Minchen Li

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Contents

Research Focus

Numerical optimization and differentiable simulation for computer graphics, computational mechanics, robotics.

Bio

Minchen is an assistant adjunct professor at UCLA Department of Mathematics. He was a postdoctoral researcher at the SIG Center for Computer Graphics at the University of Pennsylvania after completing his Ph.D. in the same group, advised by Chenfanfu Jiang. Minchen is a winner of the 2021 ACM SIGGRAPH Outstanding Doctoral Dissertation Award, the 2021 Symposium on Computer Animation Doctoral Dissertation Award, and the 2020 Adobe Research Fellowship. His Ph.D. dissertation features the Incremental Potential Contact (IPC) method, which *"presents a breakthrough in the notoriously challenging and long-standing problem of robust frictional contact simulation in nonlinear solid dynamics with guarantees of non-intersection"* and has led to a series of follow-up works in both academia and industry. Minchen had four successive internships at Adobe Research. He received his M.Sc. in Computer Science from the University of British Columbia in 2018, advised by Alla Sheffer.

Education

University of Pennsylvania Philadelphia, PA, USA
Ph.D. in Computer and Information Science *Sep. 2018 – Dec. 2020*
- Thesis title: Robust and Accurate Simulation of Elastodynamics and Contact
- Thesis advisor: Chenfanfu Jiang

University of British Columbia Vancouver, BC, Canada
M.Sc. in Computer Science *Sep. 2015 – Apr. 2018*
- Thesis title: FoldSketch: Enriching Garments with Physically Reproducible Folds
- Thesis advisor: Alla Sheffer

Zhejiang University Hangzhou, China
B.Eng. (Hons) in Computer Science and Technology *Sep. 2011 – Jun. 2015*
- Thesis title: Skeletal Animation in Virtual Try-On System
- Thesis advisor: Jijun Li

Academic Positions

Assistant Adjunct Professor Jul. 2021 – Aug. 2023
Department of Mathematics, UCLA *Los Angeles, CA, USA*

Postdoctoral Researcher Feb. 2021 – Jun. 2021
SIG Lab, University of Pennsylvania *Philadelphia, PA, USA*
- Advisor: Chenfanfu Jiang

Mitacs Globalink Research Intern Jul. 2014 – Sep. 2014
WiNMoS Lab, University of British Columbia *Vancouver, BC, Canada*
- Advisor: Victor C.M. Leung, Wei Cai

Industry Experience

Co-Founder Aug. 2022 – present
Timestep Technologies, Inc. *Los Angeles, CA, USA*

Research Intern May. 2020 – Aug. 2020
Creative Intelligence Lab, Adobe Research *Seattle, WA, USA*

Research Intern May. 2019 – Aug. 2019
Creative Intelligence Lab, Adobe Research *Seattle, WA, USA*

Research Intern May. 2018 – Aug. 2018
Creative Intelligence Lab, Adobe Research *Seattle, WA, USA*

Research Intern Sep. 2017 – Nov. 2017
Creative Intelligence Lab, Adobe Research *Seattle, WA, USA*

Awards and Honors

Symposium on Computer Animation (SCA) Doctoral Dissertation Award	2021
ACM SIGGRAPH Outstanding Doctoral Dissertation Award	2021
Adobe Research Fellowship	2020
Mitacs Globalink Graduate Fellowship	2015 – 2016
Excellent Bachlor Thesis Award	2015
First Class Scholarship for Outstanding Merits	2013 – 2014

Publications [Google Scholar]

Dissertation and Thesis:

- Minchen Li. Robust and Accurate Simulation of Elastodynamics and Contact. Ph.D. Dissertation, University of Pennsylvania, 2020. *[2021 ACM SIGGRAPH Outstanding Doctoral Dissertation Award] [2021 Symposium of Computer Animation Doctoral Dissertation Award]*
- Minchen Li. FoldSketch : Enriching Garments with Physically Reproducible Folds. M.Sc. Thesis, University of British Columbia, 2018.

Tutorials:

- Minchen Li. A Tutorial on Backward Propagation Through Time (BPTT) in the Gated Recurrent Unit (GRU) RNN. Technical Report, 2016. DOI: 10.13140/RG.2.2.32858.98247.

