

# Zhimin Fan

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## Education

### Nanjing University

M.Eng. in Computer Science and Technology Advisor: [Jie Guo](#) Average: 90.85/100.00 09/2023 – Present

Nanjing, China

### Southeast University

B.Eng. in Computer Science and Engineering GPA: 3.98/4.00 Average: 93.25/100.00 09/2019 – 06/2023

Nanjing, China

## Publications

### [DSCombiner: Double Shrinkage for Combining Biased and Unbiased Monte Carlo Renderings](#)

Chenxi Zhou, Keheng Xu, Mufan Guo, Xianhao Yu, **Zhimin Fan**, Guihuan Feng, Yanwen Guo, Jie Guo  
*ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2025)*

### [Bernstein Bounds for Caustics](#)

**Zhimin Fan**, Chen Wang, Yiming Wang, Boxuan Li, Yuxuan Guo, Ling-Qi Yan, Yanwen Guo, Jie Guo  
*ACM Transactions on Graphics (Proceedings of SIGGRAPH 2025)*

### [Multiple Importance Reweighting for Path Guiding](#)

**Zhimin Fan**, Yiming Wang, Chenxi Zhou, Ling-Qi Yan, Yanwen Guo, Jie Guo  
*ACM Transactions on Graphics (Proceedings of SIGGRAPH 2025)*

### [Specular Polynomials](#)

**Zhimin Fan**, Jie Guo, Yiming Wang, Tianyu Xiao, Hao Zhang, Chenxi Zhou, Zhenyu Chen, Pengpei Hong, Yanwen Guo, Ling-Qi Yan  
*ACM Transactions on Graphics (Proceedings of SIGGRAPH 2024)*

### [Conditional Mixture Path Guiding for Differentiable Rendering](#)

**Zhimin Fan**, Pengcheng Shi, Mufan Guo, Ruoyu Fu, Yanwen Guo, Jie Guo  
*ACM Transactions on Graphics (Proceedings of SIGGRAPH 2024)*

### [Manifold Path Guiding for Importance Sampling Specular Chains](#)

**Zhimin Fan**<sup>\*</sup>, Pengpei Hong<sup>\*</sup> (Joint first authors), Jie Guo, Changqing Zou, Yanwen Guo, and Ling-Qi Yan  
*ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2023)*

## Selected awards

National Scholarship, Nanjing University	2024, 2025
President Scholarship, Southeast University	2021
National Scholarship, Southeast University	2020
Gold Medal at International Collegiate Programming Contest (ACM-ICPC) Asia Regional Contest	2020
Provincial First Prize at the Chinese Physics Olympiad	2018
Provincial First Prize at National Olympiad in Informatics in Provinces	2016, 2017

## Academic services

**Reviewer:** SIGGRAPH (2025), SIGGRAPH Asia (2024; 2025×4), TOG (2025), TVCG (2024), EG (2025; 2026×2)

## Skills

**English:** TOEFL iBT 104 (R28/L26/S23/W27)

**Languages:** C/C++, Python, CUDA, GLSL

**Frameworks & Tools:** PyTorch, Mitsuba, Maya

## Research experience

### Physical constraints in specular light transport

07/2022 – 05/2025

(locally fitting constraint solutions → globally convergent solving → bounding and sampling)

- **Manifold Path Guiding for Importance Sampling Specular Chains**

Fitted the distribution of solutions to specular constraints.

Achieved up to 40x variance reduction over existing unbiased methods.

*Contributions: idea, main implementation & experiments, writing.*

- **Specular Polynomials**

Reformulated specular constraints into polynomial systems, enabling globally convergent root finding.

Reduced dimensionality with rational coordinate mappings and resultant methods.

*Contributions: idea, implementation (serial/CUDA), writing.*

- **Bernstein Bounds for Caustics**

Bound the constraint solutions, including their positions and irradiance, using the Bernstein polynomial basis.

Enabled low-variance sampling of specular triangles with up to an order-of-magnitude speedup.

*Contributions: idea, prototype & rendering code, main figures, writing.*

### Computational constraints for Monte Carlo rendering

02/2023 – 09/2025

(distribution-level → sample-level → estimator-level)

- **Conditional Mixture Path Guiding for Differentiable Rendering**

Formulated a distribution-level mixture of primal and differential distributions for path-derivative sampling.

*Contributions: idea, guiding framework implementation (JIT tracer), writing.*

- **Multiple Importance Reweighting for Path Guiding**

Analyzed sample-level reweighting behavior in adaptive MIS, focusing on low bias and consistency.

*Contributions: idea, experiments, writing.*

- **DSCombiner: Double Shrinkage for Combining Biased and Unbiased Monte Carlo Renderings**

Developed an estimator-level framework for merging biased and unbiased Monte Carlo integrators.

Derived an MSE-optimal combination rule, whose parameters are learned through a neural predictor.

*Contributions: idea discussion, writing support, polishing.*

## Research interests

My work investigates constraints in rendering, from physical constraints in specular light transport to computational constraints for Monte Carlo estimation. I am interested in extending these formulations toward data-driven and generative image synthesis, enabling controllability and physical consistency.

## Invited talks

### Light transport with specular constraints: modeling, solving, and bounding

08/2025

Outstanding Students Panel, CAD/CG

Yantai, China

### Recent advancements in specular path sampling

07/2025

Student Forum, CSIG Intelligent Graphics Frontiers Seminar

Taiyuan, China

### Research experience on path sampling for realistic rendering

05/2025

GAMES Polaris Forum

Online

## Industrial experience

### Bytedance Technology

Beijing, China

R&D Intern, Graphics development

07/2022 – 01/2023

Implemented several projection algorithms for panoramic video, using OpenGL ES, Metal, and Unity.