SHAONING HAN

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RESEARCH INTERESTS

- **Methodologies:** mixed-integer programming, nonconvex and nonsmooth optimization, submodular optimization, variational inequality, (parametric) pivoting methods
- **Applications:** inference problems with combinatorial structures in statistics and machine learning, portfolio optimization and risk, data science, signal denoising, revenue management, quality control

ACADEMIC EMPLOYMENT

National University of Singapore Singapore
Department of Mathematics
Institute of Operations Research and Analytics (Courtesy Appointment)
Presidential Young Professor (Assistant Professor) July 2024 - Present

University of Southern California Los Angeles, CA, USA
Department of Industrial & Systems Engineering
Postdoctoral Scholar August 2022 - June 2024
• Advisor: Jong-Shi Pang

EDUCATION

Ph.D in Industrial Engineering, University of Southern California, August 2022
• Advisor: Andrés Gómez

B.S. in Mathematics, University of Science and Technology of China, June 2017

HONORS & AWARDS

- INFORMS Computing Society Prize, 2025
- Mathematical Programming 2024 Meritorious Service Award, 2025
- Third Place, INFORMS Junior Faculty Interest Group (JFIG) Paper Prize, 2023
- Honorable Mention, Journal of Global Optimization Best Paper Award, 2023

JOURNAL PAPERS

1. Improving the Solution of Indefinite Quadratic Programs and Linear Programs with Complementarity Constraints by a Progressive MIP Method.
   Xinyao Zhang, **Shaoning Han**, and Jong-Shi Pang.
   Mathematical Programming Computation (2025).

2. Analysis of a Class of Minimization Problems Lacking Lower Semicontinuity.
   Shaoning Han, Ying Cui, and Jong-Shi Pang.
   Mathematics of Operations Research (2024).

3. Compact Extended Formulations for Low-rank Functions with Indicator Variables.
   Shaoning Han, and Andrés Gómez.
   Mathematics of Operations Research (2024).
   • Third Place, INFORMS JFIG Paper Competition (2023).

4. Continuous Selections of Solutions to Parametric Variational Inequalities.
   Shaoning Han, and Jong-Shi Pang.
   SIAM Journal on Optimization (2024), Vol. 34 (1), pp. 870–892.

5. On the Number of Pivots of Dantzig's Simplex Methods for Linear and Convex Quadratic Programs.
   Shaoning Han, Xinyao Zhang, and Jong-Shi Pang.
   Operations Research Letters (2024).

6. Comparing Solution Paths of Sparse Quadratic Minimization with a Stieltjes Matrix.
   Ziyu He, **Shaoning Han**, Andrés Gómez, Ying Cui, and Jong-Shi Pang.
   Mathematical Programming (2024), Vol. 204, pp. 517–566.

7. 2×2-Convexifications for Convex Quadratic Optimization with Indicator Variables.
   Shaoning Han, Andrés Gómez, and Alper Atamtürk.
   Mathematical Programming (2023), Vol. 202, pp. 95–134.

8. Some Strongly Polynomially Solvable Convex Quadratic Programs with Bounded Variables.
   Jong-Shi Pang, and **Shaoning Han**.
   SIAM Journal on Optimization (2023), Vol. 33 (2), pp. 899–920.

9. The Equivalence of Optimal Perspective Formulation and Shor's SDP for Quadratic Programs with Indicator variables.
   Shaoning Han, Andrés Gómez, and Alper Atamtürk.
   Operations Research Letters (2022), Vol. 50 (2), pp. 195–198.

10. Fractional 0-1 Programming and Submodularity.
    Shaoning Han, Andrés Gómez, and Oleg A. Prokopyev.
    Journal of Global Optimization (2022), Vol. 84, pp. 77–93.
    • Honorable Mention, Journal of Global Optimization Best Paper Award (2023)

11. Sparse and Smooth Signal Estimation: Convexification of ℓ_0-Formulations.
    Alper Atamtürk, Andrés Gómez, and **Shaoning Han**. [alphabetical order]
    Journal of Machine Learning Research (2021), Vol. 22 (52), pp. 1–43.

PREPRINTS

1. Convex Submodular Minimization with Indicator Variables.
   Shaoning Han and Andrés Gómez.
   Submitted (2025).

2. Real-Time Solution of Quadratic Optimization Problems with Banded Matrices and Indicator Variables.
   Andrés Gómez, **Shaoning Han**, and Leonardo Lozano.
   Revision under review at **Operations Research** (2025).

