Dong Jiang of HUST*

*Mar 2020 - Sept 2020*

- To achieve efficient wireless transmission of both signal and power, considering the magnetic circuit structure and the DSP-based high-frequency inverter, a power-signal wireless transmission system for CT equipment was designed.
- To meet the performance indicators, the wireless power transmission topology was selected. The simulation analysis of the resonant compensation circuits for both the double LCC and the LCL-S type ICPT systems was completed.
- To achieve synchronous transmission of medical information, i.e., simultaneous transmission of power and signal, the circuit design of the signal modulation and demodulation unit based on the carrier modulation was accomplished.
- The wireless transmission device was simulated using electromagnetic simulation software such as 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.

- **Undergraduate Innovation and Entrepreneurship Training Program: Overhead Transmission Line Vibration Monitoring and Self-Powering Integrated System** Wuhan, China

*Major Principal; Advisor: Professor Han Peng of HUST*

*Dec 2019 - Apr 2020*

- Proposed an integrated system for the monitoring and the self-powering of overhead transmission lines, aimed at addressing the limitations of the current power supply solutions of the monitoring system for transmission lines.

- Designed and modeled the vibration monitoring and vibration energy harvesting device using SOLIDWORKS. Independently completed the structural modeling and assembly design of multiple components.
- Performed simulation of the designed mechanical device using ANSYS Maxwell and COMSOL, including the electromagnetic simulation during device operation and the multiphysics simulation considering the coupling characteristics between electromagnetic and mechanical motion.
- Responsible for the machining and assembly of the mechanical device, setting up the experimental platform, collecting vibration energy, monitoring the vibration state of the overhead transmission line, and completing experimental verification of the vibration energy collection. Authored two patents as the primary inventor.

## COMPETITION PROJECTS

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### • **National University Students Electrical Math Modeling Competition: Operation Data Analysis and Equivalent Modeling of High-speed rail traction power supply system**

Wuhan, China

May 2021

*Team Leader*

- Conducted spectral analysis on a substantial amount of measured three-phase voltage and current data from a traction substation to evaluate the three-phase imbalance of voltage and current. 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, technical characteristics, 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.
- To improve the accuracy of the model, high-order mathematical models for the power grid, power electronic converters, and dynamic train loads were established to better approximate actual conditions.

### • **MCM/ICM: Post-Disaster Response to Australian Wildfires Based on Drone Monitoring and Situational Awareness**

Wuhan, China

Feb 2021

*Team Leader*

- To address the post-disaster response to forest fires, an economic model was established and a safety function was set to establish the comprehensive evaluation index. By considering historical fire characteristics, and using Monte Carlo analysis to conduct 150,000 random fire experiments, the optimal drone procurement plan was obtained.
- To evaluate the adaptability of the established model, the grey prediction model was used to analyze the correlation between fire conditions and various factors such as light, rainfall, and temperature. Historical data from the past 10 years was used to predict future fire conditions. The results showed that the established model has good adaptability.
- To describe the impact of actual terrain on the position of relay drones, a network grid model based on cellular automata was established. Based on the grid model, a relay drone cruising strategy was proposed to reduce the number of required drones, and a credibility index was introduced to measure the time lag of grid information.

## BASIC SKILLS

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- **Language:** Mandarin (native speaker), English (fluent, CET-6: 577)
- **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
- **Certificate:** the National Computer Level-2 C++ Language Programming Examination, the National Computer Level-3 Network Technology Engineer Examination, the National Computer Level-4 Network Engineer Examination

## AWARDS

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- **Scholarships and Honors**

- National Scholarship (Top 0.2% highest scholarship from Ministry of Education of China) *2019 & 2021*
- First Prize Scholarship (Top 1%) *2021*
- First Prize Scholarship (Top 1%) *2020*
- Outstanding Undergraduates in Term of Academic Performance (Top 1%) *2019*
- Merit Student of HUST (Top 10%) *2019*
- Outstanding Individual in Social Practice Activities (Top 5%) *2019*

- **Competitions**

- First Prize in “Challenge Cup” National Competition (the most valuable college competition in China) *2021*
- First Prize in Electrical Cup Mathematical Modeling Competition (Top 3%) *2021*
- Honorable Mention in MCM/ICM *2021*
- Second Prize in National Mathematics Competition for College Students *2019*

## EXTRACURRICULAR EXPERIENCE

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