KUAN YANG

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EDUCATION

Cuiying Honors College[1] & School of Mathematics and Statistics, Lanzhou University **2017/09 - 2021/06**

- Combined modules in Pure and Applied Mathematics: Mathematical Analysis (92), Advanced Algebra (90), Theory of Probability (91), C++ Programming (91), Operational Research (A+), Abstract Algebra (95), Numerical Analysis (96), Graph Theory (95), Stochastic Process (91), Fundamentals of Topology (Algebraic Topology, 93)
- Selected as candidate of China's Top - Notch Undergraduate Training Program
- Strong quantitative background and good handling of mathematical courses (Average: 91.34, Rank: 3 / 184(Overall), 1 / 184 (Penultimate year)) highlighting flexible cross-disciplinary application

School of Mathematics, University of Leeds **2019/09 - 2020/02**

- Study Abroad Program for Outstanding Undergraduate by China Scholarship Council, nominated as one of only two candidates by home university, sponsored by Ministry of Education
- 85 UK Credits of Modules in Level 2 - 3 in Various Mathematical Aspects: Metric and Function Spaces (98), Statistical Methods (98), Analytic Solutions of Partial Differential Equations (92), Computational Mathematics (91)
- General taste of education system in UK, an average of 90.34 under high workload

Massive Open Online Course

- **Introductory Lectures on Economics, Prof. Zhaofeng Xue, Peking University** **2017.6-2017.9**
  Gathering fundamental principles and theories on finance and economics, enrich background for cross-disciplinary and flexible application of Mathematics
- **Coding with C Programming Language, Prof. Kai Weng, Zhejiang University** **2018.2-2018.4**
  Improve and lay a solid basis for computer programming, obtaining introductory skills on algorithm

RESEARCH PROJECT

Study on Resistive Switching Behavior of ZnO RRAM by Numerical Simulation **Tutor: Dr. Ying-tao LI and Prof. Jing QI**

Lab of Prof. Deyan He, School of Physcial Science and Technology, Lanzhou University *Sept. 2018 to present*

- First professional and long-term experience on the cross-disciplinary application for mathematics, by practical utilization of learned courses including **Stochastic Process, C/C++ Programming Language, Mathematical Analysis**
- With the intention to convey explanation for the conduction mechanism and anatomy of resistive switching process, based on which we propose optimization for industrial mass production purpose
- Innovate the models, by utilizing Markov Chain and Markov Random Field (**MRF**), to simulate the dynamic formation and rupture of conductive filament in RRAM, which contributes to the resistive switching behavior, with C/C++ and MATLAB
- In-Depth Analysis, combined with experiments, on the various morphology of conductive filament and the related difference in electrical performance
- Reasoning the phenomena occurred in experiments and explore the factors which causes change on morphology of conductive filament, including materials, initial state and applied bias
- Win 2 highly competitive sponsorship
- 7 Publications, Presentations and Working Papers, details in Papers & Presentations
- Seek financial sponsor and performance test facility for the team voluntarily

Introductory Study on Spectral Theory **Tutor: Prof. Alexander STROHMAIER**

School of Mathematics, University of Leeds *Jul. 2020 to present*

- First experience of studying advanced pure mathematics in a straightforward way
- Aim to learn pure mathematics together with numerical analysis, focus on eigenvalues and the Dirichlet to Neumann map, will obtain new techniques including Calderon projectors, Dirichlet to Neumann map, some elements of pseudodifferential operators and a bit of intuition about the meaning of eigenfunctions.
- Read Partial Differential Equations I by Michael Taylor before the project, Spectral Theory and Differential Operators by Brian Davies along with some course notes at the start.
- Working on calculation of spectra and eigenfunctions, learned the impact of domain, boundary condition on eigenvalue and eigenfunction by numerical experiments through Freefem++
- Will try to expand the work to more types of Differential Equations

Innovative Research on Evidence-Based Economics **Tutor: Prof. Lili WEI**

Institute of Green Finance, Lanzhou University *2018.2 - 2018.10*

- Intend to analyze the core factors for poverty and the fundamental five alleviation method applied by government by Evidence-Based tools, try to undergo data analysis highly demanding for quantitative background
- Correlation analysis and visualization of importance for certain keywords through massive literature review and Graph Theory
- Independently writing codes by C++ to arrange and format literature for the whole research team

[1] Cuiying Honors College was founded in August 2010 within Lanzhou University as part of China's Top-Notch Undergraduate Training Program. The Ministry of Education and the Ministry of Finance have invested in this pilot plan in order to foster future scientists with exceptional talent in fundamental disciplines. Every year, this National program admits only the best 1,000 students among the 6 million new undergraduates across China. Details: http://chc.lzu.edu.cn

