

Yixin Chen

PhD Candidate at University of Toronto, Toronto, ON, Canada

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RESEARCH INTERESTS

My research focuses on physics-based simulations, with a particular emphasis on high-performance, differentiable, and interactive fluid flow simulation and control.

EDUCATION

University of Toronto, Toronto, Canada

Sep. 2020 — Present

PhD in Computer Science

ShanghaiTech University, Shanghai, China

Sep. 2015 — Jul. 2019

BEng in Computer Science and Technology

PUBLICATIONS

Fast Subspace Fluid Simulation with A Temporally-Aware Basis

Conditionally accepted to ACM SIGGRAPH 2025 (Transactions on Graphics)

Siyuan Chen, **Yixin Chen**, Jonathan Panuelos, Otman Benckekroun, Yue Chang, Eitan Grinspun, Zhecheng Wang

Fluid Control with Laplacian Eigenfunctions

ACM SIGGRAPH 2024 (Conference Track)

Yixin Chen, David I.W. Levin, Timothy Langlois

Meta-ABC: A High-complexity Lattice Geometry Dataset for Deep Learning

Under revision

Yixin Chen, Towaki Takikawa, Ty Trusty, David I.W. Levin, Alec Jacobson, Elissa Ross, Daniel Hambleton

Multi-Agent Path Planning with Asymmetric Interactions In Tight Spaces

Computer Graphics Forum (CGF) 2022

Vismay Modi, **Yixin Chen**, Abhishek Madan, Shinjiro Sueda, David I.W. Levin

GPU Optimizations for High-Quality Kinetic Fluid Simulation

IEEE Transactions on Visualization and Computer Graphics (TVCG) 2021

Yixin Chen, Wei Li, Rui Fan, Xiaopei Liu

Fast and Scalable Turbulent Flow Simulation with Two-Way Coupling

ACM SIGGRAPH 2020 (Transactions on Graphics)

Wei Li, **Yixin Chen**, Mathieu Desbrun, Changxi Zheng, Xiaopei Liu

ACADEMIC EXPERIENCE

Dynamic Graphics Project, Department of Computer Science, University of Toronto

Research Assistant (RA) — Advisor: Professor David I.W. Levin

Sep. 2020 — Present

Physics-based Simulation

- Conducted a comprehensive survey of current research on physics-based simulations, especially focusing on elastic body and fluid dynamics, and identified critical limitations in existing methodologies
- Implemented several fundamental physics-based simulation methods, creating a robust code library in C++ and Python
- Specialized in simulating complex elastic lattice geometries to enhance accuracy and performance
- Concentrating on the challenges of interactive and efficient fluid control problems with reduced-order models

FLARE Lab, School of Information Science and Technology, ShanghaiTech University

Research Assistant (RA) — Advisor: Professor Xiaopei LIU

Feb. 2019 — Jan. 2020

Fast and Scalable Turbulent Flow Simulation with Two-Way Coupling

Collaborated with Professor Changxi Zheng from Columbia University, USA and Professor Mathieu Desbrun from California Institute of Technology, USA

- Proposed a stable and accurate solution for fluid-solid coupling using a kinetic method with lattice Boltzmann equations
- Derived numerical optimizations to determine high-order relaxation rates in the non-orthogonal central-moment relaxation model and dimensional mapping for fluid-solid coupling

- Implemented a novel LBE solver with parallel optimization for both single and multi-GPU systems, achieving real-time coupling simulations with volume rendering

GPU Optimizations for Highly-Quality Kinetic Fluid Simulation

Collaboration with Professor Rui Fan from ShanghaiTech University, China

- Derived an efficient parameterized data layout and memory access method for numerical fluid simulation based on the latest kinetic methods using lattice Boltzmann equations
- Proposed GPU optimization algorithms for single-scale and multi-scale fluid simulation using kinetic method to effectively balance efficiency and accuracy
- Implemented CUDA-based parallel optimization on single and multi-GPU, significantly faster than state-of-the-art GPU-based Navier-Stokes solvers for given accuracy and 10-20 times faster than a direct implementation

WORKING EXPERIENCE

Research Scientist and Engineer Intern

May. 2022 — Present

Adobe Inc. Seattle, WA, U.S. — Mentor: Timothy Langlois

Efficient and Interactive Fluid Control with Reduced-order Models

- Reviewed current fluid control research, identifying limitations in previous methods and potential areas for improvement
- Implemented several baseline 2D and 3D fluid control methods to establish foundational performance benchmarks
- Developed an interactive and efficient 2D fluid control method based on the Laplacian eigenfluids pipeline to control single-phase fluid animations
- Currently working on interactive and high-performance free-surface flow simulation and control problems

Research Scientist Intern

Jan. 2023 — Jun. 2023

Metafold 3D, Toronto, ON, Canada

- Developed a microstructure simulation method and implemented corresponding code for efficient and accurate modeling
- Integrated a new simulation pipeline into the production environment, enhancing workflow efficiency and performance

Teaching Assistant (CSC317, CSC417)

Sep. 2021 — Apr. 2022

Department of Computer Science, University of Toronto, Toronto, ON, Canada

- Assisted course instructors with grading assignments, ensuring accurate and timely feedback for students
- Organized and led Q&A sessions to address student inquiries and provide detailed feedback on course material

Software Development Intern

Aug. 2020 — Dec. 2020

UBTech Robotics, Chengdu, Sichuan, China

- Participated algorithm training and data management, including collection, organization, labeling
- Collaborated with research teams to evaluate and test various functionalities of robotic products, providing detailed feedback through comprehensive reports

Research Scientist Intern

Jan. 2020 — Aug. 2020

Dgene Digital Technology (Shanghai) Co., Ltd., Shanghai, China

- Contributed to advanced research in Computer Graphics, with a focus on high-performance, high-quality fluid simulation using the Lattice Boltzmann Method (LBM)
- Developed and optimized fluid simulation platforms for applications in various fields, including smart cities and intelligent healthcare solutions

SELECTED COURSES

School of Graduate Studies

GPA:3.96

- CSC2521H Topics in Computer Graphics (Seminar on Geometry and Animation)
- CSC2549H Physics-Based Animation
- CSC2233H Topics in Storage Systems
- CSC2558H Topics in Multidisciplinary HCI
- CSC2514H Human-Computer Interaction
- CSC2520H Geometry Processing
- CSC2505H Numerical Methods for Optimization Problems
- CSC2530H Computer Vision for Advanced Digital Photography

SKILLS

- **Programming Languages:** Python, C++, C, MATLAB, SQL, HTML
- **Computer Skills:** Git, LaTeX, Microsoft Office, Adobe Photoshop, Adobe After Effects, Adobe Illustrator
- **Engineering Platforms:** CUDA, OpenGL, OpenCV, CMake, Origin pro, Mathematica, NVVP, Taichi, WARP
- **Languages:** Chinese (Native), English (Fluent)