

Curriculum Vitae

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Frank E. Curtis, Ph.D.
Professor
Director of Graduate Studies
Industrial and Systems Engineering
Lehigh University

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A. Biographical Information

Home Address

301 W. 53rd St., Apt. 9A
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200 W. Packer Ave., Rm. 475
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Educational History

- Ph.D. Northwestern University, September 2003 – June 2007
Industrial Engineering and Management Sciences
Academic distinction : Nemhauser Doctoral Dissertation Award
Dissertation title : *Inexact Sequential Quadratic Programming Methods for Large-Scale Nonlinear Optimization*
..... advisor : Prof. Jorge Nocedal
..... committee : Prof. Robert Fourer, Prof. Sanjay Mehrotra, Dr. Richard A. Waltz
- M.S. Northwestern University, September 2003 – December 2004
Industrial Engineering and Management Sciences
- B.S. College of William and Mary, August 1999 – May 2003
Mathematics and Computer Science (double major)
Academic distinctions : Phi Beta Kappa, Magna Cum Laude, Highest Honors in Mathematics
Thesis title : *Special Classes of Zero-One Matrices*
..... advisors : Prof. Chi-Kwong Li, Prof. Rex Kincaid
..... committee : Prof. Weizhen Mao, Prof. John Drew

Employment History

- Professor : Lehigh University, May 2021 – present
Department of Industrial and Systems Engineering
- Associate Professor : Lehigh University, July 2015 – May 2021
Department of Industrial and Systems Engineering
- Assistant Professor : Lehigh University, August 2009 – June 2015
Department of Industrial and Systems Engineering
- Postdoctoral Researcher : New York University, September 2007 – August 2009
Courant Institute of Mathematical Sciences
- Postdoctoral Researcher : Northwestern University, July 2007 – August 2007
Department of Industrial Engineering and Management Sciences
- Graduate Research Assistant : Northwestern University, May 2004 – June 2007
Department of Industrial Engineering and Management Sciences
- Intern : Intel Corporation, June 2005 – August 2005
Corporate Technology Group
- Undergraduate Research Assistant : College of William and Mary, May 2002 – August 2003
Department of Mathematics

Endowed Positions

Frank Hook Assistant Professor
P. C. Rossin Assistant Professor

Lehigh University, August 2013 – July 2015
Lehigh University, August 2010 – July 2012

Visiting Positions

Visiting Associate Professor (McCarter Fellow)
Visiting Research Scientist
Visiting Research Scientist

Northwestern University, May 2018 – June 2018
New York University, January 2018 – May 2018
Columbia University, August 2017 – May 2018

B. Publications and Creative Activities¹**Books (Edited)**

- [1] Tamás Terlaky and Frank E. Curtis, editors. *Modeling and Optimization: Theory and Applications – Selected Contributions from the MOPTA 2010 Conference*. Springer Proceedings in Mathematics and Statistics. Springer, New York, NY, USA, 2012.

Book Chapters (Authored; Refereed)

- [2] Arvind U. Raghunathan, Frank E. Curtis, Yusuke Takaguchi, and Hiroyuki Hashimoto. Fast Market Clearing Algorithms. In *Energy Markets and Responsive Grids*, chapter 7, pages 155–175. Springer, 2018.

Published Review Articles (Authored; Refereed)

- [3] James V. Burke, Frank E. Curtis, Adrian S. Lewis, Michael L. Overton, and Lucas E. A. Simoes. Gradient Sampling Methods for Nonsmooth Optimization. In *Numerical Nonsmooth Optimization*, chapter 6, pages 201–225. Springer, 2020.
- [4] Léon Bottou, Frank E. Curtis, and Jorge Nocedal. Optimization Methods for Large-Scale Machine Learning. *SIAM Review*, 60(2):223–311, 2018.
- [5] Frank E. Curtis and Katya Scheinberg. Optimization Methods for Supervised Machine Learning: From Linear Models to Deep Learning. In *INFORMS Tutorials in Operations Research*, chapter 5, pages 89–114. Institute for Operations Research and the Management Sciences (INFORMS), 2017.

