

Junpeng Gao

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EDUCATION

Shanghai Tech University

Bachelor of Science in Physics

Bachelor Thesis: Structure-Preserving ODE solver benchmarks for Hamiltonian systems

Shanghai, China

Sep 2016 – Jul 2020

Eidgenössische Technische Hochschule Zürich

Master of Science in Computational Science and Engineering

Zürich, Switzerland

Sep 2021 – Present

RESEARCH & WORK INTERESTS

- Computational design and fabrication of compliant and deformable objects like soft robots and metamaterials.
- Computational geometry and mechanism for compliant and deployable structure.
- AI-facilitated simulation and differentiable simulation for physics.
- Development of high-performance scientific computing and simulation software.

PUBLICATION

- M2N: Mesh Movement Networks for PDE Solvers [NeurIPS2022]
- Sim-to-Real of Soft Robots with Learned Residual Physics[RA-L 2024] [[Project Page](#)]

WORK EXPERIENCE

Huawei Noah's Ark Lab

Research Intern in AI4Science

Beijing, China

Sep 2020 – Mar 2021

- Mesh movement networks: Propose a new graph attention network based r-adaptivity method to improve the accuracy and efficiency of solving PDEs systems.
- Implement graph attention network and generate PDE training data.
- Investigate numerical ODE step size controllers and implement basic adaptive algorithms.

Dassault systemes

Research & Development Intern for Computational Homogenization

Vélizy, France

March 2023 – August 2023

- Improve deep material network (DMN) architecture to support stiffness tensor prediction of porous material.
- Apply Hashin-Shtrikman bounds to investigate the capability of deep material network.
- Implement online prediction module of varying loading cases for different microstructures.
- Develop FE-DMN in C++ combined with Abapus to make multi-scale modeling online prediction.

RESEARCH EXPERIENCE

Residual Physics for Soft Robotics

Semester project

Soft Robotics Lab, ETH

May 2022 – Jan 2024

- Conduct real experiments and collect motion data with the motion capture system (Miquis M3, Qualisys).
- Simulate the cantilever beam and SoPrA with the differentiable simulator DiffPD.
- Develop a new hybrid learning framework to decrease sim2real errors for soft robots.
- Make benchmarks with pure data-driven methods and system identification.

Developable Document Unwarping

Master thesis

Interactive Geometry Lab, ETH

March 2024 – September 2024 (expected)

- Implement vision transformer architecture for document unwarping.
- Improve the developability of quad-mesh based deformed paper with contact element net optimizations.
- Investigate the convergence of Gaussian curvature for deformed document surface.

RELATED PROJECTS

High-Performance Linear Multi-step Methods

SciML.jl

Open Source Project

- Rewrite the code of quasi-constant step size numerical differentiation formula: **QNDF**.
- Investigate and implement fixed leading coefficients BDF scheme and DASSL controller: **FBDF**.
- Add FBDF algorithm support for Differential Algebraic Equations (DAEs): **DFBDF**.

Optimize Performance for Particle Swarm Algorithm

Advanced Systems Lab Course

Course project

- Implement particle swarm algorithm with RBF surrogates, and add CPU-level parallelism support with SIMD and loop unrolling.
- Develop Bunch-Kaufman linear solver for symmetric indefinite system and optimize cache locality.

MISCELLANEOUS

Computational design for additive manufacturing

IDEA League

Summer School

July 1st - 5th 2024

- Perform topology optimization and generative design for the bike crank with Fusion 360.
- Run structural analysis for the designed structure under different load cases
- Apply lattice structure optimization with Grasshopper with the collaboration of the team

SKILLS

Programming Languages: Python, Julia, Matlab, C++.

Scientific Software: FEniCS, DifferentialEquations.jl, Pytorch, Fusion 360.

Language Skills : Native Chinese, Fluent English.