

# Rohit Kannan, Ph.D.

Mathematical Optimizer

Curriculum Vitae: October 7, 2021

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## EDUCATION

Ph.D.	Chemical Engineering	Massachusetts Institute of Technology	2018
M.S.	Chemical Engineering Practice	Massachusetts Institute of Technology	2014
B.Tech.	Chemical Engineering	Indian Institute of Technology Madras	2012

## PROFESSIONAL APPOINTMENTS

Postdoctoral Fellow, Center for Nonlinear Studies, Los Alamos National Laboratory	since 2021
Postdoctoral Associate, Wisconsin Institute for Discovery, University of Wisconsin-Madison	2018-2020
Engineering Consultant, Alcon, Fort Worth, TX	2013
Engineering Consultant, Corning Inc., Corning, NY	2013
Research Intern, Laboratory of Computational Systems Biotechnology, EPFL, Switzerland	2011
Research Intern, Technology Transfer Lab, Orchid Chemicals and Pharmaceuticals, India	2010

## SELECT HONORS AND AWARDS

Center for Nonlinear Studies Postdoctoral Fellowship, Los Alamos National Laboratory	2020
Best Paper in the <i>Advances in Optimization I</i> session, AIChE Annual Meeting	2015
George M. Keller Graduate Fellowship, MIT	2012-2013
Reliance Heat Transfer Award for academic excellence, IIT Madras	2012
Oil and Natural Gas Corporation Scholarship, Govt. of India	2012
Institute Merit Award for academic excellence, IIT Madras	2010 & 2011
Prof. M. Ramanujam Memorial Award, IIT Madras	2011
EPFL, <a href="#">DAAD WISE</a> , and <a href="#">MITACS Globalink</a> Summer Research Fellowships (chose EPFL)	2011
Top 10 Ranks in the Regional Mathematics Olympiad, India	2004, 2006 & 2008
Selected for the Indian National Informatics and Chemistry Olympiads (top 1%)	2008

## PUBLICATIONS

### Working

7. R. Kannan, N. Ho-Nguyen, and J. R. Luedtke, "Multistage stochastic optimization given time series data".
6. R. Kannan, H. Nagarajan, and D. Deka, "Stochastic unit commitment with reserve saturation".
5. R. Kannan, D. Deka, and H. Nagarajan, "Accelerating global optimization solvers with machine learning".
4. E. Turan, R. Kannan, and J. Jäschke, "Optimization of PID controllers using semi-infinite programming".
3. A. S. R. Subramanian, R. Kannan, F. Holtorf, T. A. Adams II, T. Gundersen, and P. I. Barton, "Optimization under uncertainty of a hybrid waste tire and natural gas feedstock flexible polygeneration system using decomposition algorithms".
2. R. Kannan and P. I. Barton, "GOSSIP: decomposition software for the global optimization of nonconvex two-stage stochastic mixed-integer nonlinear programs".
1. R. Kannan and P. I. Barton, "A modified Lagrangian relaxation algorithm for two-stage stochastic mixed-integer nonlinear programs".

### Submitted

3. R. Kannan, G. Bayraksan, and J. R. Luedtke (2021), "[Heteroscedasticity-aware residuals-based contextual stochastic optimization](#)", Technical Report, arXiv preprint arXiv:2101.03139, pp. 1-15.
2. R. Kannan, G. Bayraksan, and J. R. Luedtke (2020), "[Residuals-based distributionally robust optimization with covariate information](#)", arXiv preprint arXiv:2012.01088, pp. 1-31. Status: Under Review.
1. R. Kannan, G. Bayraksan, and J. R. Luedtke (2020), "[Data-driven sample average approximation with covariate information](#)", *Available on Optimization Online*, pp. 1-48. Status: Under Major Revision.

## Peer-Reviewed Journals

5. R. Kannan and J. R. Luedtke (2021), "[A stochastic approximation method for approximating the efficient frontier of chance-constrained nonlinear programs](#)", *Mathematical Programming Computation*, pp. 1-47.
4. R. Kannan, J. R. Luedtke, and L. A. Roald (2020), "[Stochastic DC optimal power flow with reserve saturation](#)", *Electric Power Systems Research* (special issue for XXI Power Systems Computation Conference), pp. 1-9.
3. R. Kannan and P. I. Barton (2018), "[Convergence-order analysis of branch-and-bound algorithms for constrained problems](#)", *Journal of Global Optimization*, 71(4), pp. 753-813.
2. R. Kannan and P. I. Barton (2017), "[The cluster problem in constrained global optimization](#)", *Journal of Global Optimization*, 69(3), pp. 629-676.
1. R. Kannan and A. K. Tangirala (2014), "[Correntropy-based partial directed coherence for testing multi-variate Granger causality in nonlinear processes](#)", *Physical Review E*, 89(6), 062144, pp. 1-15.

