KUAN YANG

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EDUCATION

Cuiying Honors College & 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
- Average: 91.34, Rank: 3 / 184(Overall), 1 / 184 (Penultimate year)

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)
- Average: 90.34

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 **Lanzhou University**

Tutor: Dr. Ying-tao LI and Prof. Jing QI *Sept. 2018 to present*

- First professional and long-term experience on the cross-disciplinary application for mathematics
- 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 applying algorithm of 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, on 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 sponsorship from Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment and Cuiying Foundation
- 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 **University of Leeds**

Tutor: Prof. Alexander STROHMAIER *Jul. 2020 to present*

- Aimed 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 **Institute of Green Finance, Lanzhou University**

Tutor: Prof. Lili WEI *2018.2 - 2018.10*

- Introductory program for beginners in research
- 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 literatures for the whole research team

Analysis on the Stability and Spatial Evolution of Boxed Pigs **Research Center for Ecology and Environmental Sciences**

Tutor: Prof. Ruiwu WANG *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.

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 progess 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 $\mathrm{SiO_2/TiO_2}$ -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
  This work analyzes the different morphology of conductive filament composed of copper and silver
- 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, submitted to Applied Physics Letters, 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, submitted to IEEE Electron Device Letters
  This work analyzes the impact of different initial states on the electrical performance and presents comprehensive statistics to support our 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, based on which we propose conduction mechanism and explain the multi-level 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 analyzes that the gathering of oxygen ions during applying bias leads to the effect

GRANTS, AWARDS AND SCHOLARSHIPS

- **China Top-Notch Undergraduate Training Program Funding** — **2%, RMB 150,000 = GBP 16,600**
- **MOE Outstanding Undergraduate Study Abroad Scholarship** — **2 of university, RMB 80,000 = GBP 9,000**
- **Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment** — **Ranked 1st, (1%), RMB 15,000 = GBP 2,150**
  This Endowment was donated to six univerisites 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
- **National Scholarship** — **1 of grade, RMB 8,000 = GBP 900**
- **National Second Prize, Ranked 1st Provincially, 2020 Contemporary Undergraduate Mathematical Contest in Modelling** — **< 1%**
- **University of Leeds - CSC Scholarship** — **< 1%,GBP 830**
- **Cuiying Foundation** — **RMB 5,000 = USD 710**

SOCIAL RESPONSIBILITY & INTERNSHIP

Office Assistant — **Cuiying Honors College, Lanzhou University**

Report to: Executive Dean, Prof. Deyan He and School Mgr. Ms. Yan Fang — *Sept. 2018 - present*

- In charge of Education Foundation, Travel and Commodity, Foreign Affairs, Financial Affairs and General Management.
- 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; Skillful at travel cost management: Cut down 20% cost in Australia travelling by leading stragetic cooperation with Quest on William
- Cut down operations cost through statistical method; General audition on cost to avoid inappropriate expenditures by Operational Research method
- Undertaking complete preparation and operation for two academic conference and reception work, achieve feasible value and cost ratio, serve famous scholars including CAS fellow Prof. Yigong SHI
- Drafting and polishing official speech; Drafting official document

Mathematical Analysis for Sales, Marketing and Quality Control for Industries — **Sept. 2017 - present**

- For MaxMara, with Delia Giangregorio: Advice on grouping types of customers according to purchasing power by SIR model from ODE
- For Tods, with Amanda Chen, Methodology to achieve balance between efficiency and precision on spotting quality flaw, by sampling method from Operational Research
- For Marriot Hotels Group, Investigation on the relation between customer feedback and returned purchases by Conditional Field Model

Voluntary Work **over 180 hours**

- Statistical analysis for local epidemic prevention, coding work to produce a simple task assignment system to monitor high-risk traveller and put forward a faster positive testing strategy from Operational Research for COVID-19
- Voluntary interpreter in Lanzhou Urban Planning Exhibition Museum
- Held the introductory bilingual talk overseas guests, campus sightseeing and free talks for Lanzhou University

INTEGRATED SKILLS

- Coding: C/C++, Linux/UNIX, LaTeX, Python, MATLAB, R, HTML
- Language: Mandarin(Native), English(Fluent)
- Instrument: Violin, HPC operation