Preprints:

- Yuxing Qiu, Feng Gao, Minchen Li, Govind Thattai, Yin Yang, Chenfanfu Jiang. TPA-Net: Generate A Dataset for Text to Physics-based Animation. Arxiv 2211.13887.
- Yunuo Chen, Minchen Li, Wenlong Lu, Chuyuan Fu, Chenfanfu Jiang. Midas: A Multi-Joint Robotics Simulator with Intersection-Free Frictional Contact. Arxiv 2210.00130.
- Zeshun Zong*, Xuan Li* (equal contribution), Jianping Ye, Sian Wen, Yin Yang, Danny M. Kaufman, Minchen Li, Chenfanfu Jiang. Topology Optimization with Frictional Self-Contact. Arxiv 2208.04844.
- Yu Fang*, Jiancheng Liu*, Mingrui Zhang* (equal contributions), Jiasheng Zhang, Yidong Ma, Minchen Li, Yuanming Hu, Chenfanfu Jiang, Tiantian Liu. Complex Locomotion Skill Learning via Differentiable Physics. Arxiv 2206.02341.
- Zizhou Huang, Teseo Schneider, Minchen Li, Chenfanfu Jiang, Denis Zorin, Daniele Panozzo. A Large-Scale Benchmark for the Incompressible Navier-Stokes Equations. Arxiv 2112.05309.

Conference Proceedings and Journal Articles:

- Yu Fang*, Minchen Li* (equal contributions), Yadi Cao, Xuan Li, Joshuah Wolper, Yin Yang, Chenfanfu Jiang. Augmented Incremental Potential Contact for Sticky Interactions. IEEE Transactions on Visualization and Computer Graphics (TVCG), 2023.
- Yunuo Chen, Tianyi Xie, Cem Yuksel, Danny M. Kaufman, Yin Yang, Chenfanfu Jiang, Minchen Li. Multi-Layer Thick Shells. ACM SIGGRAPH 2023.
- Tianyi Xie, Minchen Li, Yin Yang, Chenfanfu Jiang. A Contact Proxy Splitting Method for Lagrangian Solid-Fluid Coupling. ACM Transactions on Graphics (SIGGRAPH), 2023.
- Lei Lan, Minchen Li, Chenfanfu Jiang, Huamin Wang, Yin Yang. Second-order Stencil Descent for Interior-point Hyperelasticity. ACM Transactions on Graphics (SIGGRAPH), 2023.
- Yuxing Qiu, Samuel Reeve, Minchen Li, Yin Yang, Stuart Slattery, Chenfanfu Jiang. A Sparse Distributed Gigascale Resolution Material Point Method. ACM Transactions on Graphics, 2022 (presentation at SIGGRAPH 2023).
- Yadi Cao, Menglei Chai, Minchen Li, Chenfanfu Jiang. Efficient Learning of Mesh-Based Physical Simulation with Bi-Stride Multi-Scale Graph Neural Network. International Conference on Machine Learning (ICML), 2023.
- Hangxin Liu, Zeyu Zhang, Ziyuan Jiao, Zhenliang Zhang, Minchen Li, Chenfanfu Jiang, Yixin Zhu, Song-Chun Zhu. Reconfigurable Data Glove for Reconstructing Physical and Virtual Grasps. Engineering, 2023.
- Xuan Li, Yadi Cao, Minchen Li, Yin Yang, Craig Schroeder, Chenfanfu Jiang. PlasticityNet: Learning to Simulate Metal, Sand, and Snow for Optimization Time Integration. Neural Information Processing Systems (NIPS), 2022.
- Yunuo Chen*, Minchen Li* (equal contributions), Lei Lan, Hao Su, Yin Yang, Chenfanfu Jiang. A Unified Newton Barrier Method for Multibody Dynamics. ACM Transactions on Graphics (SIGGRAPH), 2022.
- Xuan Li, Minchen Li, Chenfanfu Jiang. Energetically Consistent Inelasticity for Optimization Time Integration. ACM Transactions on Graphics (SIGGRAPH), 2022.
- Lei Lan, Danny M. Kaufman, Minchen Li, Chenfanfu Jiang, Yin Yang. Affine Body Dynamics: Fast, Stable & Intersection-free Simulation of Stiff Materials. ACM Transactions on Graphics (SIGGRAPH), 2022.
- Lei Lan, Guanqun Ma, Yin Yang, Changxi Zheng, Minchen Li, Chenfanfu Jiang. Penetration-free Projective Dynamics on the GPU. ACM Transactions on Graphics (SIGGRAPH), 2022.
- Ziyin Qu, Minchen Li, Fernando de Goes, Chenfanfu Jiang. The Power Particle-In-Cell Method. ACM Transactions on Graphics (SIGGRAPH), 2022.
- Yadi Cao, Yunuo Chen, Minchen Li, Yin Yang, Xinxin Zhang, Mridul Aanjaneya, Chenfanfu Jiang. An Efficient B-Spline Lagrangian/Eulerian Method for Compressible Flow, Shock Waves, and Fracturing Solids. ACM Transactions on Graphics, 2022 (presentation at SIGGRAPH 2022).
- Minchen Li. Reliable Contact Simulation with IPC. IEEE Computer Graphics and Applications, Dissertation Impact, 2022.
- Yidong Zhao*, Jinhyun Choo* (equal contribution), Yupeng Jiang, Minchen Li, Chenfanfu Jiang, Kenichi Soga. A Barrier Method for Frictional Contact on Embedded Interfaces. Computer Methods in Applied Mechanics and Engineering (CMAME), 2022.
- Xuan Li*, Yu Fang* (equal contribution), Minchen Li, Chenfanfu Jiang. BFEMP: Interpenetration-Free MPM-FEM Coupling with Barrier Contact. Computer Methods in Applied Mechanics and Engineering (CMAME), 2021.
- Minchen Li, Danny M. Kaufman, Chenfanfu Jiang. Codimensional Incremental Potential Contact. ACM Transactions on Graphics (SIGGRAPH), 2021.
- Yu Fang*, Minchen Li* (equal contribution), Chenfanfu Jiang, Danny M. Kaufman. Guaranteed Globally Injective 3D Deformation Processing. ACM Transactions on Graphics (SIGGRAPH), 2021.
- Zachary Ferguson, Minchen Li, Teseo Schneider, Francisca Gil-Ureta, Timothy Langlois, Chenfanfu Jiang, Denis Zorin, Danny M. Kaufman, Daniele Panozzo. Intersection-free Rigid Body Dynamics. ACM Transactions on Graphics (SIGGRAPH), 2021.
- Lei Lan*, Yin Yang* (equal contribution), Danny M. Kaufman, Junfeng Yao, Minchen Li, Chenfanfu Jiang. Medial IPC: Accelerated Incremental Potential Contact With Medial Elastics. ACM Transactions on Graphics (SIGGRAPH), 2021.