## Peer-Reviewed Conferences

1. R. Kannan and P. I. Barton (2016), "[The cluster problem in constrained global optimization](#)", Proceedings of the XIII *Global Optimization Workshop* (GOW'16), pp. 9-12.

## Theses

2. Ph.D.: "[Algorithms, analysis and software for the global optimization of two-stage stochastic programs](#)", *Massachusetts Institute of Technology*, 2018.
1. B.Tech.: "Partial directed coherence for nonlinear Granger causality: A generalized correlation function-based approach", *Indian Institute of Technology Madras*, 2012.

## TEACHING AND MENTORSHIP

- Math Lecturer for the IIT Joint Entrance Exam (IIT JEE), Massachusetts Institute of Technology 2016
  - Recorded [online video lectures](#) for the entrance exam to the IITs as part of an MIT team.
  - [Featured on MIT OpenCourseWare](#) and supported by the MIT Office of Digital Learning.
- Teaching Assistant, Dept. of Chemical Engineering, Massachusetts Institute of Technology 2015
  - Teaching assistant for the graduate-level *Chemical Reactor Engineering* course (50 students).
  - Shared responsibility for office hours, online discussion forums, homework assignments (including development of MATLAB and Q-Chem-based exercises), and grades.
- Math Olympiad Trainer, Science and Math Academy for Real Talents, Chennai, India 2008-2011
  - Coached around 30 middle-school and high-school students each year for the Math Olympiad.
  - One trainee was among the 40 students selected to represent India at the 2010 *International Math Olympiad Training Camp*.

## SERVICE

- External Examiner (Invited) for the following students:
  - Mari E. Rugland, "An object-oriented framework for the optimization of flexible renewable energy systems", Master's thesis, Department of Chemical Engineering, Norwegian University of Science and Technology (NTNU), 2021.  
Supervisors: Johannes Jäschke, Truls Gundersen, and Avinash S. R. Subramanian.
  - Petter E. Nordby, "Optimization of flexible renewable energy systems under uncertainty", Master's thesis, Department of Energy & Process Engineering, Norwegian University of Science and Technology (NTNU), 2021.  
Supervisors: Truls Gundersen, Johannes Jäschke, and Avinash S. R. Subramanian.
- Invited Peer-Reviewer for the following journals and conferences ([Publons Profile](#)):

- Operations Research
- Mathematical Programming
- Journal of Global Optimization
- Set-Valued and Variational Analysis
- Computers and Chemical Engineering
- Electric Power Systems Research
- American Control Conference
- Journal of Optimization Theory and Applications
- Computational Optimization and Applications
- Optimization Methods and Software
- INFORMS Journal on Optimization
- Industrial and Engineering Chemistry Research
- IEEE Transactions on Control Systems Technology

- Session Chair (Invited), “Computational Stochastic Programming”, 2018 *INFORMS Annual Meeting*.
- Organizer of monthly teleconference meetings on *Optimization Under Uncertainty* (15 participants) as part of the [DOE MACSER Project](#) (Nov. 2018 to Nov. 2020).
- Volunteered for the Science Activities team of the National Services Scheme at IIT Madras (Sept. 2008 to May 2009). Designed and demonstrated science experiments to students in underprivileged schools.

## RESEARCH HIGHLIGHTS

### Academic

- CNLS Postdoctoral Fellow, Los Alamos National Laboratory since 2021
  - Enhanced the performance of the solver Alpine on nonconvex QCQPs using machine learning.
  - Designed a practical algorithm for stochastic unit commitment with reserve saturation (MINLP).
- Postdoctoral Associate, University of Wisconsin-Madison 2018-2020
  - Designed a state-of-the-art stochastic subgradient algorithm for NLPs with joint chance constraints.
  - Modeled saturation of generation reserves in DC-OPF with renewable energy sources and designed a scalable decomposition method. [Featured on the UW-Madison College of Engineering Website](#).
  - Investigated new formulations for integrating machine learning within stochastic optimization.
- Research Assistant, Massachusetts Institute of Technology 2013-2018
  - Designed decomposition algorithms and a state-of-the-art software for the global optimization of two-stage stochastic MINLPs. Software used at NTNU for designing flexible polygeneration systems.
  - Analyzed the convergence rate of B&B algorithms and identified properties of relaxation schemes required to avoid the so-called cluster problem in constrained global optimization.