Published Journal Articles (Authored; Refereed)

- [6] Albert S. Berahas, Frank E. Curtis, Daniel P. Robinson, and Baoyu Zhou. Sequential Quadratic Optimization for Nonlinear Equality Constrained Stochastic Optimization. *SIAM Journal on Optimization*, 31(2):1352–1379, 2021.
- [7] Frank E. Curtis, Daniel P. Robinson, Clément W. Royer, and Stephen J. Wright. Trust-Region Newton-CG with Strong Second-Order Complexity Guarantees for Nonconvex Optimization. *SIAM Journal on Optimization*, 31(1):518–544, 2021.
- [8] Frank E. Curtis and Daniel P. Robinson. Regional Complexity Analysis of Algorithms for Nonconvex Smooth Optimization. *Mathematical Programming*, 187:579–615, 2021.
- [9] Chenxin Ma, Martin Jaggi, Frank E. Curtis, Nathan Srebro, and Martin Takáč. An Accelerated Communication-Efficient Primal-Dual Optimization Framework for Structured Machine Learning. *Optimization Methods and Software*, 36(1):20–44, 2021.

¹Standard practice in my research field is to list authors alphabetically, as is done for most of the articles in this section. These articles and technical reports are available on my personal website: <http://coral.ise.lehigh.edu/frankecurtis/publications>

- [10] Mertcan Yetkin, Sudharsan Kalidoss, Frank E. Curtis, Lawrence V. Snyder, and Arindam Banerjee. Practical optimal control of a wave-energy converter in regular wave environments. *Renewable Energy*, 171:1382–1394, 2021.
- [11] James V. Burke, Frank E. Curtis, Hao Wang, and Jiashan Wang. Inexact Sequential Quadratic Optimization with Penalty Parameter Updates within the QP Solver. *SIAM Journal on Optimization*, 30(3):1822–1849, 2020.
- [12] Frank E. Curtis and Katya Scheinberg. Adaptive Stochastic Optimization: A Framework for Analyzing Stochastic Optimization Algorithms. *IEEE Signal Processing Magazine*, 37(5):32–42, 2020.
- [13] Frank E. Curtis and Rui Shi. A Fully Stochastic Second-Order Trust Region Method. *Optimization Methods and Software*, <https://doi.org/10.1080/10556788.2020.1852403>, 2020.
- [14] Frank E. Curtis, Daniel P. Robinson, and Baoyu Zhou. A Self-Correcting Variable-Metric Algorithm Framework for Nonsmooth Optimization. *IMA Journal of Numerical Analysis*, 40(2):1154–1187, 2020.
- [15] Wenbo Gao, Donald Goldfarb, and Frank E. Curtis. ADMM for Multiaffine Constrained Optimization. *Optimization Methods and Software*, 35(2):257–303, 2020.
- [16] Albert Berahas, Frank E. Curtis, and Baoyu Zhou. Limited-Memory BFGS with Displacement Aggregation. *Mathematical Programming*, DOI: 10.1007/s10107-021-01621-6, 2021.
- [17] Frank E. Curtis, Daniel P. Robinson, and Mohammadreza Samadi. An Inexact Regularized Newton Framework with a Worst-Case Iteration Complexity of $\mathcal{O}(\epsilon^{-3/2})$ for Nonconvex Optimization. *IMA Journal of Numerical Analysis*, 39(3):1296–1327, 2019.
- [18] Frank E. Curtis, Katya Scheinberg, and Rui Shi. A Stochastic Trust Region Algorithm Based on Careful Step Normalization. *INFORMS Journal on Optimization*, 1(3):200–220, 2019.
- [19] Frank E. Curtis and Daniel P. Robinson. Exploiting Negative Curvature in Deterministic and Stochastic Optimization. *Mathematical Programming, Series B*, 176(1):69–94, 2019.
- [20] Frank E. Curtis, Zachary Lubbets, and Daniel P. Robinson. Concise Complexity Analyses for Trust Region Methods. *Optimization Letters*, 12(8):1713–1724, 2018.
- [21] Frank E. Curtis, Daniel P. Robinson, and Mohammadreza Samadi. Complexity Analysis of a Trust Funnel Algorithm for Equality Constrained Optimization. *SIAM Journal on Optimization*, 28(2):1533–1563, 2018.
- [22] Frank E. Curtis and Wei Guo. R -Linear Convergence of Limited Memory Steepest Descent. *IMA Journal of Numerical Analysis*, 38(2):720–742, 2018.
- [23] Frank E. Curtis, Andreas Wächter, and Victor M. Zavala. A Sequential Algorithm for Solving Nonlinear Optimization Problems with Chance Constraints. *SIAM Journal on Optimization*, 28(1):930–958, 2018.
- [24] Tianyi Chen, Frank E. Curtis, and Daniel P. Robinson. FaRSA for ℓ_1 -Regularized Convex Optimization: Local Convergence and Numerical Experience. *Optimization Methods and Software*, 33(2):396–415, 2018.
- [25] Frank E. Curtis, Nicholas I. M. Gould, Daniel P. Robinson, and Philippe L. Toint. An Interior-Point Trust-Funnel Algorithm for Nonlinear Optimization. *Mathematical Programming*, 161(1):73–134, 2017.
- [26] Tianyi Chen, Frank E. Curtis, and Daniel P. Robinson. A Reduced-Space Algorithm for Minimizing ℓ_1 -Regularized Convex Functions. *SIAM Journal on Optimization*, 27(3):1583–1610, 2017.