- Xuan Li*, Jessica McWilliams* (equal contribution), Minchen Li, Cynthia Sung, Chenfanfu Jiang. Soft Hybrid Aerial Vehicle via Bistable Mechanism. IEEE International Conference on Robotics and Automation (ICRA), 2021. *[Best Paper Award in Mechanisms and Design]*
- Yue Li*, Xuan Li*, Minchen Li* (equal contribution), Yixin Zhu, Bo Zhu, Chenfanfu Jiang. Lagrangian-Eulerian Multi-Density Topology Optimization with the Material Point Method. International Journal for Numerical Methods in Engineering (IJNME), 2021.
- Minchen Li, Zachary Ferguson, Teseo Schneider, Timothy Langlois, Denis Zorin, Daniele Panozzo, Chenfanfu Jiang, Danny M. Kaufman. Incremental Potential Contact: Intersection- and Inversion-free, Large-Deformation Dynamics. ACM Transactions on Graphics (SIGGRAPH), 2020.
- Joshuah Wolper, Yunuo Chen, Minchen Li, Yu Fang, Ziyin Qu, Jiecong Lu, Meggie Cheng, Chenfanfu Jiang. AnisoMPM: Animating Anisotropic Damage Mechanics. ACM Transactions on Graphics (SIGGRAPH), 2020.
- Yu Fang*, Ziyin Qu* (equal contribution), Minchen Li, Xinxin Zhang, Yixin Zhu, Mridul Aanjaneya, Chenfanfu Jiang. IQ-MPM: An Interface Quadrature Material Point Method for Non-sticky Strongly Two-Way Coupled Nonlinear Solids and Fluids. ACM Transactions on Graphics (SIGGRAPH), 2020.
- Xinlei Wang*, Yuxing Qiu* (equal contribution), Stuart R. Slattery, Yu Fang, Minchen Li, Song-Chun Zhu, Yixin Zhu, Min Tang, Dinesh Manocha, Chenfanfu Jiang. A Massively Parallel and Scalable Multi-GPU Material Point Method. ACM Transactions on Graphics (SIGGRAPH), 2020.
- Xinlei Wang*, Minchen Li* (equal contribution), Yu Fang, Xinxin Zhang, Ming Gao, Min Tang, Danny M. Kaufman, Chenfanfu Jiang. Hierarchical Optimization Time Integration for CFL-rate MPM Stepping. ACM Transactions on Graphics, 2020 (presentation at SIGGRAPH 2020).
- Yupeng Jiang, Minchen Li, Chenfanfu Jiang, Fernando Alonso-Marroquin. A Hybrid Material-Point SpheropolygonElement Method for Solid and Granular Material Interaction. International Journal for Numerical Methods in Engineering (IJNME), 2020.
- Minchen Li, Ming Gao, Timothy Langlois, Chenfanfu Jiang, Danny M. Kaufman. Decomposed Optimization Time Integrator for Large-Step Elastodynamics. ACM Transactions on Graphics (SIGGRAPH), 2019.
- Yu Fang, Minchen Li, Ming Gao, Chenfanfu Jiang. Silly Rubber: An Implicit Material Point Method for Simulating Nonequilibrated Viscoelastic and Elastoplastic Solids. ACM Transactions on Graphics (SIGGRAPH), 2019.
- Joshuah Wolper, Yu Fang, Minchen Li, Jiecong Lu, Ming Gao, Chenfanfu Jiang. CD-MPM: Continuum Damage Material Point Methods for Dynamic Fracture Animation. ACM Transactions on Graphics (SIGGRAPH), 2019.
- Minchen Li, Danny M. Kaufman, Vladimir G. Kim, Justin Solomon, Alla Sheffer. OptCuts: Joint Optimization of Surface Cuts and Parameterization. ACM Transactions on Graphics (SIGGRAPH Asia), 2018.
- Minchen Li, Alla Sheffer, Eitan Grinspun, and Nicholas Vining. FoldSketch: Enriching Garments with Physically Reproducible Folds. ACM Transactions on Graphics (SIGGRAPH), 2018.
- Xinxin Zhang, Minchen Li, and Robert Bridson. Resolving Fluid Boundary Layers with Particle Strength Exchange and Weak Adaptivity. ACM Transactions on Graphics (SIGGRAPH), 2016.
- Minchen Li, Wei Cai, Ke Wang, Hong Ji, and Victor C.M. Leung. Prototyping Decomposed Cloud Software: A Case Study on 3D Skeletal Game Engine. IEEE International Conference on Cloud Computing Technology and Science (CloudCom), 2015.
- Wei Cai, Conghui Zhou, Minchen Li, Xiuhua Li, and Victor C.M. Leung. MCG Test-bed: An Experimental Test-bed for Mobile Cloud Gaming. ACM MobiSys Workshop on Mobile Gaming (MobiGames), 2015.