### Industry

- Engineering Consultant, Alcon, Fort Worth, TX 2013
  - Led an MIT team to design a measure of residual stress in molded intraocular lens wafers.
  - Increased bioavailability of an ophthalmic drug through experiments and pharmacokinetic modeling.
- Engineering Consultant, Corning Inc., Corning, NY & Wilmington, NC 2013
  - Led an MIT team to model the effects of oxygen on the cure rate of UV-curable acrylate polymers.
  - Accelerated cell media development by identifying key components using statistical analysis.
- Research Intern, Orchid Chemicals and Pharmaceuticals, India 2010
  - Designed and implemented solutions to scale up the production of a research drug.
  - Investigated methods for increasing the size of drug crystals to reduce filtration time.

## PRESENTATIONS

### Plenary

2. R. Kannan and J. R. Luedtke, “A stochastic approximation method for approximating the efficient frontier of chance-constrained nonlinear programs”, CAST Division Plenary, *AIChE Annual Meeting*, Nov. 2021.
1. R. Kannan and P. I. Barton, “GOSSIP: decomposition software for the Global Optimization of nonconvex two-Stage Stochastic mixed-Integer nonlinear Programs”, CAST Division Plenary, *AIChE Annual Meeting*, Nov. 2016.

**Invited**

16. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Residuals-Based Distributionally Robust Optimization with Covariate Information", *INFORMS Annual Meeting*, Oct. 2021. Session: Learning and Decision-Making with Contextual Information.
15. R. Kannan, J. R. Luedtke, and L. A. Roald, "Stochastic DC Optimal Power Flow With Reserve Saturation", *Los Alamos - Arizona Days*, May 2021. Session: Engineered Systems.
14. R. Kannan, "A Modular Framework for Integrating Machine Learning within Stochastic Optimization", Department of Mathematical Sciences, *Florida Institute of Technology*, March 2021.
13. R. Kannan, "A Modular Framework for Integrating Machine Learning within Stochastic Optimization", Department of Chemical and Biomolecular Engineering, *Clarkson University*, March 2021.
12. R. Kannan, "A Modular Framework for Integrating Machine Learning within Stochastic Optimization", Systems and Industrial Engineering Department, *University of Arizona*, Feb. 2021.
11. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Data-Driven Sample Average Approximation with Covariate Information", *INFORMS Annual Meeting*, Nov. 2020. Session: Data, Statistics and Learning in Energy Systems Optimization.
10. R. Kannan, J. R. Luedtke, and L. A. Roald, "Stochastic DC Optimal Power Flow With Reserve Saturation", *INFORMS Annual Meeting*, Nov. 2020. Session: Optimization in Energy Systems Under Uncertainty.
9. R. Kannan, "Data-Driven Stochastic Optimization with Covariate Information", Mathematics and Computer Science Division, *Argonne National Laboratory*, Sep. 2020.
8. R. Kannan, "Predict, then Smart Optimize with Stochastic Programming", Center for Nonlinear Studies, *Los Alamos National Laboratory*, July 2020.
7. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Predict, then Smart Optimize with Stochastic Programming", *IPAM Workshop on Intersections between Control, Learning and Optimization*, Feb. 2020.
6. R. Kannan and P. I. Barton, "GOSSIP: decomposition software for the Global Optimization of nonconvex two-Stage Stochastic mixed-Integer nonlinear Programs", *INFORMS Annual Meeting*, Nov. 2018. Session: Computational Stochastic Programming.
5. R. Kannan, "Algorithms, Analysis, and Software for the Global Optimization of Chemical Process Systems Under Uncertainty", *ExxonMobil Research and Engineering*, Clinton, NJ, Dec. 2017.
4. R. Kannan, "Algorithms, Analysis, and Software for the Global Optimization of Chemical Process Systems Under Uncertainty", *Lawrence Berkeley National Laboratory*, Nov. 2017.
3. R. Kannan, "Algorithms, Analysis, and Software for the Global Optimization of Chemical Process Systems Under Uncertainty", Wisconsin Institute for Discovery, *University of Wisconsin-Madison*, Oct. 2017.
2. R. Kannan, "Optimization of Chemical Process Systems Under Uncertainty", *Rockwell Automation R&D*, Austin, TX, March 2017.
1. R. Kannan and P. I. Barton, "Convergence-Order Analysis of Lower Bounding Schemes for Constrained Global Optimization Problems", *Fifth International Conference on Continuous Optimization (ICCOPT)*, Aug. 2016. Session: Advances in Deterministic Global Optimization.