- [27] Frank E. Curtis, Daniel P. Robinson, and Mohammadreza Samadi. A Trust Region Algorithm with a Worst-Case Iteration Complexity of $\mathcal{O}(\epsilon^{-3/2})$ for Nonconvex Optimization. *Mathematical Programming*, 162(1):1–32, 2017.
- [28] Frank E. Curtis and Arvind U. Raghunathan. Solving Nearly-Separable Quadratic Optimization Problems as Nonsmooth Equations. *Computational Optimization and Applications*, 67(2):317–360, 2017.
- [29] Frank E. Curtis, Tim Mitchell, and Michael L. Overton. A BFGS-SQP Method for Nonsmooth, Nonconvex, Constrained Optimization and its Evaluation using Relative Minimization Profiles. *Optimization Methods and Software*, 32(1):148–181, 2017.
- [30] Frank E. Curtis and Zheng Han. Globally Convergent Primal-Dual Active-Set Methods with Inexact Subproblem Solves. *SIAM Journal on Optimization*, 26(4):2261–2283, 2016.
- [31] Frank E. Curtis and Wei Guo. Handling Nonpositive Curvature in a Limited Memory Steepest Descent Method. *IMA Journal of Numerical Analysis*, 36(2):717–742, 2016.
- [32] Frank E. Curtis, Nicholas I. M. Gould, Hao Jiang, and Daniel P. Robinson. Adaptive Augmented Lagrangian Methods: Algorithms and Practical Numerical Experience. *Optimization Methods and Software*, 31(1):157–186, 2016.
- [33] Frank E. Curtis and Xiaocun Que. A Quasi-Newton Algorithm for Nonconvex, Nonsmooth Optimization with Global Convergence Guarantees. *Mathematical Programming Computation*, 7(4):399–428, 2015.
- [34] Frank E. Curtis, Hao Jiang, and Daniel P. Robinson. An Adaptive Augmented Lagrangian Method for Large-Scale Constrained Optimization. *Mathematical Programming*, 152(1–2):201–245, 2015.
- [35] Frank E. Curtis, Zheng Han, and Daniel P. Robinson. A Globally Convergent Primal-Dual Active-Set Framework for Large-Scale Convex Quadratic Optimization. *Computational Optimization and Applications*, 60(2):311–341, 2015.
- [36] James V. Burke, Frank E. Curtis, Hao Wang, and Jiashan Wang. Iterative Reweighted Linear Least Squares for Exact Penalty Subproblems on Product Sets. *SIAM Journal on Optimization*, 25(1):261–294, 2015.
- [37] Frank E. Curtis, Travis Johnson, Daniel P. Robinson, and Andreas Wächter. An Inexact Sequential Quadratic Optimization Algorithm for Nonlinear Optimization. *SIAM Journal on Optimization*, 24(3):1041–1074, 2014.
- [38] James V. Burke, Frank E. Curtis, and Hao Wang. A Sequential Quadratic Optimization Algorithm with Rapid Infeasibility Detection. *SIAM Journal on Optimization*, 24(2):839–872, 2014.
- [39] Frank E. Curtis and Xiaocun Que. An Adaptive Gradient Sampling Algorithm for Nonsmooth Optimization. *Optimization Methods and Software*, 28(6):1302–1324, 2013.
- [40] Frank E. Curtis and Michael L. Overton. A Sequential Quadratic Programming Algorithm for Nonconvex, Nonsmooth Constrained Optimization. *SIAM Journal on Optimization*, 22(2):474–500, 2012.
- [41] Frank E. Curtis, Johannes Huber, Olaf Schenk, and Andreas Wächter. A Note on the Implementation of an Interior-Point Algorithm for Nonlinear Optimization with Inexact Step Computations. *Mathematical Programming, Series B*, 136(1):209–227, 2012.
- [42] Frank E. Curtis. A Penalty-Interior-Point Algorithm for Nonlinear Constrained Optimization. *Mathematical Programming Computation*, 4(2):181–209, 2012.
- [43] Frank E. Curtis, Olaf Schenk, and Andreas Wächter. An Interior-Point Algorithm for Large-Scale Nonlinear Optimization with Inexact Step Computations. *SIAM Journal on Scientific Computing*, 32(6):3447–3475, 2010.

