CHUWEN ZHANG

Contact Information

- Email: chuwzhang@gmail.com
- GitHub: https://github.com/bzhangcw
- URL: https://bzhangcw.github.io
- Phone: (+86) 13227265529

Academic Background

The University of Chicago

Principal Postdoctoral Researcher, Booth School of Business — July. 2025 - July. 2026 (expected)
Advisor: Amy R. Ward

Purdue University

Visiting PhD Student, Mitchell E. Daniels, Jr. School of Business — Mar. 2024 - Mar. 2025
Advisor: Pengyi Shi

Shanghai University of Finance and Economics

Ph.D. Candidate in Management Science and Engineering — Sept. 2021 - June. 2025 (expected)
Advisor: Yinyu Ye, Dongdong Ge
Thesis: Homogeneous Models for Second-Order Methods and Interior-Point Algorithms.

The University of Texas at Austin

M.S. in Operations Research, 3.9/4.0 — Aug. 2015 - Jun. 2017
Advisor, Jonathan F. Bard

Shanghai Jiao Tong University

B.E. in Industrial Engineering, 3.7/4.3 — Sept. 2011 - Jun. 2015

Professional Experience

Cardinal Operations (Shanshu)

- Algorithm Expert — Oct. 2021 - current
- Senior & Staff Algorithm Engineer — Oct. 2019 - Oct. 2021
- Algorithm Engineer (Operations Research) — Sept. 2018 - Sept. 2019

Responsible for design of optimization models and algorithms for smart decision making for complex business scenarios. Participated in key projects with major companies and research institutions.

Publications

Working papers & preprints

[£]: equal contribution, $(\alpha\beta)$: alphabetic order, [€]: corresponding author.

- **C Zhang**, P Shi, A Ward. A Game-Theoretic Framework of Fairness Dynamics: Equilibrium, Control and Beyond (in preparation)
- **C Zhang**, C He, B Jiang, Y Ye. Price Updating by Barrier Algorithms (in preparation for *Operations Research*)
- **C Zhang**[£], Y Jiang[£], B Jiang, D Ge, Y Ye. Infeasible Primal-Dual Interior-Point Methods for Nonconvex Conic Optimization
- Y Jiang[£], C He[£], **C Zhang**[£€], D. Ge, B. Jiang, and Y. Ye, "A Universal Trust-Region Method for Convex and Nonconvex Optimization," arXiv preprint arXiv:2306.17516, 2023.

Journal publications

J6 C He[£], Y Jiang[£], **C Zhang**[£€], D Ge, B Jiang, and Y Ye. Homogeneous Second-Order Descent Framework: A Fast Alternative to Newton-Type Methods, 2025, *Mathematical Programming (to appear)*.

J5 **C Zhang**, D Ge, C He, B Jiang, Y Jiang, C Xue, and Y Ye. A Homogeneous Second-Order Descent Method for Nonconvex Optimization, 2025, *Mathematics of Operations Research (to appear)*.

J4 M Zhang[£], J Yang[£], **C Zhang**[£], S He, H Liu, J Wang, and Z Wang. An approximate dynamic programming approach for solving aircraft fleet engine maintenance problem: Methodology and a case study. European Journal of Operational Research, October 2024, DOI: 10.1016/j.ejor.2024.10.008

J3 ($\alpha\beta$) Q Deng, Q Feng, W Gao, D Ge, B Jiang, Y Jiang, J Liu, T Liu, C Xue, Y Ye, and **C Zhang**. An Enhanced Alternating Direction Method of Multipliers-Based Interior Point Method for Linear and Conic Optimization. *INFORMS Journal on Computing*, 2024, DOI: 10.1287/ijoc.2023.0017

J2 R Wang, **C Zhang**, S Pu, J Gao, and Z Wen. A Customized Augmented Lagrangian Method for Block-Structured Integer Programming. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 46(12):9439–9455, December 2024, DOI: 10.1109/TPAMI.2024.3416514

J1 **C Zhang**, J. F Bard, and R Chacon. Controlling work in process during semiconductor assembly and test operations. *International Journal of Production Research*, 55(24):7251–7275, 2017, DOI: 10.1080/00207543.2017.1333649

Conference publications

C2 C Xie, C Li, **C Zhang**, Q Deng, D Ge, and Y Ye. Trust Region Methods for Nonconvex Stochastic Optimization beyond Lipschitz Smoothness. *Proceedings of the AAAI Conference on Artificial Intelligence*, 38(14):16049–16057, 2024, DOI: 10.1609/aaai.v38i14.29537

C1 J Tan, C Xue, **C Zhang**, Q Deng, D Ge, and Y Ye. A Homogenization Approach for Gradient-Dominated Stochastic Optimization. In *Proceedings of the Fortieth Conference on Uncertainty in Artificial Intelligence*, pages 3323–3344. PMLR, September 2024

Technical Reports

- C He, Y Jiang, **C Zhang**, D Ge, B Jiang, and Y Ye. Technical Report: The Homogeneous Second-Order Descent Framework with Inexact Eigenvalue Computations. Technical report, 2024
- H Lu, J Yang, H Hu, Q Huangfu, J Liu, T Liu, Y Ye, **C Zhang**, and D Ge. cuPDLP-C: A Strengthened Implementation of cuPDLP for Linear Programming by C language, January 2024. arXiv:2312.14832 [math]
- **C Zhang**, D Ge, C He, B Jiang, Y Jiang, and Y Ye, DRSOM: A Dimension Reduced Second-Order Method.

