

# CUI HONGJIAN

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## EDUCATION BACKGROUND

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**National University of Singapore**, Electrical and Computer Engineering, *PhD* 2018.8 - 2023.8

**Supervisors:** Prof John Ho, Prof Qiu Chengwei; with scholarship, graduated

**National University of Singapore**, Mechanical Engineering, *Bachelor* 2014.8 - 2018.5

**Distinction**, received full scholarship from University and Ministry of Education (MOE). Second award in High School Physics Olympic, China.

## SUMMARY

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Having good math and physics analytical background, skilled in programming. Seeking for opportunities in quantitative researcher/analyst.

## TECHNICAL SKILLS

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- **Programming:**  
Python (Algorithm, data processing and equation analyzing), HTML, SQL, C/C++, Linux, MATLAB
- **Simulation and Modelling:**  
**Simulation:** MATLAB, COMSOL, Solidworks (CSWP from Dassault Systèmes)  
**Other software:** Latex, Adobe Illustrator, Photoshop, Word, Excel, PowerPoint

## PHD THESIS

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**PT-symmetry in Non-Hermitian Hamiltonian Wireless Coupled Electronic Oscillators.** Employing mathematical modeling expertise and analytical techniques for equation manipulation, I have adeptly transposed principles from quantum mechanics to formulate a comprehensive model to describe physical world for coupled electronics. This approach allows for a nuanced exploration of the intricate interplay between quantum mechanics and coupled electronics, facilitating a deeper understanding of their dynamic behavior. I published related papers on **top Physics journal (JCR q1)** as first author. (PhysRevApplied, Editors' Suggestion.)

## WORK AND INTERNSHIP

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**MARVELL**, Staff Design Verification Engineer 2022.07-present

- Programming functional verification tests using Verilog, C++ and PEARL for verifying of automotive Ethernet switch unit. Creating test plan, and programming tests.
- Taking charge of several IC design units such as PMU, preemption, EEPROM and several new automotive ASIC design features.
- Implemented several algorithms for processing Ethernet frame contents and queue management in coverage and test, such as round-robin.
- Ensuring the automotive's functional safety which satisfies ISO 26262 standard.

## PAPERS

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**Fano Resonance Enabled Frequency Locking in Physiological Parameters Readout** Paper submitted

- **Innovation:**
  - 1 Our team first extracted mathematical model from coupled oscillators with physical phenomenon called Fano resonance.
  - 2 The Fano resonance is able to lock the active resonator's frequencies to passive's self-resonant frequencies.
  - 3 We designed and programmed our circuit with C++ and MCU which can transfer active resonator's frequency signals to digital signals. And we wirelessly monitored heart pulse rate from radial artery.

**High-Efficiency Selective Wireless Power Transfer in a Bistable PT-Symmetric Circuit** 2022.10

- **Innovation:**
  - 1 We first designed the circuit and mathematically described single-transmitter, multi-receiver's wireless powering model as Non-Hermitian Hamiltonian.

2 Based on mathematical prediction, the wireless powering efficiency can be boosted to 65% where conventional devices only have 25%. We experimentally verified the results.

- **Main Contribution:** Equations Analysis. Simulations and Experiment. Paper writing. Published on top physics journal as first author. DOI: [10.1103/PhysRevApplied.18.044076](https://doi.org/10.1103/PhysRevApplied.18.044076)

### **Wireless Magnetic Actuation with a Bistable Parity-Time-Symmetric Circuit** 2021.2

- **Innovation:** We exploited the wireless actuation applications for non-Hermitian circuit. The current design improve the robustness and controllability from maximum attraction to maximum repulsion while actuating.
- **Main contribution:** PDMS microfluidic devices fabrication. Electronics simulations and experiment. Published on Physical Review Applied. DOI: <https://doi.org/10.1103/PhysRevApplied.15.024023>

## **SCHOOL PROJECTS AND AWARDS**

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### **Graduate Assistant** 2019.2- 2022.1

- EE2033 Integrated Lab.Teaching RTL-SDR, Pluto, GNU radio in communication system. Teaching signal processing, filter design, modulation and demodulation lab.
- ME2121 Engineering Thermodynamics. Teaching air conditioner electronics Lab and heat transfer/heat engine tutorial.

### **Machine Vision and Neural Networks** 2018.8-2019.8

- Researching and coding for image thinning and segmentation algorithm (Stentiford, Zhang Suen Algorithm). Improved thinning performance of algorithm. Solved problems where traditional dilation and erosion algorithm makes small edge disappearing.
- Developed code for regression, Convolutional Neural Networks (CNN), Back Propagation (BP), Support Vector Machine (SVM), Self-organizing map (SOM) and Q-learning Algorithm without Keras and sklearn kit. Analyzing code and improve the classification accuracy.

### **American Society of Machenical Engineers, National University of Singapore president**

2017.1-2017.12

- Supervise junior members holding modelling and simulation competitions with Siemens, MOH for designing for elderly cares equipment and green-power cars. Funded 2000 SGD for events.

### **Leetcode Competition** Current

- Attended leetcode Spring seasonal programming competitions. Ranked as top 15% as team.

### **Kaggle Optiver-Trading at the Close** Current

- Attended Kaggle competitions. Ranked as top 5% and get silver medal.

- 1 This competition is based on actual stock quotes and trading data to accurately infer the rise and fall of stock prices in the last 10 minutes of trading each day.
- 2 A series of feature combinations such as transaction price difference, quote price difference, and trading volume are extracted. LightGBM model is chosen for development. Additionally, to enhance the model's robustness, we divided the transaction dates into five segments to create test sets, conducting thorough testing to avoid overfitting.