

Kaizhao Sun

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CURRENT EMPLOYMENT

- **DAMO Academy, Alibaba Group (U.S.) Inc.** Bellevue, WA, USA
Senior Algorithm Engineer in the Decision Intelligence Lab Jun. 2022–Present

EDUCATION

- **Georgia Institute of Technology** Atlanta, GA, USA
Ph.D. in Operations Research with a minor in Mathematics Aug. 2017–May 2022
– Thesis: Decomposition Algorithms based on the Nonconvex Augmented Lagrangian Framework
- **Georgia Institute of Technology** Atlanta, GA, USA
B.S. in Industrial and Systems Engineering (Operations Research Track) Aug. 2013–May 2017
B.S. in Mathematics (Discrete Math Track) Aug. 2013–May 2017

RESEARCH INTEREST

I am interested in optimization (math program) in its broad sense. In particular, I have been using decomposition methods to design parallel algorithms for challenging nonconvex problems, both continuous and discrete, from engineering and data sciences.

PUBLICATIONS AND PREPRINTS

- [1] **K. Sun**, M. Sun, and W. Yin, “Decomposition methods for global solutions of mixed-integer linear programs”, *SIAM Journal on Optimization*, vol. 34, no. 2, pp. 1206–1235, 2024.
- [2] **K. Sun** and X. A. Sun, “Dual descent ALM and ADMM”, *SIAM Journal on Optimization*, 2024.
- [3] I. Aravena, D. K. Molzahn, S. Zhang, C. G. Petra, *et al.*, “Recent developments in security-constrained AC optimal power flow: Overview of challenge 1 in the ARPA-E grid optimization competition”, *Operations Research*, vol. 71, no. 6, pp. 1997–2014, 2023.
- [4] A. Gholami, **K. Sun**, S. Zhang, and X. A. Sun, “An ADMM-based distributed optimization method for solving security-constrained AC optimal power flow”, *Operations Research*, vol. 71, no. 6, pp. 2045–2060, 2023.
- [5] **K. Sun** and X. A. Sun, “A two-level distributed algorithm for nonconvex constrained optimization”, *Computational Optimization and Applications*, vol. 84, no. 2, pp. 609–649, 2023.
- [6] **K. Sun** and X. A. Sun, “Algorithms for difference-of-convex programs based on difference-of-moreau-envelopes smoothing”, *INFORMS Journal on Optimization*, vol. 5, no. 4, pp. 321–339, 2023.
- [7] **K. Sun** and X. A. Sun, “A two-level ADMM algorithm for AC OPF with global convergence guarantees”, *IEEE Transactions on Power Systems*, vol. 36, no. 6, pp. 5271–5281, 2021.

EXPERIENCE

- **Georgia Institute of Technology** Atlanta, GA, USA
Graduate Research Assistant Aug. 2017–May 2022

- Decomposition algorithms for large-scale nonconvex constrained programs.
- Research collaboration with ISO New England on decentralized OPF.

Graduate Teaching Assistant

- ISyE 6669: Deterministic Optimization Spring 2018 and Fall 2018
- ISyE 6644: Simulation and Modeling for Engineering and Science Spring 2018
- ISyE 3103: Introduction to Supply Chain Modeling: Logistics Fall 2017

- **Damo Academy, Alibaba Group US** Bellevue, WA, USA
 Research Intern at Decision Intelligence Lab Jun. 2020–Aug. 2020
 - Mentors: Dr. Wotao Yin, Dr. Jian Tan, and Mou Sun.
 - Studied generic two-block mixed-integer linear programs (MILP) with block angular structures.
 - Proposed an ALM-based decomposition framework and an ADMM variant with convergence guarantees.
 - Demonstrated the exactness and efficiency of the proposed algorithms on various MILP problems.

GRID OPTIMIZATION COMPETITION

I have participated in the ARPA-E Grid Optimization Competition (GO Competition) Challenges I and II. Entrant teams from around the globe strive to develop innovative algorithmic software for modern power grids in the form of coding competition. I am a member of the GMI-GO team led by faculty advisors Prof. X. Andy Sun (PI) and Prof. Santanu Dey.