- [44] Richard H. Byrd, Frank E. Curtis, and Jorge Nocedal. Infeasibility Detection and SQP Methods for Nonlinear Optimization. *SIAM Journal on Optimization*, 20(5):2281–2299, 2010.
- [45] Richard H. Byrd, Frank E. Curtis, and Jorge Nocedal. An Inexact Newton Method for Nonconvex Equality Constrained Optimization. *Mathematical Programming*, 122(2):273–299, 2010.
- [46] Frank E. Curtis, Jorge Nocedal, and Andreas Wächter. A Matrix-Free Algorithm for Equality Constrained Optimization Problems with Rank Deficient Jacobians. *SIAM Journal on Optimization*, 20(3):1224–1249, 2009.
- [47] Frank E. Curtis and Jorge Nocedal. Flexible Penalty Functions for Nonlinear Constrained Optimization. *IMA Journal of Numerical Analysis*, 28(4):749–769, 2008.
- [48] Richard H. Byrd, Frank E. Curtis, and Jorge Nocedal. An Inexact SQP Method for Equality Constrained Optimization. *SIAM Journal on Optimization*, 19(1):351–369, 2008.
- [49] Frank E. Curtis and Jorge Nocedal. Steplength Selection in Interior-Point Methods for Quadratic Programming. *Applied Mathematics Letters*, 20(5):516–523, 2007.
- [50] Frank E. Curtis and Rex Kincaid. Determinant Optimization on Binary Matrices. *American Journal of Mathematical and Management Sciences*, 26(1–2):33–70, 2006.
- [51] Frank E. Curtis, John Drew, Chi-Kwong Li, and Daniel Pragel. Central Groupoids, Central Digraphs, and Zero-One Matrices A Satisfying $A^2 = J$. *Journal of Combinatorial Theory, Series A*, 105(1):35–50, 2004.

