Zhekai Li

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EDUCATION

- **Shanghai Jiao Tong University (SJTU)** — Shanghai, China
  M.S. 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-)*

- **Huazhong University of Science and Technology (HUST)** — Wuhan, China
  B.S. 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

WORKING PAPER

- **Exploring Drug Candidates: All ε-Best Arms Identification in Linear Bandits** — *Oct. 2023 - Present*
  Advised by Ruihao Zhu and Cheng Hua

  - **Finalist (1/4), 2024 INFORMS Conference on Quality, Statistics, and Reliability (ICQSR) Best Paper Competition**

  - **Abstract:** Motivated by the need to successfully identify multiple candidates that can potentially enhance outcomes in complex and high trial-and-error cost tasks such as drug discovery, we propose a nearly optimal adaptive allocation policy to identify all ε-best arms (i.e., at most ε worse compared to the optimum). Specifically, we introduce LinFACTE, an algorithm designed to optimize the identification of all ε-best arms in linear bandits. We introduce, for the first time, a novel information-theoretic lower bound on the sample complexity of this problem, providing a significant advancement in understanding the budgetary challenges involved. Additionally, we demonstrate that our algorithm achieves instance optimality, matching this lower bound up to logarithmic factors. We also develop extended upper bounds for our algorithm when allowing misspecification of the model and provides results in generalized linear models. Numerical results demonstrate the practical advantages of LinFACTE compared to baseline methods, highlighting its ability to accelerate early-stage exploratory experiments in different real applications.

PUBLICATIONS

- **Z. Li**, R. Yang, Z. Fang, H. Yu, X. Cai, "Research on Commutation Mechanism and Harmonic Suppression of Offshore Wind Farm Integration With DRU-VSC Hybrid Transmission System," Proceedings of the CSEE, pp. 1–16, doi: 10.13334/j.0258-8013.pcsee.240697. (*Ranked first in power and energy engineering journals, and second in citations among all Chinese journals*) [Paper][Link]
  - Established simplified and detailed models of the parallel hybrid converter system.
  - Comprehensively studied the switching dynamics and commutation of the system.
  - Proposed parameter design guidance and harmonic voltage suppression strategy for offshore wind power systems with parallel hybrid converters.

- **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][Link]
  - Proposed an optimized control strategy to address the absence of the AC filter capacitor in traditional dual closed-loop control, resolved the control instability problem, and achieved the adaptive current limitation.

- ○ Conducted state-space modeling and small-signal stability analysis, demonstrated the good dynamic response of the system.

- **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][Link]
  - ○ Developed an MMC fast simulation model with the energy storage interface to reduce resource and time requirements.
  - ○ Conducted hardware-in-the-loop (HIL) on the RT-Lab platform to evaluate system voltage and current stress.

- 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][Link]
  - ○ Developed a motor drive topology based on the series winding structure and the matched fault-tolerant algorithm for optimization, increased the power density by more than 50%.
  - ○ Designed, modeled, and version iterated the motor base, the electronic speed controller (ESC) mounting fixture, and the motor test stand for the UAV power system using SOLIDWORKS.

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.

Other Research Experience (Selected)

- **Research Assistant for Meng Li (C.T. Bauer Chair of AI at C.T. Bauer College of Business, University of Houston)** *June. 2023 - Aug. 2023*
  - ○ Assisted in writing the response letter of the paper (Reject and Resubmit from *Management Science*) regarding the field experiment of patient no-shows at the hospital; also designed the associated laboratory experiment.
  - ○ Literature review of Human-Centered Artificial Intelligence (HCAI).

- **Operation Data Analysis and Equivalent Modeling of High-speed rail traction power supply system - The Electrician Mathematical Contest in Modeling** *May. 2021*
  - ○ Conducted spectral analysis on measured three-phase voltage and current data from a traction substation.
  - ○ Designed two regeneration braking energy schemes and built system simulation models in MATLAB/Simulink. Conducted modeling and quantitative analysis of schemes from economics, safety, and energy storage utilization.
  - ○ Used a sliding window-based load detection algorithm to analyze characteristics of dynamic traction load waveforms.

- **Post-Disaster Response to Australian Wildfires Based on Drone Monitoring and Situational Awareness - MCM/ICM** *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.
  - ○ 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.

- **Overhead Transmission Line Vibration Monitoring and Self-Powering Integrated System - College Students' Innovative Entrepreneurial Training Program** *Dec. 2019 - Apr. 2020*
  - ○ Proposed an integrated system scheme for monitoring and self-powering the overhead transmission lines.
  - ○ Designed and modeled the vibration energy harvesting device using SOLIDWORKS.
  - ○ Performed electromagnetic and multiphysics simulations using Ansoft Maxwell and COMSOL.

Academic Service

- Assisted in Peer Review Process for POMS

- Reviewer for *2023 IEEE Conference on Energy Internet and Energy System Integration*

Awards

- **Scholarships and Honors**
  - Wen-Yuan Pan Scholarship (Top 1%; $1200)   *2023*
  - National Scholarship (Top 0.2% highest scholarship from Ministry of Education of China; $1500)   *2019* & 2021
  - NR Electric Co., Ltd. Scholarship (Top 1%; $1200)   *2021*
  - Tellhow Sci-tech Co., Ltd. Scholarship (Top 1%; $1500)   *2020*
  - Outstanding Academic Performance Award (Top 1%)   *2019*

- **Competitions**
  - Finalist for the Best Paper Competition at 2024 ICQSR Conference   *2024*
  - 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*

Skills

- **Language:** Mandarin (native), English (fluent, GRE: 331, TOEFL: 96)

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

- **Modeling and Simulation:** 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

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), Ultimate Frisbee (SJTU's professional sports team), Fitness

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