- **ARPA-E Grid Optimization Competition Challenge 1** Nov. 2018–Feb. 2020
 GMI-GO Team Member
 - Problem: Security-constrained AC Optimal Power Flow (SC-ACOPF) under time limit. (In optimization language, this is a large-scale + two-stage + mixed-integer nonlinear program.)
 - Our Approach: We deployed various optimization techniques in C++, including:
 - * smoothing techniques for disjunctive constraints;
 - * outer approximation of second-order cones;
 - * a convergence-guaranteed distributed algorithm through MPI;
 - * an effective contingency screening method;
 - * extensive engineering tuning and experiments of Ipopt, Gurobi, and Mosek;
 - * various safe-guarding mechanisms for robust solution output.
 - Result: Our team ranked in third place in the Final Event, receiving \$400,000 research grants award.
- **ARPA-E Grid Optimization Competition Challenge 2** Aug. 2020–Oct. 2021
 GMI-GO Team Member
 - Extension of SC-ACOPF with additional complicated constraints:
 - * unit commitment, line switching, discretized tap ratio and phase shift.
 - Result: Our team was among the competition prize winners, receiving a total of \$120,000 research grants award:
 - * third place in off-line divisions of Challenge 2 Trial Event 3 (\$60,000);
 - * fifth place in real-time divisions of Challenge 2 Final Event (\$60,000).

AWARDS AND HONORS

- Prize-winning team in ARPA-E Grid Optimization Challenge 2 October 2021
- Third-place team in ARPA-E Grid Optimization Challenge 1 February 2020
- McLean Fellowship Stipend Fall 2018 and Spring 2019
- ISyE Stipend Fall 2017 and Spring 2018

INVITED AND CONTRIBUTED TALKS

- Dual Descent ALM and ADMM
 - ISyE Ph.D. Student Seminar, GA, USA, Nov. 2021
 - INFORMS Annual Meeting, Indianapolis, IN, USA, Oct. 2022
- Algorithms for DC Programs Based on DME Smoothing
 - SIAM Conference on Optimization (OP21), Virtual, Jul. 2021
 - INFORMS Annual Meeting, Anaheim, CA, USA, Oct. 2021
 - INFORMS Optimization Society Conference, Greenville, SC, USA, Mar. 2022
- Decomposition Methods for Global Solutions of Mixed-Integer Linear Programs
 - Integer Programming and Combinatorial Optimization (IPCO) Workshop (poster), Virtual, May 2021
 - Mixed Integer Programming (MIP) Workshop (poster), Virtual, May 2021
 - SIAM Conference on Optimization (OP23), Seattle, WA, USA, May 2023
- A Two-level ADMM Algorithm for AC OPF with Global Convergence Guarantees
 - Power Systems Engineering Research Center (PSERC) Meeting (poster)
 - * Phoenix, AZ, USA, Dec. 2017
 - * Wichita, KS, USA, May 2018
 - Georgia Tech Workshop on Electric Energy Systems and Optimization (poster)
 - * Atlanta, GA, USA, Nov. 2018
 - * Atlanta, GA, USA, Nov. 2019
 - INFORMS Annual Meeting, Virtual, Oct. 2020
- Distributed Algorithms for Sparse Regression
 - INFORMS Annual Meeting, Seattle, WA, USA, Oct. 2020
- A Two-level Distributed Algorithm for Nonconvex Constrained Optimization
 - INFORMS Annual Meeting, Phoenix, AZ, USA, Oct. 2018
 - International Conference on Continuous Optimization (ICCOPT), Berlin, Germany, Aug. 2019

SERVICE

- Session co-chair for *Recent Advances in Stochastic Programs and Structured Discrete Optimization*, SIAM Conference on Optimization 23, Seattle, WA
- Session chair for *Forecasting/Accounting and Nonlinear Programming*, INFORMS Annual Meeting 21, Anaheim, CA
- Session Co-chair of the session *Distributed and Decentralized Optimization*, ICCOPT 2019, Berlin, Germany
- External reviewer for
 - Optimization: MOR, MPC, JOTA, IJOO, Quantum,
 - Power Systems: IEEE (TAC, TCNS, TII, TPWRS, TSG, L-CSS), IET, ACC, CDC
 - Machine Learning: AISTATS 21, NeurIPS 22

TECHNICAL SKILLS

- Programming Languages: working knowledge of C++, Julia, Python, and Matlab.
- Optimization Solvers: experience with IPOPT, Gurobi, Mosek, Baron, Bonmin, Couenne, and Xpress.
- Typesetting: L^AT_EX and Markdown.