

# CHENYANG YUAN

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## WORK

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**Research Scientist**, *Toyota Research Institute*, Cambridge, MA 2022–Present

- Explore optimization-based interpretations of diffusion models to improve fundamental understanding of how these models work
- Integrate numerical constraints into diffusion models, with applications to vehicle engineering design
- Develop and deploy optimization algorithms for planning and assignment tasks to improve factory logistics efficiency
- Publish basic research and/or file patents related to above topics

## EDUCATION

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**PhD in Electrical Engineering and Computer Science** 2018 – 2022

*Massachusetts Institute of Technology*, Cambridge, MA

GPA: 5/5

Thesis: *Polynomial Structure in Semidefinite Relaxations and Non-Convex Formulations*

**SM in Electrical Engineering and Computer Science**

2016 – 2018

*Massachusetts Institute of Technology*, Cambridge, MA

GPA: 5/5

Thesis: *Focused Polynomials, Random Projections and Approximation Algorithms for Polynomial Optimization over the Sphere*

**BA in Computer Science**

2012–2016

*The University of Berkeley at California*, Berkeley, CA

GPA: 3.94/4

## PROGRAMMING SKILLS

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**Proficient in** Python, Julia, PyTorch, Javascript, L<sup>A</sup>T<sub>E</sub>X, Emacs, Git, Docker

**Experience in** Java, C, Rust, Haskell, Scheme, HTML/CSS, Android, SQL, Assembly

## INTERNSHIPS

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**Research Intern**, *Lyft Inc.* June – September 2016

- Worked with locations team on estimation of travel times using real-time traffic data derived from driver GPS routes.

**Undergraduate Student Researcher**, *UC Berkeley*

Spring 2015 – Spring 2016

- With professor Alex Bayen’s group, worked on applying optimization to traffic control, inferring route flows of cars from cellular connection data and using queueing theory to investigate possible attacks on on-demand rideshare networks.

**Undergraduate Student Researcher**, *UC Berkeley*

Spring 2014 – Spring 2015

- With professor Ras Bodik’s group on the synthesis of a layout engine for an experimental browser, Servo, using SAT/SMT solvers.

**Software Engineering Intern**, *Clover Network Inc.*

June – September 2013

- Amongst other projects, designed and built an API auto-documentation system and API explorer.

## PUBLICATIONS

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Artem Lukoianov, **Chenyang Yuan**, Justin Solomon, Vincent Sitzmann (2025). Locality in Image Diffusion Models Emerges from Data Statistics. *Neural Information Processing Systems (NeurIPS Spotlight)*

Abulikemu Abuduweili, **Chenyang Yuan**, Changliu Liu, Frank Permenter (2025). Enhancing Sample Generation of Diffusion Models using Noise Level Correction. *Transactions on Machine Learning Research (TMLR)*

Jie Yun, **Chenyang Yuan**, Katherine Irelan, MJ Kabongo, Eldar Urkumbayev, David L. Des Marais (2025). A Machine Learning Enabled Approach to Assess Trade-offs between Growth and Stress Tolerance in Pooideae Grasses Following Domestication. *Journal Of Experimental Botany (JXB)*

Rui Zhou, Yanxia Zhang, **Chenyang Yuan**, Frank Permenter, Nikos Arechiga, Matt Klenk, Faez Ahmed (2025). Parametric-ControlNet: Multimodal Control in Foundation Models for Precise Engineering Design Synthesis. *Journal of Mechanical Design (JMD)*

Hayata Morita, Kohei Shintani, **Chenyang Yuan**, Frank Permenter (2025). WheelSDF: Implicit Representation-Based 3D Shape Generation and Interpolation for Wheel Design. *International Design Engineering Technical Conferences (IDETC)*

Binyang Song, **Chenyang Yuan**, Frank Permenter, Nikos Arechiga and Faez Ahmed (2024). Data-Driven Car Drag Prediction with Depth and Normal Renderings. *Journal of Mechanical Design (JMD)*