Analysis on the Stability and Spatial Evolution of Boxed Pigs **Tutor: Prof. Ruiwu WANG**

Research Center for Ecology and Environmental Sciences, Northwestern Polytechnical University *2018.8 - 2019.2*

- Game Theory research by cooperative team work, aim at proposing general methodology to maximize income by classical model and bring to more complicated practicality of daily life
- Add different weights of power for pigs compared with basic models, and calculate the estimated income under various circumstance
- Figure out the stable solutions for replicator equations and the results for spatial evolution, this work will be submitted to Physical Review E as 3rd author.

CONFERENCE ATTENDANCE

- Analysis on the resistive switching behavior and the morphology of conductive filament of RRAM by Markov Random Field simulation, 22nd. Chun - Tsung Scholar Annual Conference, **Plenary Talk**, Nov. 2020, Shanghai, China
  The only one Chun-Tsung Scholar from Lanzhou University to report the progress of the ZnO RRAM project
- 11th. Representative Congress and 15th. Symposium of Operations Research Society of China, Oct. 2020, Hefei, China
- A comprehensive stochastic modeling for the effect of Cu ions and Oxygen Vacancies in Cu/ZnO/Pt RRAM, CIMTEC Congress 2021, IEEECSC, **Oral Presentation**, Jun. 2021, Montecatini Terme, Italy

JOURNAL PAPERS

- Anatomy of Unidirectional Volatile Switching Behavior in SiO_2/TiO_2 -Based Select Ion Device, Yingtao LI, Hong WANG, Liping FU, **Kuan YANG**, Zewei WU, Xiaoqiang SONG, Lujie YIN, Sikai CHEN, Qingliang FENG, and Xiaoping GAO, submitted to Nanoscale (NR-ART-11-2020-008199)
  This work explains for unidirectional volatile behavior in multilayer device through experiments and theoretical analysis by simulation on the evolution of conductive filament
- The Conduction Mechanism Explanation Under Co-existence of Cu Atom and Oxygen Vacancy in Zinc Oxide Based RRAM By by Markov Random Field Simulatiom, Junjie HU, **Kuan YANG, (co-first)**, Junhao CHEN, Haiqing QI, Dongliang YANG, Qi WANG, Yingtao LI, Deyan HE and Jing QI, Applied Physics Letters (APL20-AR-07536), Under Revision
  This work incorporates the algorithm of Markov Random Field Model, which **hasn't been reported in Physics before, scales down the massive calculation, simplifies the coding** and explains the general conduction mechanism of conductive filament composed of both copper atoms and oxygen vacancy.
- Anatomy of Resistive switching Behavior in Titanium Oxide Based RRAM Device, **Kuan YANG**, Junhao CHEN, Ying-tao LI, IEEE Transaction on Electron Device (TED-2021-01-0037-R), Under Revision
  This work analyzes the impact of different initial states on the electrical performance and presents comprehensive statistics to support theories
- Analysis on the multi-level storage of Ag/ZnO/Ag nanowire by Markov Chain Model, **Kuan YANG**, Junjie HU, Junhao CHEN and Jing QI, in progress
  This work illustrates the schematics of the morphology of conductive filament under different applied bias, based on which we propose conduction mechanism and explain the multi-level stages in resistance
- Analysis on the Bubble Phenomena and Resistive Switching Mechanism in Alumina, Liping Fu, **Kuan YANG**, Junhao CHEN and Yingtao LI, in progress
  This work is inspired by the phenomena that the top electrode is broken and bubbles exist on the electrode after performance test, and simulation gives that the gathering of oxygen ions during applying bias leads to the bubbles

GRANTS, AWARDS AND SCHOLARSHIPS

- **China Top-Notch Undergraduate Training Program Funding** **by Ministry of Education**
  2% *RMB 150,000 = GBP 16,600*
- **Outstanding Undergraduate Study Abroad Scholarship** **by China Scholarship Council**
  2 of university *RMB 80,000 = GBP 9,000*
- **Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment**[2] **Top Research Grants in University**
  Ranked 1st among applicants, (1%) *RMB 15,000 = GBP 2,150*
- **National Scholarship** **by Ministry of Education**
  1 of grade *RMB 8,000 = GBP 900*
- **Contemporary Undergraduate Mathematical Contest in Modelling** **China Society for Industrial and Applied Mathematics**
  < 1%, Ranked 1st provincially for the selected problem *National Second Prize*
- **University of Leeds - CSC Scholarship** **by University of Leeds**
  < 1% *GBP 830*
- **Cuiying Foundation** **by Cuiying Honors College**
  Ranked top and received extended sponsorship *RMB 8,000 = GBP 900*
- **Top Student Award** **by Lanzhou University**
  Ranked 1st in the class (<10%)