Software

ABIP: An ADMM-based IPM for linear and conic optimization

- GitHub: `https://github.com/leavesgrp/ABIP`.

cuPDLP-C: C Implementation of PDLP for linear programming

- GitHub: `https://github.com/COPT-Public/cuPDLP-C`.

Conference Talks & Workshops

- A Homogeneous Framework for Nonconvex and Convex Optimization
  July 2024, International Symposium on Mathematical Programming, Montréal, Canada
- Homogeneous Second-Order Methods for Nonconvex and Convex Optimization
  May 2023, SIAM Conference on Optimization, Washington, USA
- DRSOM: A Dimension-Reduced Second-Order Method
  Dec. 2022, NeurIPS Workshop, Higher-Order Optimization, Spotlight paper
  Oct. 2022, INFORMS Annual Meeting, Indianapolis, USA

Industrial Projects

High-speed railway: train scheduling and timetable optimization

Cardinal Operations Apr. 2020 - Dec. 2023

- Developed space-time network model for the train timetabling problem (TTP) on a macro level for Beijing-Shanghai high-speed railway (or Jinghu high-speed railway in Mandarin). As one of the busiest railways in the world, the Beijing-Shanghai high-speed railway transported over 210 million passengers in 2019.1 In our test case, the problem consists of 29 stations and 292 trains in both directions (up and down), including two major levels of speed: 300 km/h and 350 km/h.
- Designed optimization algorithms for Chinese high-speed railway network to improve the efficiency of train scheduling and timetable. Implemented a novel augmented Lagrangian method/heuristics for the TTP, the results, for the first time, show that the proposed method can successfully schedule all 584 trains in 15 min.
- Research paper: A Customized Augmented Lagrangian Method for Block-Structured Integer Programming. IEEE Transactions on Pattern Analysis and Machine Intelligence, 46(12):9439–9455, December 2024, DOI: 10.1109/TPAMI.2024.3416514.

Fleet engine maintenance and lifecycle management

Cardinal Operations Apr. 2020 - Dec. 2023

- Designed optimization algorithms for one of China's "Big Three" airlines to decrease immense engine maintenance costs. The goal is to generate optimal repair plans for engines within the entire fleet, to ensure high service levels, and to minimize zero-backup risks under stochastic damage development and uncertain failure events captured by the distributional robust approach.
- Research paper: An approximate dynamic programming approach for solving aircraft fleet engine maintenance problem: Methodology and a case study. *European Journal of Operational Research*, October 2024, DOI: 10.1016/j.ejor.2024.10.008

Algorithms for air-cargo operation optimization

Cardinal Operations Sept. 2019 - Dec. 2019

- Designed optimization algorithms for an air-cargo operation problem in a top global courier company. Implemented MILP, mixed integer SOCP programs for the upper-level aircraft parking problem, and heuristic based scheduling algorithms to operate cargo trucks to minimize the total transferring distance and total operation time. Established approaches for dynamic and DRO extension (under uncertain plane schedule and ground transferring time) from the static assignment problem. Based on simulation results, our position assignments and scheduling algorithm reduce total operation time by 30% on average.
- Applied a geometric rounding algorithm to integral assignment constraints on fractional solutions by the SOCP or LP relaxation, which achieves a 10% relative MIP gap comparable to 8% obtained by mixed integer solvers for a static planning horizon of 24 hours.

- Responsible for solution architecture design, modeling with Mosek and Gurobi, geometric rounding, and most of the software engineering tasks.

Large-scale MILP algorithm design for production planning

Cardinal Operations Sept. 2018 - Sept. 2019

- Developed a large-scale planning model for a global ICT giant to tackle difficulties in delivery requirements and to maintain a favorable service level.
- Designed an LP-based iterative framework to decompose the full problem via various pre and post processing techniques, graph-based heuristics to deal with integral and nonlinear features. The model has been deployed and used in real production.
- Responsible for solution architecture design, modeling with Gurobi, rounding heuristics, and a large part of software engineering tasks. Later responsible for major revision of the entire system to support transition to COPT.
- Extended the model as a S&OP and APS product tailored for manufacturing industry. The product has been used in projects with other industry leaders in China.

Skills

Proficient: Python, Julia, Scala, C++

Modeling: JuMP, Mosek, Gurobi, COPT, CLP, Spark ML

Summary: proficient in linear, conic, and mixed integer optimization, and methods for large scale applications with real-world practice. Familiar with common machine learning algorithms and experienced in modeling pipeline in big data environment.