Frank Permenter\*, **Chenyang Yuan**\* (2024). Interpreting and Improving Diffusion Models from an Optimization Perspective. *International Conference on Machine Learning (ICML)*

Rui Zhou, **Chenyang Yuan**, Frank Permenter, Yanxia Zhang, Nikos Arechiga, Matt Klenk, Faez Ahmed (2024). Bridging Design Gaps: A Parametric Data Completion Approach With Graph-Guided Diffusion Models. *International Design Engineering Technical Conferences (IDETC)*

Yan-Ying Chen, Nikos Arechiga, **Chenyang Yuan**, Matthew Hong, Matt Klenk, Charlene Wu (2024). Stylish and Functional: Guided Interpolation Subject to Physical Constraints. *NeurIPS Workshop on Foundation Models for Science (FM4Science)*

Hayata Morita, Kohei Shintani, **Chenyang Yuan**, Frank Permenter (2024). VehicleSDF: A 3D generative model for constrained engineering design via surrogate modeling. *NeurIPS Workshop on Data-driven and Differentiable Simulations, Surrogates, and Solvers (D3S3)*

Binyang Song, **Chenyang Yuan**, Frank Permenter, Nikos Arechiga and Faez Ahmed (2023). Surrogate Modeling of Car Drag Coefficient with Depth and Normal Renderings. *International Design Engineering Technical Conferences (IDETC)*

Benoît Legat\*, **Chenyang Yuan**\* and Pablo Parrilo (2023). Low-Rank Univariate Sum of Squares Has No Spurious Local Minima. *SIAM Journal on Optimization (SIOPT)*

Nikos Arechiga\*, Frank Permenter\*, Binyang Song\* and **Chenyang Yuan**\* (2023). Drag-Guided Diffusion Models for Vehicle Image Generation. *NeurIPS Workshop on Diffusion Models*

**Chenyang Yuan** and Pablo Parrilo (2022). Maximizing Products of Linear Forms, and the Permanent of Positive Semidefinite Matrices. *Mathematical Programming Series A (MAPR)*

J. Thai, **C. Yuan**, A. Bayen (2016). Resiliency of Mobility-as-a-Service Systems to Denial-of-Service Attacks. *IEEE Transactions on Control of Network Systems (TCNS)*

**C. Yuan**\*, J. Thai\*, A. Bayen (2016). ZUbers against ZLyfts Apocalypse: An Analysis Framework for DoS Attacks on Mobility-as-a-Service Systems. *International Conference on Cyber-Physical Systems (ICCPS)*

MV Reddy, HY Cheng, JH Tham, **CY Yuan**, HL Goh, BVR Chowdari (2012). Preparation of Li(Ni<sub>0.5</sub>Mn<sub>1.5</sub>)O<sub>4</sub> by polymer precursor method and its electrochemical properties. *Electrochimica Acta*

(\* denotes equal contribution / alphabetical ordering)

## PREPRINTS

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**Chenyang Yuan** and Pablo Parrilo, Semidefinite Relaxations of Products of Nonnegative Forms on the Sphere, *Preprint*, *arxiv:2102.13220*

## SELECTED SOFTWARE PROJECTS

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**smalldiffusion** <https://github.com/yuanchenyang/smалldiffusion>  
 A lightweight diffusion library for training and sampling from diffusion models. It is built for easy experimentation when training new models and developing new samplers, supporting minimal toy models to state-of-the-art pretrained models.

**SumOfSquares.py** <https://github.com/yuanchenyang/SumOfSquares.py>  
 Sum of squares optimization modeller built on top of picos. Features easy access to pseudoexpectation operators for both formulating problems and extracting solutions via rounding algorithms

**Interactive SICP Textbook / coding.js** <http://xuanji.appspot.com/isicp/1-1-elements.html>  
 An interactive version of the classic Structure and Interpretation of Computer Programs book, created together with a friend. I wrote the asynchronous Javascript-based Scheme interpreter used on the website.