INTERNSHIP

[2]This Endowment was donated to six universities including Lanzhou University, Peking University and Hsinchu Tsinghua University by the Nobel Prize Winner Dr. Tsung-Dao Lee, only 40 quota per year available for best students in research

Office Assistant for General Affairs **Cuiying Honors College, Lanzhou University**
Report to: Executive Dean, Prof. Deyan He and School Mgr. Ms. Yan Fang *Sept. 2018 - present*

- Independently raised donation from Quest on William to set up foundation, **accomplished first issue of AUD 1,000 donation.**
- Be first responsible for general business travel arrangement, successfully reach consensus and obtained lowest negotiated rate among same scale company with hotels including Marriott, IHG and Hilton, cut down 20% cost in Australia travelling by leading strategic cooperation with Quest on William
- Independently undertaking complete preparation and operation for two academic conference and reception work, cut down cost for conference but maintain the quality of the service, serve famous scholars including CAS fellow Prof. Yigong SHI
- Maintain smooth relationship with external professors as liaison, working as an agent to coordinate between the requirement from the school and the expectation from the students
- Drafting and polishing official speech and document

Mathematical Analysis for Sales, Marketing and Quality Control for Industries **Sept. 2017 - present**
Analysis for Sales and Marketing **MaxMara, with Delia Giangregorio (COO, China)**

- Apply SIR model, offer basic advice on grouping types of customers according to purchasing power from numerical based results
- Simulate the market response to price adjustment and discount by imposing different threshold in income scale of customers by Monte Carlo method
- Offer ideas and thinking in a customer's viewpoint

Analysis on the Warranty and After-Sales Problems **Tods, with Amanda Chen**

- Discuss the warranty service through survival analysis, treat the potential failure time of products as death of survival function and stopping time, offer suggestions of optimization in the covering time period for warranty to minimize the after-sales cost
- Methodology for balance between efficiency and precision on spotting quality flaw, by sampling method from Operational Research

Pricing Strategy for Leisure and Business Guests **Marriott Hotels Group**

- Setting two types of behavioural models of leisure and business to analyze the main concern during staying in hotel, based on which proposing directional offer and revision in loyalty program to stimulate consumption and attract targeted guest on the lowest cost
- Simulate the guest reaction to COVID-19 by Monte Carlo, where additional parameters including tolerance for cost are incorporated to reflect leisure-oriented and business-oriented types of travel

Voluntary Work **over 180 hours**
Local epidemic prevention **2020.2 - 2020.4**

- Statistical analysis on the figures and the growing tendency for epidemic spreading
- Coding work to produce a simple task assignment system to monitor high-risk traveller
- Put forward a faster positive testing strategy from Operational Research for COVID-19

Voluntary interpreter in Lanzhou Urban Planning Exhibition Museum **Once per Semester**

- Held the introductory introduction for overseas guests
- Learn the concerning factors for Urban Structuring and history of the city construction
- Obtain practical utilization of the Shortest Path Problem in the planning of roads

INTEGRATED SKILLS

- Coding: Proficient: C/C++, Linux/UNIX, LaTeX, Python, MATLAB; Intermediate: R, HTML, Markdown, Freefem++
- Language: Mandarin(Native), English(Fluent, IELTS:7.5 (R: 9.0, L: 8.5, S:6.5, W:6.5))
- : Violin, HPC operation
- GRE: (Q:169, V:154, W:3.5)

REFEREE

- **Professor Alexander Strohmaier** **Academic and Research**
  Chair in Analysis, University of Leeds *A.Strohmaier@leeds.ac.uk*
- **Professor Deyan He** **Academic, Research and Professional Skills**
  Associate Provost & Executive Dean of Cuiying Honors College, Lanzhou University *hedy@lzu.edu.cn*
- **Professor Jing Qi** **Academic, Research**
  Professor in Physics, Lanzhou University *qijing@lzu.edu.cn*
- **Dr. Adrian Barker** **Academic**
  Associate Professor in Applied Mathematics *A.J.Barker@leeds.ac.uk*
- **Dr. Yingtao Li** **Research**
  Associate Professor in Physics, Lanzhou University *li_yt06@lzu.edu.cn*
- **Dr. Luisa Cutillo** **Academic**
  Lecturer in Statistics, University of Leeds *L.Cutillo@leeds.ac.uk*