Invited Talks

Department of Computer Science and Engineering Seminar, UC San Diego Apr. 19, 2023
- Topic: Reliable Simulation of Frictional Contact for Deformable Solids and Beyond

Computer Science Department Seminar, Carnegie Mellon University Mar. 13, 2023
- Topic: Reliable Simulation of Frictional Contact for Deformable Solids and Beyond

Computer Science Department Seminar, Cornell University Mar. 6, 2023
- Topic: Reliable Simulation of Frictional Contact for Deformable Solids and Beyond

School of Interactive Computing Seminar, Georgia Institute of Technology Feb. 2, 2023

- Topic: Reliable Simulation of Frictional Contact for Deformable Solids and Beyond

Graphics And Mixed Environment Seminar (GAMES) Aug. 15, 2022
- Topic: Multibody Simulation with Affine Body Dynamics [Recording (Chinese)]

Graphics & Vision Seminar, Snap Research Jun. 16, 2022
- Topic: Multibody Simulation with Affine Body Dynamics

Social Robot Seminar, School of Film, Xiamen University Jun. 9, 2022
- Topic: Multibody Simulation with Affine Body Dynamics

Pixel Cafe Seminar, University of California, San Diego Apr. 29, 2022
- Topic: Multibody Simulation with Affine Body Dynamics

Software for Soft Robotics Research Workshop, RoboSoft 2022 Apr. 4, 2022
- Topic: Reliable Contact Simulation with IPC