Journal Articles Under Review (Authored; Refereed)

- [52] Frank E. Curtis, Yutong Dai, and Daniel P. Robinson. A Subspace Acceleration Method for Minimization Involving a Group Sparsity-Inducing Regularizer. arXiv 2007.14951, 2020.
- [53] Frank E. Curtis and Minhan Li. Gradient Sampling Methods with Inexact Subproblem Solutions and Gradient Aggregation. arXiv 2005.07822, 2020.

Published Conference Articles (Authored; Refereed)

- [54] Frank E. Curtis. A Self-Correcting Variable-Metric Algorithm for Stochastic Optimization. In *Proceedings of the 33rd International Conference on Machine Learning*, New York, NY, USA, 2016. JMLR.
- [55] Arvind U. Raghunathan, Frank E. Curtis, Yusuke Takaguchi, and Hiroyuki Hashimoto. Accelerating Convergence to Competitive Equilibrium in Electricity Markets. In *IEEE Power and Energy Society General Meeting*, 2016.

Dissertations (Authored)

- [56] Frank E. Curtis. *Inexact Sequential Quadratic Programming Methods for Large-Scale Nonlinear Optimization*. PhD thesis, Department of Industrial Engineering and Management Science, Northwestern University, Evanston, IL, USA, 2007.
- [57] Frank E. Curtis. Special Classes of Zero-One Matrices. Undergraduate Honors Thesis, Department of Mathematics, College of William and Mary, Williamsburg, VA, USA, 2003.

Software

- [NonOpt](#), author
Open source C++ code for solving nonsmooth, nonconvex optimization problems.
- [GRANSO](#), contributor
Matlab source code for solving nonsmooth, nonconvex optimization problems with nonsmooth, nonconvex constraints. I co-advised, with Michael Overton, the writing of the code by Tim Mitchell; see Published Journal Article [29] above.
- [ILOPT](#), contributor
Open source C++ software package for solving nonlinear optimization problems. Code written by Andreas Wächter and Carl Laird, managed by Andreas Wächter and Stefan Vigerske as part of the [COIN-OR](#) initiative. I aided in the implementation of a new algorithm in the package, an interior-point method with inexact step computations; see Published Journal Articles [41, 43] above.
- [filterSD](#), manager
Open source Fortran 77 software package for solving nonlinear optimization problems. Code written by Roger Fletcher, managed by me as part of the [COIN-OR](#) initiative.
- [PIPAL](#), author
Matlab source code for solving nonlinear optimization problems. Code written by me; see Published Journal Article [42] above.
- [SLQP-GS](#), author
Matlab source code for solving nonsmooth optimization problems. Code written by me; see Published Journal Article [40] above.
- [pypdas](#) + [ipdas](#), written by former Ph.D. student, Zheng Han
Python code implementing primal-dual active-set solvers for certain types of quadratic optimization problems, typically arising in optimal control; see Published Journal Articles [35, 30] above.

Websites

- [Personal Homepage](#)
My personal homepage includes descriptions of my research projects; electronic versions of my journal articles, technical reports, and materials from my scholarly presentations; freely available prototype software; syllabi for my courses; information about my collaborators and students; and basic contact information for myself.
- [Lehigh ISE Department](#)
Since 2011, I have aided in maintaining and updating the ISE department's website, especially those pages related to advertising our Ph.D. program and its students.
- [OptML Research Group](#)
Established in 2015, the Optimization and Machine Learning (OptML) Research Group at Lehigh was created by Katya Scheinberg, Martin Takáč, and me. It is now led by me, Daniel P. Robinson, Martin Takáč, and Luis Nunes Vicente. The group meets for research discussions on a weekly basis and maintains resources for faculty members and students working in and around the intersection between Optimization and Machine Learning.
- [COR@L Laboratory](#)
Since 2010, I have aided in maintaining and updating the website of the COR@L Laboratory, housed in the ISE department at Lehigh. This site includes information for and about the laboratory's people and projects. The laboratory also maintains a set of mailing lists that are used extensively by members of the ISE department to share and disseminate information to others within the department and outside the university that are affiliated with the laboratory.