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## SELECTED AWARDS

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<b>Outstanding Course Development and Teaching Award</b> , for developing a new linear algebra course (EE16A) at UC Berkeley	<i>May 2016</i>
<b>First Place</b> , Cal vs Stanford Big Hack Created a scheme interpreter in C on my TI-89 graphing calculator	<i>Apr 2013</i>
<b>Honorable Mention</b> , 12th Asian Physics Olympiad One of the 8 students representing Singapore in this competition.	<i>May 2011</i>

## INVITED TALKS

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<b>ICCOPT</b> Session on Algebraic Methods in Optimization	<i>Jul 2025</i>
<b>ISMP</b> Session on Recent Advances in Quadratic and Semidefinite Optimization	<i>Jul 2024</i>
<b>MIT LIDS</b> Seminar	<i>Dec 2023</i>
<b>ICCOPT</b> Session on Algorithms for Large-scale Conic and Polynomial Optimization	<i>Jul 2022</i>
<b>MIT LIDS</b> and Stats Tea Talk	<i>Dec 2021</i>
<b>INFORMS Annual Meeting</b> Optimization in Julia Session	<i>Oct 2021</i>
<b>Fields Institute</b> Workshop on Real Algebraic Geometry and Algorithms	<i>Jun 2021</i>
<b>MIT LIDS</b> Student Conference	<i>Jan 2021</i>
<b>MIT</b> CS Theory Lunch	<i>Feb 2020</i>

## TEACHING

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<b>A Practical Introduction to Diffusion Models (6.S183)</b> , <i>MIT</i>	<i>IAP 2025</i>
<b>Algebraic Techniques and Semidefinite Programming (6.256)</b> , <i>MIT</i>	<i>Spring 2021</i>
<b>Linear Algebra and Optimization (6.S084/18.061)</b> , <i>MIT</i>	<i>Fall 2020/2021</i>
<b>Nonlinear Optimization (6.252)</b> , <i>MIT</i>	<i>Spring 2020</i>
<b>Efficient Algorithms and Intractable Problems (CS170)</b> , <i>UC Berkeley</i>	<i>Spring 2016</i>
<b>Designing Information Devices and Systems (EE16A)</b> , <i>UC Berkeley</i>	<i>Fall 2015</i>
<b>Discrete Mathematics and Probability Theory (CS70)</b> , <i>UC Berkeley</i>	<i>Spring 2015</i>
<b>Structure and Interpretation of Computer Programs (CS61A)</b> , <i>UC Berkeley</i>	<i>Fall 2013 – Fall 2014</i>
<b>Math/Physics Olympiad Trainer</b> , <i>NUS High School of Math and Science</i>	<i>March-August 2012</i>

## SELECTED COURSEWORK

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**CS:** *Berkeley:* Graduate Algorithms and Theory, Compilers, Security, AI, Randomized Algorithms. *MIT:* Advanced Algorithms, Inference and Information, Geometric Computing, Algebraic Techniques and Semidefinite Programming

**EE:** *Berkeley:* Information Theory, *MIT:* Dynamic Systems and Control

**Math:** *Berkeley:* Complex Analysis, Honors Abstract Algebra. *MIT:* High-dimensional Statistics

**Physics:** *Berkeley:* Analytical Mechanics, Quantum Mechanics, General Relativity, Electronics Lab

## REVIEWING EXPERIENCE

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SIAM Journal on Optimization (SIOPT); Mathematical Programming (MAPR); Optimization Letters; American Control Conference (ACC); Conference on Decision and Control (CDC); IEEE Control Systems Letters (L-CSS); International Conference on Learning Representations (ICLR); Journal of Machine Learning Research (JMLR); Journal of Combinatorics; Symposium on Theory of Computing (STOC); International Colloquium on Automata, Languages, and Programming (ICALP); Sum of Squares: Theory and Applications (book chapter)