3. Rank-one convexification for quadratic optimization problems with step function penalties.
   Soobin Choi, Valentina Cepeda, Andrés Gómez, and **Shaoning Han**.
   Submitted (2024).

4. Single-Neuron Convexifications for Binarized Neural Networks.
   Shaoning Han, and Andrés Gómez.
   Technical Report (2021).

TEACHING

National University of Singapore

- *MA 3253: Linear and Network Optimization* (Undergraduate Level), Spring 2025
- *MA 5243: Advanced Mathematical Programming* (Graduate Level), Fall 2024, 2025

University of Southern California

- *ISE 530: Optimization Methods for Analytics* (Graduate Level), Fall 2023

TALKS

- *Analysis of a Class of Heaviside Composite Minimization Problems.* INFORMS Annual Meeting, Atlanta, GA, October 2025
- *Real-Time Solution of Mixed-Integer Quadratic Programs Using Decision Diagrams.* Research Seminar, Indian Statistical Institute, Virtual, September 2025
- *Analysis of a Class of Heaviside Composite Minimization Problems.* International Conference on Continuous Optimization, Los Angeles, CA, July 2025
- *Real-Time Solution of Mixed-Integer Quadratic Programs Using Decision Diagrams.* Young Applied Mathematicians Forum, Singapore, January 2025
- *Exploiting Submodularity in Mixed-Integer Convex Optimization.* NUS-PKU-SJTU Workshop on Data Science and Machine Learning, Singapore, November 2024
- *Real-Time Solution of Mixed-Integer Quadratic Programs Using Decision Diagrams.* INFORMS Annual Meeting, Seattle, WA, October 2024
- *On Polynomial-Time Solvability of Combinatorial Markov Random Fields.* 25th International Symposium on Mathematical Programming (ISMP), Montréal, Québec, Canada, July 2024
- *Polynomial-time solvability of combinatorial Markov random fields.* INFORMS Optimization Society Conference, Houston, TX, March 2024
- *On the convex hull of mixed-integer nonlinear submodular minimization.* INFORMS Annual Meeting, Phoenix, AZ, October 2023
- *Mixed-binary convex quadratic optimization and its applications in inference with sparsity.* The Academy of Mathematics and Systems Science (AMSS) of the Chinese Academy of Sciences, China, March 2023
- *On polynomial-time solvability of combinatorial Markov random fields.* INFORMS Annual Meeting, Indianapolis, IN, October 2022
- *Convexification for low-rank functions with indicator variables.* International Conference on Continuous Optimization, Bethlehem, PA, July 2022
- *Strongly polynomial algorithm for box-constrained quadratic programs with H_0-matrix.* INFORMS Optimization Society Conference, Greenville, SC, March 2022
- *Fractional 0-1 programming and submodularity.* INFORMS Annual Meeting, Anaheim, CA, October 2021
- *On SDP formulations for quadratic optimization with indicator variables.* INFORMS Annual Meeting, virtual, November 2020

SERVICE

Journal/Conference Reviewer

- Mathematical Programming (Series A and B)
- SIAM Journal on Optimization
- Operations Research
- Mathematics of Operations Research
- Journal of Global Optimization
- Operations Research Letters
- Computational Optimization and Applications
- Journal of Optimization Theory and Applications
- Vietnam Journal of Mathematics
- Naval Research Logistics
- Optimization Letters
- Conference on Integer Programming and Combinatorial Optimization (IPCO)

Session Chair

- Nonsmooth Optimization - Theory and Algorithms, 2025 International Conference on Continuous Optimization (ICCOPT), Los Angeles, CA, July 2025
- Recent algorithmic advances in nonsmooth optimization, 2024 INFORMS Optimization Society Conference, Houston, TX, March 2024
- Recent advances in convex and mixed-integer conic optimization, 2024 INFORMS Optimization Society Conference, Houston, TX, March 2024
- Recent advances in nonsmooth optimization, 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
- Recent advances in mixed-integer nonlinear programming, 2023 INFORMS Annual Meeting, Phoenix, AZ, October 2023
- Algorithms for discrete optimization problems, 2022 INFORMS Optimization Society Conference, Greenville, SC, March 2022

Professional Member

- Institute for Operations Research and the Management Sciences (INFORMS)
- Society for Industrial and Applied Mathematics (SIAM)
- Mathematical Optimization Society (MOS)
- Association for Computing Machinery (ACM)

PhD Qualifying Exam Committee Member

- Xinyao Zhang (USC, ISE)