- [U.S.–Mexico Workshop on Optimization and its Applications](#)

This workshop has been held every few years to foster collaboration between researchers in the United States and Mexico working in fields related to mathematical optimization. I co-organized the workshop in 2016 and was solely responsible for creating and maintaining the website, which housed information about the workshop and included web forms for registration and abstract submission.

- [MOPTA Conferences](#)

The MOPTA Conference has been held annually since 2001, and has been held at Lehigh since 2009. I aided in creating and maintaining the conference website in 2010, and was solely responsible for creating and maintaining the website from 2011 to 2013. The conference website includes information about the meeting, but also includes web forms for registration, abstract submission, and submission for the student modeling competition (co-sponsored by [AIMMS](#)).

C. Honors and Awards

Chaired Assistant Professorships

Frank Hook Assistant Professorship	Lehigh University	2013–2015
P. C. Rossin Assistant Professorship	Lehigh University	2010–2012

Recognitions by Professional Societies

Lagrange Prize in Continuous Optimization	MOS/SIAM	2021
ICS Prize	INFORMS Computing Society	2018
Vice Chair for Nonlinear Programming	INFORMS Optimization Society	2010–2012
Future Academician Colloquium Participant	INFORMS Society	2006

Paper Awards

Best Paper of the Year Award	Optimization Letters	2018
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Recognitions by Conferences

ICML 2018 Top 10 Reviewer Award	ICML	2018
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Teaching Awards

Graduate Teacher of the Year, ISE	Lehigh University	2014–2015, 2019
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Dissertation and Thesis Awards

Nemhauser Doctoral Dissertation Award	Northwestern University	2008
Highest Honors in Mathematics	College of William and Mary	2003

Graduate and Undergraduate Academic Awards

Walter P. Murphy Fellowship	Northwestern University	2003–2004
Cissy Patterson Award for Mathematics	College of William and Mary	2003

Honor Society Memberships

Phi Beta Kappa		2003–present
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Media Mentions

- Article on ARPA-E Website on “Department of Energy Announces Grid Optimization Competition Challenge 1 Winners,” February, 2020; article on placement of our “GO-SNIP” team led by Lehigh.

- Article in INFORMS Computing Society Newsletter on “The Gradient Sampling Methodology,” February, 2019.
- Interviewee for Resolve magazine (of the P.C. Rossin College of Engineering and Applied Science of Lehigh University), Volume 1, 2018; article on establishment of I-DISC.
- Column for Optima, newsletter of the Mathematical Optimization Society, Volume 99, 2015; response to interview of Roger Fletcher.
- Interviewee for Resolve magazine (of the P.C. Rossin College of Engineering and Applied Science of Lehigh University), Volume 1, 2015; article on research and as a *Rising Star*.
- Interviewee for Resolve magazine (of the P.C. Rossin College of Engineering and Applied Science of Lehigh University), Volume 2, 2013; article on research and being awarded DOE Early Career Award.
- Interviewee for Resolve magazine (of the P.C. Rossin College of Engineering and Applied Science of Lehigh University), Volume 1, 2012; article on research and being awarded NSF grant.

D. Research Funding and Training Grants

Awarded Research Grants (Competitive)

