

## EDUCATION

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- **Georgia Institute of Technology** Atlanta, GA, USA  
Ph.D. in Operations Research with a minor in Mathematics August 2017–May 2022
  - Thesis: Decomposition Algorithms based on the Nonconvex Augmented Lagrangian Framework
  - Committee: Drs. Xu Andy Sun (advisor), Santanu S. Dey, Renato D.C. Monteiro, Wotao Yin, and Enlu Zhou
  - Relevant Courseworks: Linear/Convex/Nonlinear/Discrete Optimization, Machine Learning, Stochastic Process, Simulation, Numerical Analysis, Functional Analysis, Graph Theory
- **Georgia Institute of Technology** Atlanta, GA, USA  
B.S. in Industrial and Systems Engineering (ISyE) August 2013–May 2017
  - Capstone Project: Work Measurement Improvement for UPS Small Package Facility  
B.S. in Discrete Mathematics August 2013–May 2017
  - Thesis: A MIP Formulation of the Unit Commitment Problem and Polytope Analysis

## RESEARCH INTERESTS

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My research focuses on the theory and application of optimization. I am currently working on:

- distributed and decomposition algorithms for large-scale continuous/discrete optimization,
- theory and algorithms based on nonconvex augmented Lagrangian duality,
- convexification and smoothing in optimization, and
- sampling algorithms.

I am also interested in efficient and practical solution methods for nonconvex nonsmooth problems arising from data science and engineering fields.

## PUBLICATIONS

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- [1] A. Gholami, **K. Sun**, S. Zhang, and X. A. Sun, “Solving large-scale security constrained ac optimal power flow problems”, *arXiv preprint arXiv:2202.06787*, 2022.
- [2] **K. Sun**, M. Sun, and W. Yin, “Decomposition methods for global solutions of mixed-integer linear programs”, *arXiv preprint arXiv:2102.11980*, 2021.
- [3] **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.
- [4] **K. Sun** and X. A. Sun, “Algorithms for difference-of-convex (DC) programs based on difference-of-Moreau-envelopes smoothing”, *arXiv preprint arXiv:2104.01470*, 2021.
- [5] **K. Sun** and X. A. Sun, “Dual descent ALM and ADMM”, *arXiv preprint arXiv:2109.13214*, 2021.
- [6] **K. Sun** and X. A. Sun, “A two-level distributed algorithm for general constrained non-convex optimization with global convergence”, *arXiv preprint arXiv:1902.07654*, 2019.

## EXPERIENCE

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- **Georgia Institute of Technology**

Graduate Research Assistant

Atlanta, GA, USA

January 2017-Present

- 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

- **Alibaba US-Damo Academy**

Research Intern at Decision Intelligence Lab

Bellevue, WA, USA

June 2020-August 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

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I have been participating in the ARPA-E Grid Optimization Competition (GO Competition). 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**

GMI-GO Team Member

November 2018-February 2020

- 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**

GMI-GO Team Member

August 2020-October 2021

- 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

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- Prize-winning team in ARPA-E Grid Optimization Challenge 2 October 2021
- SIAM Conference on Optimization (OP21) Student Travel Award Summer 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

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- Dual Descent ALM and ADMM
  - ISyE Ph.D. Student Seminar, GA, USA, November 2021
- Algorithms for DC Programs Based on DME Smoothing
  - SIAM Conference on Optimization (OP21), Virtual, July 2021
  - INFORMS Annual Meeting, Anaheim, CA, USA, October 2021
  - INFORMS Optimization Society Conference, SC, USA, March 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
- A Two-level ADMM Algorithm for AC OPF with Global Convergence Guarantees
  - Power Systems Engineering Research Center (PSERC) Meeting (poster)
    - \* Phoenix, AZ, USA, December 2017
    - \* Wichita, KS, USA, May 2018
  - Georgia Tech Workshop on Electric Energy Systems and Optimization (poster)
    - \* Atlanta, GA, USA, November 2018
    - \* Atlanta, GA, USA, November 2019
  - INFORMS Annual Meeting, Virtual, October 2020
- Distributed Algorithms for Sparse Regression
  - INFORMS Annual Meeting, Seattle, WA, USA, October 2020
- A Two-level Distributed Algorithm for Nonconvex Constrained Optimization
  - INFORMS Annual Meeting, Phoenix, AZ, USA, October 2018
  - International Conference on Continuous Optimization (ICCOPT), Berlin, Germany, August 2019

## SERVICE

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- Session chair for *Forecasting/Accounting and Nonlinear Programming*, INFORMS Annual Meeting 21, Anaheim, CA
- Co-chair of the session *Distributed and Decentralized Optimization*, ICCOPT 2019, Berlin, Germany
- Reviewer for
  - Optimization: MPC, JOTA, IJO, Quantum,
  - Power Systems: IEEE (TAC, TCNS, TII, TPWRS, TSG, L-CSS), IET, ACC, CDC
  - Machine Learning: AISTATS 21

## TECHNICAL SKILLS

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- Programming Languages: working knowledge of C++, Julia, Python, and Matlab.
- Optimization Solvers: experience with IPOPT, Gurobi, Mosek, Baron, Bonmin, Couenne, and Xpress.
- Typesetting:  $\text{\LaTeX}$  and Markdown.