

# Minchen Li

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## 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, and a co-founder of TimeStep Inc. 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, 2021 Symposium on Computer Animation Doctoral Dissertation Award, and the 2020 Adobe Research Fellowship. His Ph.D. dissertation features the invention of 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

<b>University of Pennsylvania</b> <i>Ph.D. in Computer and Information Science</i> <ul style="list-style-type: none"><li>Thesis title: Robust and Accurate Simulation of Elastodynamics and Contact</li><li>Thesis advisor: Chenfanfu Jiang</li></ul>	Philadelphia, PA, USA <i>Sep. 2018 – Dec. 2020</i>
<b>University of British Columbia</b> <i>M.Sc. in Computer Science</i> <ul style="list-style-type: none"><li>Thesis title: FoldSketch: Enriching Garments with Physically Reproducible Folds</li><li>Thesis advisor: Alla Sheffer</li></ul>	Vancouver, BC, Canada <i>Sep. 2015 – Apr. 2018</i>
<b>Zhejiang University</b> <i>B.Eng. (Hons) in Computer Science and Technology</i> <ul style="list-style-type: none"><li>Thesis title: Skeletal Animation in Virtual Try-On System</li><li>Thesis advisor: Jijun Li</li></ul>	Hangzhou, China <i>Sep. 2011 – Jun. 2015</i>

## ACADEMIC POSITIONS

<b>Assistant Adjunct Professor</b> <i>Department of Mathematics, UCLA</i>	Jul. 2021 – present <i>Los Angeles, CA, USA</i>
<b>Postdoctoral Researcher</b> <i>SIG Lab, University of Pennsylvania</i> <ul style="list-style-type: none"><li>Advisor: Chenfanfu Jiang</li></ul>	Feb. 2021 – Jun. 2021 <i>Philadelphia, PA, USA</i>

**Mitacs Globalink Research Intern**  
*WiNMoS Lab, University of British Columbia*  
• Advisor: Victor C.M. Leung, Wei Cai

Jul. 2014 – Sep. 2014  
Vancouver, BC, Canada

## INDUSTRY EXPERIENCE

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<b>Co-Founder</b> <i>TimeStep Inc.</i>	Sep. 2021 – present <i>Los Angeles, CA, USA</i>
<b>Research Intern</b> <i>Creative Intelligence Lab, Adobe Research</i>	May. 2020 – Aug. 2020 <i>Seattle, WA, USA</i>
<b>Research Intern</b> <i>Creative Intelligence Lab, Adobe Research</i>	May. 2019 – Aug. 2019 <i>Seattle, WA, USA</i>
<b>Research Intern</b> <i>Creative Intelligence Lab, Adobe Research</i>	May. 2018 – Aug. 2018 <i>Seattle, WA, USA</i>
<b>Research Intern</b> <i>Creative Intelligence Lab, Adobe Research</i>	Sep. 2017 – Nov. 2017 <i>Seattle, WA, USA</i>

## AWARDS AND HONORS

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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 Bachelor Thesis Award	2015
First Class Scholarship for Outstanding Merits	2013 – 2014

## PUBLICATIONS [[GOOGLE SCHOLAR](#)]

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### 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:

- 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:

- 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).
- 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.
- Joshua 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. Slattey, 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).
- 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 Nonequibrated Viscoelastic and Elastoplastic Solids. ACM Transactions on Graphics (SIGGRAPH), 2019.
- Joshua 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

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|---|---------------|
| <b>Graphics And Mixed Environment Seminar (GAMES)</b>   | Aug. 15, 2022 |
| • Topic: Multibody Simulation with Affine Body Dynamics   |               |
| <b>Graphics &amp; Vision Seminar, Snap Research</b>   | Jun. 16, 2022 |
| • Topic: Multibody Simulation with Affine Body Dynamics   |               |
| <b>Social Robot Seminar, School of Film, Xiamen University</b>  | Jun. 9, 2022  |
| • Topic: Multibody Simulation with Affine Body Dynamics   |               |
| <b>Pixel Cafe Seminar, University of California, San Diego</b>  | Apr. 29, 2022 |
| • Topic: Multibody Simulation with Affine Body Dynamics   |               |
| <b>Software for Soft Robotics Research Workshop, RoboSoft 2022</b>  | Apr. 4, 2022  |
| • Topic: Reliable Contact Simulation with IPC   |               |
| <b>Colloquia@CS, McGill University</b>  | Mar. 25, 2022 |
| • Topic: Reliable Contact Simulation with IPC   |               |
| <b>ACM SIGGRAPH Outstanding Doctoral Dissertation Award Talk</b>  | Aug. 9, 2021  |
| • Topic: Incremental Potential Contact  |               |
| <b>Graphics And Mixed Environment Seminar (GAMES)</b>   | Nov. 26, 2020 |
| • Topic: Incremental Potential Contact: Intersection- and Inversion-free, Large-Deformation Dynamics<br>[Recording (Chinese)] |               |
| <b>School of Computing (SoC) Seminar, Clemson University</b>  | Nov. 20, 2020 |
| • Topic: Robust and Accurate Simulation of Elastodynamics and Contact   |               |
| <b>Computer Graphics Summer School, Peking University</b>   | Aug. 26, 2020 |
| • Topic: Incremental Potential Contact: Intersection- and Inversion-free, Large-Deformation Dynamics                          |               |
| <b>Graphics And Mixed Environment Seminar (GAMES)</b>   | Sep. 5, 2019  |
| • Topic: Decomposed Optimization Time Integrator for Large-Step Elastodynamics [Recording (Chinese)]                          |               |
| <b>Graphics And Mixed Environment Seminar (GAMES)</b>   | Dec. 27, 2018 |
| • Topic: OptCuts: Joint Optimization of Surface Cuts and Parameterization [Recording (Chinese)]                               |               |

## TEACHING

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### 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

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### Program Committee

- Pacific Graphics (2022)

### Reviewer [[Publons Profile](#)]

- Pacific Graphics (2022)
- ACM SIGGRAPH Asia (2021, 2022)
- The Visual Computer (2021)
- IEEE ICRA (2021)
- IEEE TVCG (2020, 2022)
- ACM Transactions on Graphics (2020, 2021)
- ACM SIGGRAPH (2020, 2021, 2022)
- Eurographics (2020)
- Virtual Reality (2019, 2020)

## MEDIA PUBLICITY

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- **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](#)]