# Cui Hongjian

(+65) 90361601 · [e0350311@u.nus.edu](mailto:e0350311@u.nus.edu) · Electromagnet, wireless sensors, Programming · [github website](#)

## Education Background

**National University of Singapore**, Electrical and Computer Engineering, *PhD*    2018.8 - present
**Supervisors: Prof John Ho, Prof Qiu Chengwei;** with scholarship, thesis submitted

**National University of Singapore**, Mechanical Engineering, *Bachelor*    2014.8 - 2018.5
**Distinction**, Top 5% in Harbin No.3 High school (best in Hei Longjiang Province), and First Prize in Physics Olympics, received full scholarship from University and Ministry of Education (MOE).

## Summary

With good math and physics modeling background, skilled in IOT for both software and hardware, skilled in simulation (Electronics, Math/Physics Equations, Force, Thermal Dynamics) and equations/data analysis. Skilled in algorithm (GWO,SA...) and machine learning using sklearn, tensorflow... Good self-learning skills. Interested in finance and policy making.

## Technical Skills

- **Programming:**
  Python (Algorithm and Data), HTML, SQL, C/C++, Linux, LabView, MATLAB
- **Simulation and Modelling:**
  **Simulation:** CST, MATLAB, COMSOL (Force, Thermodynamics, Waveguide, Metasurface). ADS, LTspice (Radio frequency and circuit simulations)
  **Design Tools:** Solidworks, SolidEdge, AutoCAD, Altium Designer
  **Other software:** Latex, Adobe Illustrator, Photoshop, Word, Excel, PowerPoint
- **Hardware:**
  Oscilloscope, Vector Network Analyzer (VNA), Spectrum Analyzer. Coding for Arduino, STM32 Raspberry Pi. Knowledge with NFC, RFID, BLE, SPIE, I2C, UART, TCP/IP. Experience in clean room equipment: SEM, spin coater, sputtering, Mask Aligner...

## PhD Thesis

**Wireless Sensors and Actuators in Nonlinear Electronics Systems**,The physics idea is from Bender's paper 'Real Spectra in Non-Hermitian Hamiltonians Having PT Symmetry' published in 2008. Here, we use the physics of PT-symmetry and apply it in wireless electronics, such as robust wireless power transfer, enhanced sensitivity wireless sensors and wireless actuators. Publshed related paper on top Physics journal as first author. (PhysRevApplied, Editors' Suggestion)

## Papers

**Fano Resonance Enabled Frequency Locking in Physiological Parameters Readout**    2019.6- In progress

- **Innovation:** Established equations for multi-coupled linear damped oscillators, and derived Fano resonance profile from the schematic. Designed and programmed using C++, a mix-signal sensor-reader system which can linearly read passive signals and send it to mobile phone with 0 time delay.
- **Main Contribution:** New IOT sensors developed; MATLAB for equations analyzing; ADS,CST for Electronics and EM field simulations; Designed PCB with signal processing circuit; Coding for sensors and MCUs; Fabricate wearable sensors in clean room; Python for data Analysis and machine learning.

**High-Efficiency Selective Wireless Power Transfer in a Bistable PT-Symmetric Circuit**
2021.10-2022.10

- **Innovation:** Firstly modeled Hermitian Hamiltonian equations for multi-receivers wireless power transfer (WPT) system. Solved the problems that previous resonance frequencies for WPT have to be tuned to maintain a much higher power transfer efficiency. Achieved a 83% localization energy to the selected receiver with three receivers presented, beating conventional one with only 28% in other researches with same setup.

- **Main Contribution:** Equations Analysis,Simulations and Experiment. Published on top physics journal as first author.

### Wireless Magnetic Actuation with a Bistable Parity-Time-Symmetric Circuit  2020.6-2021.2

- **Innovation:** Firstly using PT-symmetry in wireless actuation systems with Lorentz force. Achieved the circuit where a small signal injection can make a force change from maximum repulsive force to maximum attractive force.
- **Main contribution:** PDMS microfluidic devices fabrication. Electronics simulations and experiment.
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## WORK AND INTERNSHIP

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

- Programming using UVM (System Verilog, hardware descriptive language) for verifying automotive Ethernet switch unit. Creating test plan, task and functions in tests, Ethernet transactions, and coverage module for ensuring the data security and sensitivity as described in the specification with constraint random tests.
- Clearly understand the IEEE 802.1 standard, with time sensitive network (TSN), preempt, and MACSEC AES encryption algorithm. Created an algorithm for Ethernet transition coverage in preempt with multiple scenarios.
- Verifying functional safety, power management unit (PMU), and ASIC module with directed test, detecting design errors and updating the tests in legacy tests with considering corner cases.

**Applied Materials**, Process Engineer Internship  2017.1-2017.6

- Deep Reactive Ion Etching (DRIE) project. Modify etching parameters and data in recipes (CF4,SF6,RF) to meet requirement. Using scanning electron microscopy (SEM) for wafer condition inspection.

**Envilink**, Startup Company Engineer  2017.7-2018.3

- Research and Design for IOT environmental sensors(PM2.5，HCHO，CO2，Temperature and Humidity), PCB design, and sensor box design.**Support from NUS Hangar Enterprise.**

**Harbin Shangwei**, Assistant Research Engineer  2015.5-2015.8

- **High Efficiency Electromagnet** Cooperated with senior Engineers. Simplified electronics circuit for high-power crane brakes. Achieved electromagnet providing 380N which only needs 12V for working. Reduced Power consumption for conventional electromagnets.**The research gets patented from China National Academy of Engineering Patent.**

## SCHOOL PROJECTS AND AWARDS

**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

- Developing code for machine vision and neural networks. Reading papers 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 accuracy.
- Using tensorflow, sklearn... in Python to achieve GDBoost, LSTM, Transformer, GPT and diffusion model. Deployed in local sever.

**American Society of Machenical Engineers**, National University of Singapore president
2017.1-2017.12

- Holding modelling and simulation competitions with Siemens, MOH for designing for elderly cares and green-power cars. Won 2000 SGD for events.