**Contributed**

10. R. Kannan, N. Ho-Nguyen, and J. R. Luedtke, "Data-Driven Multistage Stochastic Optimization on Time Series", *AIChE Annual Meeting*, Nov. 2021. Session: Advances in Machine Learning & Intelligent Systems.
9. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Data-Driven Sample Average Approximation with Covariate Information", *AIChE Annual Meeting*, Nov. 2021. Session: Design and Operations Under Uncertainty.
8. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Residuals-Based Distributionally Robust Optimization with Covariate Information", *Robust Optimization Webinar*, April 2021.
7. R. Kannan, and P. I. Barton, "The Cluster Problem in Constrained Global Optimization", *AIChE Annual Meeting*, Nov. 2016. Session: Advances in Optimization.
6. R. Kannan, and P. I. Barton, "The Cluster Problem in Constrained Global Optimization", *Thirteenth Global Optimization Workshop*, Aug. 2016.

5. R. Kannan, and P. I. Barton, "Convergence-Order Analysis of Branch-and-Bound Algorithms for Constrained Problems", *AIChE Annual Meeting*, Nov. 2015. Session: Advances in Optimization.
4. P. I. Barton and R. Kannan, "A Decomposition Algorithm for Two-Stage Stochastic Mixed-Integer Nonconvex Programs", *XXII International Symposium on Mathematical Programming (ISMP)*, July 2015.
3. R. Kannan, and P. I. Barton, "A Software Framework for the Global Optimization of Nonconvex Two-Stage Stochastic Programs", *AIChE Annual Meeting*, Nov. 2015. Session: Software Tools and Implementations for PSE.
2. R. Kannan, and P. I. Barton, "A Decomposition Strategy for a Class of Nonconvex Two-Stage Stochastic Programs", *AIChE Annual Meeting*, Nov. 2014. Session: Design and Operations Under Uncertainty.
1. P. I. Barton and R. Kannan, "An Improved Lagrangian Relaxation Approach for Nonconvex Two-Stage Stochastic Programs", *INFORMS Annual Meeting*, Nov. 2014. Session: Chance, Inference and Robustness.

## Poster

7. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Integrated Learning and Optimization", Third Annual Wisconsin Institute for Discovery Symposium, *University of Wisconsin-Madison*, Aug. 2020.
6. R. Kannan, G. Bayraksan, and J. R. Luedtke, "Predict, then Smart Optimize with Stochastic Programming", *IPAM Workshop on Intersections between Control, Learning and Optimization*, Feb. 2020.
5. R. Kannan and J. R. Luedtke, "A Stochastic Approximation Method for Chance-Constrained Nonlinear Programs", *AIChE Annual Meeting*, Nov. 2019. Session: Systems and Process Operations.
4. R. Kannan, "Optimization and Control of Chemical Process Systems Under Uncertainty", *AIChE Annual Meeting*, Nov. 2019.
3. R. Kannan and J. R. Luedtke, "Stochastic Approximation for Chance-Constrained NLPs", *Computing in Engineering Forum*, *University of Wisconsin-Madison*, Sept. 2019.
2. R. Kannan and J. R. Luedtke, "Stochastic Approximation for Chance-Constrained NLPs", *ICERM Workshop on Optimization of Systems Impacted by Rare, High-Impact Random Events*, June 2019.
1. R. Kannan and J. R. Luedtke, "Optimizing Uncertain Systems with Reliability Requirements", Second Annual Wisconsin Institute for Discovery Symposium, *University of Wisconsin-Madison*, June 2019.

## TECHNICAL SKILLS

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|-----------|----------|---------|----------|---------------------|
| • C++/C   | • Python | • Julia | • MATLAB | • Shell Scripting   |
| • Fortran | • R      | • GAMS  | • Git    | • Cluster Computing |

## PROFESSIONAL MEMBERSHIPS

Institute for Operations Research and the Management Sciences (INFORMS)	since 2014
American Institute of Chemical Engineers (AIChE)	since 2014
Mathematical Optimization Society (MOS)	2016-2017