Colloquia@CS, McGill University Mar. 25, 2022
- Topic: Reliable Contact Simulation with IPC

ACM SIGGRAPH Outstanding Doctoral Dissertation Award Talk Aug. 9, 2021
- Topic: Incremental Potential Contact

Graphics And Mixed Environment Seminar (GAMES) Nov. 26, 2020
- Topic: Incremental Potential Contact: Intersection- and Inversion-free, Large-Deformation Dynamics [Recording (Chinese)]

School of Computing (SoC) Seminar, Clemson University Nov. 20, 2020
- Topic: Robust and Accurate Simulation of Elastodynamics and Contact

Computer Graphics Summer School, Peking University Aug. 26, 2020
- Topic: Incremental Potential Contact: Intersection- and Inversion-free, Large-Deformation Dynamics

Graphics And Mixed Environment Seminar (GAMES) Sep. 5, 2019
- Topic: Decomposed Optimization Time Integrator for Large-Step Elastodynamics [Recording (Chinese)]

Graphics And Mixed Environment Seminar (GAMES) Dec. 27, 2018
- Topic: OptCuts: Joint Optimization of Surface Cuts and Parameterization [Recording (Chinese)]

Teaching

Instructor at University of California, Los Angeles

Math 164: Optimization *Fall 2022*
Math 151A: Applied Numerical Methods *Fall 2021*
Math 32A: Calculus of Several Variables *Summer 2021*

Teaching Assistant at University of Pennsylvania

EAS 205 – Scientific Computing (Instructor: Chenfanfu Jiang) *Spring 2020*
CIS 563 – Physically Based Animation (Instructor: Chenfanfu Jiang) *Fall 2019*

Teaching Assistant at University of British Columbia

CPSC 418 – Parallel Computation (Instructor: Mark R. Greenstreet) *Spring 2016*
CPSC 314 – Computer Graphics (Instructor: Mikhail Bessmeltsev) *Fall 2015*

Research Community Service

Program Committee

- ACM SIGGRAPH Asia (2023)
- Computer Graphics International (2023)
- ACM SIGGRAPH/Eurographics SCA (2023)
- Pacific Graphics (2022)

Reviewer

- NeurIPS (2023)
- Computer Graphics International (2023)
- Journal of Rock Mechanics and Geotechnical Engineering (2023)
- Computer Graphics Forum (2023)
- ACM SIGGRAPH/Eurographics SCA (2023)
- Journal of Impact Engineering (2022)
- Pacific Graphics (2022)
- ACM SIGGRAPH Asia (2021, 2022, 2023)
- The Visual Computer (2021)
- IEEE ICRA (2021, 2023)
- IEEE TVCG (2020, 2022, 2023)
- ACM Transactions on Graphics (2020, 2021, 2023)
- ACM SIGGRAPH (2020, 2021, 2022, 2023)
- Eurographics (2020)
- Virtual Reality (2019, 2020)

Media Publicity

- **UCLA Newsroom.** UCLA team receives best paper award at international robotics conference [Webpage]
- **Adobe Research News.** The Power of Collaboration: Former Research Interns Win SIGGRAPH Awards [Webpage]
- **UPenn CIS Blog.** Minchen Li receives ACM SIGGRAPH Outstanding Dissertation Award [Webpage]
- **Gizmodo.** Meat-Tearing CG Breakthrough Promises to Make Video Game Injuries Disgustingly Realistic [Webpage]
- **80 Level.** A New Approach to Anisotropic Damage Mechanics [Webpage]
- **ACM SIGGRAPH Blog.** New Research From University of Pennsylvania Examines Realistic Damage Mechanics [Webpage]
- **Business Wire.** SIGGRAPH 2020 Technical Papers Reveal the Latest Trends in Computer Graphics, Interactive Techniques [Webpage]
- **Animation Magazine.** SIGGRAPH 2020 Digs in to CG Trends with Tech Papers Program [Webpage]
- **Adobe Research News.** Nurturing the Next Generation of Computer Scientists: The Adobe Research Fellowship [Webpage]
- **VICE.** We Are Not Prepared for the Next Generation of CGI Food [Webpage]
- **The Takeout.** Advances in science: We can now tear CGI bread in half [Webpage]
- **80 Level.** Fracture Studies for Game and Movie Animation [Webpage]
- **Adobe Research News.** Interns Find Freedom to Innovate at Adobe Research [Webpage]