

# Cun Wei Liu

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## Research Interests

Quantum Computing, Quantum Information, Computer Simulating Physics.

## Education

**National Cheng Kung University (NCKU)**

Tainan, Taiwan

B.S. IN CIVIL ENGINEERING

06/2020

- Overall GPA: 3.55/4.3, Physics Core: 4.16/4.3
- Courses: Physics (Quantum Physics I&II, Electromagnetism I&II, Solid State Physics), Computational Science, Engineering, Material Science

## Research Experience

**Research Assistant , Physics Dept. Matterwave Lab, Prof. Pei Chen Kuan**

Tainan, Taiwan

MULTIPLE WAY QUANTUM WALK (MWQW)

08/2019 - PRESENT

- Discussed the error tolerance when implementing MWQW in matterwave systems by analytical and numerical methods.
- Examined the asymptotic analysis of MWQW through Schrödinger's approach and path integrals and explored their physical meanings.
- Proposed that MWQW is a quasi-quantum walk which its exit probability  $p_{\infty}$  behaves between classical and quantum random walks.
- Connected MWQW to quantum cellular automata and its simulations in topological phases and boundary states.

SENSITIVE MEASUREMENTS THROUGH MATTER WAVES.

- Research on implementing double-diffraction Bloch oscillation to cancel the phase perturbation when performing sensitive measurements.

**Research Assistant, Civil Engineering Dept. AI Material Lab, Prof. Yun Che Wang**

Tainan, Taiwan

MACHINE LEARNING IN MATERIAL DESIGN. [APCOM2019] [CTAM2020]

02/2019 - 06/2020

- Applied generative adversarial networks (GAN) to generate high fidelity microstructure images.
- Proposed regression VGG networks (rVGG) that can predict mechanical properties from material images with 95% accuracy.
- Outperformed Finite Element Methods (FEM) in predicting time over 100 times.
- Investigated a Bayesian-optimization model that can fine-tune GAN-generated microstructure geometry through the rapid-labeling rVGG.

CONSTRUCTING HOMOGENOUS MATERIALS UNSING COMPUTATIONAL METHODS.

- Implemented pruning protocol on 96-core CPUs to generate auxetic networks inspired by "Auxetic metamaterials from disordered networks".
- Implemented a stochastic protocol to produce large scale homogenous microstructure datasets by two-point correlation function.

## Publication

- [1] Chun Wei Liu, Pei Chen Kuan, "Symmetric Quantum Walk With Phase Transition Feature". (In preparation, to be submitted in Apr. 2021).
- [2] Chun Wei Liu, Jyun-Ping Wang, Yun-Che Wang, "Machine Learning of Viscoelastic Properties of 2D Porous Materials via Deep Neural Network". (In preparation, to be submitted in Nov. 2020).
- [3] Chun Wei Liu, Tsai-Wen Ko, Yun-Che Wang, "Effective Mechanical Properties of Chiral Materials Predicted by Deep Neural Network". (In preparation, to be submitted in Dec. 2020).

## Honors & Awards

- 2020 **Chairman Special Award (entering final round)**, IBMq Qiskit Hackathon Taiwan
- 2018 **5th Place (out of 250 students)**, Asia Pacific Mechanics Contest for College Students
- 2017 **Dean's list**, GPA in top 5% of the department

## Presentation

**Design of Viscoelastic Auxetic Materials Through Machine Deep Learning** | [Link](#)

Taipei, Taiwan

ASIAN PACIFIC CONGRESS ON COMPUTATIONAL MECHANICS (APCOM2019)

12/2019

- Discussed the use of VGG networks as an alternative of Finite Element Methods (FEM) when labeling mechanical properties for microstructures.

## Selected Projects

**Predicting Handwriting Recognition With Parametrized Quantum Circuit** | [Link](#)

Xitou, Taiwan

FOR IBMQ QISKIT HACKTHON TAIWAN 2020

09/2020

- Implemented 4qubit-Ry gate circuits in predicting MNIST dataset with the learning curve converged after ten iterations.
- Analyzed the potential in predicting molecular ground state energies with Quantum LSTM Meta-Learner and VQE.

## Extracurricular Activity

**American Language Program, School of Professional Studies, Columbia University**

New York City, NY

STUDENT

07/2018 - 08/2018

- Passed the intensive C1-level English program and visited some advanced academic facilities to prepare for my graduate studies.

## Skills

**Languages:** Python, C/C++, MATLAB **Libraries/Tools:** Qiskits, Mathematica, PyTorch **Other Technologies:** GNU/Linux, Raspberry Pi, Git, LAMMPS, 编程