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 Major: 4.16/4.3
- Courses: Physcis (Quantum Physics I&II, Electromagnetism I&II, Solid State Physcis), 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 using analytical and numerical methods.
- Investigated the defects in previous asymptotic analysis methods when implementing Schrödinger's approach to MWQW.
- Connected MWQW to quantum cellular automata through analysing the hypergeometric functions obtained from path integral methods.
- Proposed that MWQW is a quasi-quantum walk which its exit probability p_∞ behaves between classical and quantum random walks.

Sensitive Measurements Through Matter Waves.

- Research on implementing double-diffraction Bloch oscillation to cancel the phase perterbation 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 summited in Dec. 2020).

[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 summited 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 summited in Dec. 2020).

Honors & Awards

2020 **Chairman Special Award (entering final round),** IBMq Qiskit Hackthon Taiwan

2018 **5th Place (out of 250 students),** Asia Pacific Mechanics Contest for College Students

2016 **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 Congresson 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.
- Analized 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, Tensorflow, PyTorch **Other Technologies:** GNU/Linux, Raspberry Pi, GCP, Git, LAMMPS, LaTeX