Cui Hongjian

(+65) 90361601 · e0350311@u.nus.edu · Electromagnet, wireless sensors, Programming · github website

Education Background

National University of Singapore, Electrical and Computer Engineering, *PhD* 2018.8 - 2022.7

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

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

Distinction, Top 5% in High school, First Prize in Physics and Math Olympics, received full scholarship from University

HanYang University, Machenical Engineering, *Summer Exchange* 2016.6 - 2016.8

Summary

With good math and physics 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.

Technical Skills

- **Programming:**
  Python (Algorithm and Data), Java, HTML, SQL, C/C++, Linux, LabView
- **Simulation and Modelling:**
  Simulation:CST, COMSOL, ANSYS HFSS, NX (Force, Thermodynamics, Waveguide, Metasurface) ADS, LTspice (Radio frequency and circuit simulations)
  Design Tools: Solidworks, SolidEdge, AutoCAD, Altium Designer
  Other softwares: 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 communication. Experience in clean room equipments: 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 electronics, such as robust wireless power transfer, enhanced sensitivity wireless sensors and wireless actuators.

Papers

Fano Resonance Enabled Frequency Locking in Physiological Parameters Readout 2019.6-

- **Innovative ideas:** Established equations for coupled damped oscillators, and derived Fano resonance profile for the system. Designed and programmed using C++ a mix-signal sensor-reader system which can linearly read passive signals and send it to mobile devices.
- **Main Contribution:** New IOT sensors developed; Matlab for equations analyzing; ADS,CST for Electronics and EM field simulations; Altium for PCB design;Coding for sensors and MCUs; Fabricate wearable sensors in cleanroom; Develop APP in JAVA for wireless data readout in mobile devices; Python for data Analysis and machine learning.

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

- **Innovative ideas:** 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 highest efficiency. Achieved a 83% localization energy for the selected receiver.
- **Main Contribution:** Equations Analysis,Simulations and Experiment. Published on PRA as first author. DOI:10.1103/PhysRevApplied.18.044076

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

- **Innovative ideas:** 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.
- Publsihed on Physical Review Applied: Impact Factor 4.985。 Zhenya Dong, Han-Joon Kim, **Hongjian Cui**, Chenhui Li, Cheng-Wei Qiu, and John S. Ho Phys. Rev. Applied 15, 024023 –Published 10 February 2021
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Work and Internship

Applied Materials, Process Engineer 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),including backend and front end, PCB design, and sensor box design.**Support from NUS Hangar Enterprise.**

Harbin Shangwei,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 needed for conventional electromagnets.**The research gets patented from China National Academy of Engineering Patent.**

School Projects and Awards

Graduate Assistant 2019.2-

- EE2033 Integrated Lab.Teaching RTL-SDR, Pluto, GNU radio in communication system. Teaching signal processing, filter desgin, modulation and demodulation.
- 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.

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.

Other projects 2019.8-2020.8

- Using raspberry pi for detecting objects in rooms. Sending emails to host if foreign is detected.
- Using STM32 for Unmanned aerial vehicles (UAV) with Kalman filter.
- Designing metasurface which achieved negative refraction index.

SOLIDWORK Professional Engineer Certified (CSWP+CSWA),Siemens SOLIDEDGE Professional Engineer 2015-

Full Scholarship from National University of Singapore 2014-

Top 1000 in Leetcode Weekly Competitions 2020-

First Prize in Physics and Math Olympics in Heilongjiang Province, China 2014