

# Jiachen Guo

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## SUMMARY

- Self-motivated researcher with expertise in Machine Learning, Large language models, and Numerical Simulation
- Adept at Deep Learning, Physics-informed machine learning, and Fast reduced-order modeling of physics.
- Skilled in software development for computational science, emphasizing efficient algorithms and robust design.
- Anticipated graduation date: Earliest 04/2026; Latest: 09/2026.

## CORE SKILLS

Machine Learning (4+ years), Deep Learning (4+ years), Finite Element Analysis (5+ years), Surrogate modeling (5+ years), Numerical Methods (5+ years), Manufacturing Simulation (3+ years), High-Performance Computing (2+ years)

## EDUCATION

### Northwestern University

Evanston, IL

*PhD Theoretical and Applied Mechanics*

GPA: 3.98/4.00

2026 (Expected)

*Awards:* Walter P. Murphy Fellowship, Predictive Science and Engineering Design Fellowship, 2<sup>nd</sup> Prize in 2022 NIST AM-Bench for macroscale tensile crack test, 1<sup>st</sup> Prize in 2022 Asynchronous NIST AMBench for Scan Geometry

### Zhejiang University

Hangzhou, China

*MEng Civil Engineering*

GPA: 91.0/100.0

2021

*Awards:* Excellent student at Zhejiang University

### Sichuan University

Chengdu, China

*BEng Civil Engineering*

GPA: 3.70/4.00

2018

*Awards:* Outstanding graduate, Baosteel Fellowship for Outstanding Student, 1<sup>st</sup> Prize in provincial engineering mechanics competition, 1<sup>st</sup> Prize Scholarship

## PROFESSIONAL & RESEARCH EXPERIENCE

### HIDENN-AI, LLC

Chicago, IL

*Machine Learning Engineer Intern*

Feb 2025 – Present

- **LLM-driven Large-scale physics modeling:** Proposed and developed a novel framework for scientific code generation using a RAG-based approach on a specialized surrogate model database, reducing development cycles by **40%**.
- **Large-scale Physical AI Model Development:** Proposed and validated AI-enhanced machine learning model, INN-TD, for ultra large-scale physical world modeling with much less training data, significant speedup, better accuracy and fast inference.
- **AI Education in Computational Science** Led 4 sessions in the 2025 HiDeNN-AI summer course, educating over **40 participants** including graduate students and industry professionals on advanced AI for computational science.

### Shanghai Municipal Engineering Design Institute Co., Ltd

Shanghai, China

*Engineer Intern*

Jun 2020 – Aug 2020

- **Data analysis:** Designed, built, and maintained a scalable data pipeline for infrastructure inspection data.

### Northwestern University

Evanston, IL

*Graduate Research Assistant*

Sep 2021 – Present

- **Ultra Large-scale Surrogate modeling of complex physics:** Architected and implemented a novel surrogate model using Tensor Decomposition (TD), accelerating large-scale PDE simulations by over **100x** while drastically reducing RAM and storage requirements.
- **Mechanistic LLM development:** Fine-tuned open-source large language models with mechanistic knowledge from physics, mechanics and tensor algebra with reinforced learning to achieve better reasoning performance in complex physics simulation
- **GPU-Accelerated Scientific Computing:** Implemented the tensor decomposition method in **JAX GPU** for ultra large-scale additive manufacturing physical process simulations.
- **Novel Operator Learning Method:** Proposed novel operator learning framework on clustered data and validated the method using microscale analysis in computational mechanics.
- **ML for Scientific Discovery:** Developed data-driven physical law discovery using dimensionless learning that successfully discovered hidden physics from additive manufacturing experimental data.

## SELECTED PUBLICATIONS

**Tensor-decomposition-based A Priori Surrogate (TAPS) modeling for ultra large-scale simulations** *Computer Methods in Applied Mechanics and Engineering* 2025

- Guo, J., Domel, G, Park, C., Zhang H., Gumus O., Lu, Y, Wagner, G.J., Qian D., Cao J., Hughes, T.J.R., & Liu, W. K.

**Interpolation Neural Network-Tensor Decomposition (INN-TD): a scalable and interpretable approach for large-scale physics-based problems** *International Conference on Machine Learning (ICML)* 2025

- Guo, J., Xie, X., Park, C., Zhang H., Politis, M., Domel, G, Hughes, T.J.R., & Liu, W. K.

**Convolutional Hierarchical Deep Learning Neural Networks-Tensor Decomposition (C-HiDeNN-TD): a scalable surrogate modeling approach for large-scale physical systems** *NeurIPS 2024 workshop on Data-driven and Differentiable Simulations* 2024

- Guo, J., Park, C., Xie, X., Sang, Z., Wagner, G. J., & Liu, W. K.

**An Introduction to Kernel and Operator Learning Methods for Homogenization by Self-consistent Clustering Analysis** *Computational Mechanics* 2023

- Huang, O.,\* Saha, S., \* Guo, J., \*(Co-first author) & Liu, W. K.

**Interpolating neural network: A novel unification of machine learning and interpolation theory** *Nature Communications, accepted* 2025,

- Park, C., Saha, S. Guo, J., Zhang H, Xie, X., ... & Liu, W. K.

**Data-driven discovery of dimensionless numbers and governing laws from scarce measurements** *Nature Communications, 13(1), 7562* 2022

- Xie, X., Samaei, A., Guo, J., Liu, W. K., & Gan, Z.

#### **SELECTED CONFERENCE PRESENTATIONS**

**A priori tensor decomposition (APT) for ultra large-scale high dimensional simulations** *U.S. National congress on computational mechanics* 2025

- Guo J., Park C., Domel G., Li. Y., Zhang H., Liu W.K.

**Multiscale Material Model Calibration using Full-field Surface Measurements from Digital Image Correlation (DIC)** *U.S. National congress on computational mechanics* 2023

- Guo J., Mojumder S, Saurez S, Li. Y., Xie X.

**Dynamic centrifuge modeling of a shallow founded structure on layered soft clay** *10th International Conference on Physical Modelling in Geotechnics* 2022

- Guo J., Cao L, Huang B., Zhao Y.

#### **PATENTS**

**A hypergravity model test method for simulating the transport of pollutants in a vertical barrier wall.** *China Invention Patent, CN112964610B*

- Huang B., Cao L, Guo J., Xu C., Li, Y.

**Convolution HiDeNN-tensor decomposition for manufacturing simulation, performance prediction, and topology optimization of multiscale material systems** *International application number PCT/US23/32981*

- Liu W., Park C., Saha S., Mojumder S., Li H., Guo J., Li Y. Xie, X.

**Mechanistic concurrent nested topology design and optimization: Bridging advanced manufacturing to optimized product realization** *US Provisional Patent Application 63/534,599*

- Liu W., Park C., Saha S. Mojumder S., Li H., Guo J., Li Y., Abbott T.

**Isogeometric convolution hierarchical deep-learning neural network: isogeometric analysis with versatile adaptivity** *US Provisional Patent Application 63/534,609*

- Liu W., Mojumder S., Li H., Li Y., Park C., Saha S. Guo J.

#### **OTHER SKILLS**

**Programming Languages:** Python, SQL, C++, MATLAB

**Packages & Tools:** Linux (Ubuntu), Docker, PyTorch, JAX, Huggingface, Langchain, Langgraph, Llamacpp, Pandas