- “Next Generation Algorithms for Stochastic Optimization with Constraints,” Office of Naval Research, Department of Defense, effective from May 11, 2021 until May 10, 2024. PI (with Co-PI Daniel P. Robinson, Lehigh University; collaboration with PI Albert S. Berahas, University of Michigan). Budget: \$500,000 (total); \$360,000 (Lehigh).
- “Collaborative Research: AF: Small: Adaptive Optimization of Stochastic and Noisy Function,” Algorithmic Foundations Program, Division on Computing and Communication Foundations, National Science Foundation, effective from October 1, 2020 until September 30, 2023. PI (collaboration with PI Katya Scheinberg, Cornell University). Budget: \$170,000 (total); \$85,000 (Lehigh).
- “An Accelerated Decomposition Framework for Structured Sparse Optimization,” Computational Mathematics Program, Division of Mathematical Sciences, National Science Foundation, effective from July 15, 2020 until June 30, 2023. Co-PI (with PI Daniel P. Robinson, Lehigh University). Budget: \$200,000 (split equally between PI and co-PI).
- “Hybrid Interior-Point/Active-Set PSCOPF Algorithms for Exploiting Power System Characteristics,” Advanced Research Projects Agency – Energy (ARPA-E), Department of Energy, effective from December 13, 2018 until December 12, 2019. PI, Lehigh University (with Andreas Wächter and co-PI Ermin Wei, Northwestern University; Daniel Molzahn, Georgia Tech; and Elizabeth Wong, University of California at San Diego). Budget: \$250,000 (total); \$82,400 (Lehigh).
 - Follow-on award: July 1, 2020 until June 30, 2022. Budget: \$400,000 (total); \$50,909 (Lehigh).
- “Collaborative Proposal: TRIPODS Institute for Optimization and Learning,” Division on Computing and Communication Foundations, National Science Foundation, effective from January 1, 2018 until December 31, 2020. Co-PI (with PI Prof. Katya Scheinberg and co-PI Prof. Martin Takáč, Lehigh University; Francesco Orabona, Boston University; and Han Liu, Northwestern University). Budget: \$895,670 (total); \$597,811 (Lehigh, split equally between PI and co-PIs).
- “AF: Small: New Classes of Optimization Methods for Nonconvex Large Scale Machine Learning Models,” Algorithmic Foundations Program, Division on Computing and Communication Foundations, National Science Foundation, effective from September 1, 2016 until August 31, 2019. Co-PI (with PI Prof. Katya Scheinberg and co-PI Prof. Martin Takáč), Lehigh University. Budget: \$499,143 (split equally between PI and co-PIs).

- “GOALI: Optimizing the Design of Ocean Wave Energy Farms,” Manufacturing Enterprise Systems Program, Division of Civil, Mechanical, and Manufacturing Innovation, National Science Foundation, effective from June 15, 2014 until May 31, 2017. Senior Personnel, Lehigh University. Budget: \$400,000 (1 month support).
- “Randomized Models for Nonlinear Optimization: Theoretical Foundations and Practical Numerical Methods,” Computational Mathematics Program, Division of Mathematical Sciences, National Science Foundation, effective from September 15, 2013 until August 31, 2016. Co-PI (with Prof. Katya Scheinberg), Lehigh University. Budget: \$200,000 (split equally between PI and co-PI).
- “Fast, Dynamic, and Scalable Algorithms for Large-Scale Constrained Optimization,” Early Career Research Program, Advanced Scientific Computing Research, Department of Energy, effective from August 1, 2013 until July 30, 2018. Single PI. Budget: \$750,000.
- “Nonlinear Optimization Algorithms for Large-Scale and Nonsmooth Applications,” Computational Mathematics Program, Division of Mathematical Sciences, National Science Foundation, effective from July 1, 2010 until June 30, 2013. Single PI. Budget: \$110,001.

Other Awarded Grants (Competitive)

- “Collaborative Research: SSMCDAT2020: Solid-State and Materials Chemistry Data Science Hackathon,” Division of Materials Research, National Science Foundation, effective from September 1, 2019 until August 31, 2020. PI, Lehigh University (with Taylor Sparks, University of Utah). Budget: \$62,639 (total); \$37,426 (Lehigh).

Industry Grants

- ExxonMobil Research and Engineering Company, November 2014. Budget: \$20,000.

Institutional Grants

- Frank Hook Assistant Professorship Award, August 2013 – July 2015. Budget: \$4,000/year.
- P. C. Rossin Assistant Professorship Award, August 2010 – July 2012. Budget: \$10,000/year.
- Faculty Innovation Grant, May 2011 – May 2012. Budget: \$25,000.

Consulting Work

- Mitsubishi Electric Research Laboratories, Inc. (MERL), January 2014 – December 2014
Conducting research on numerical methods for solving Network Utility Maximization (NUM) problems. Work being conducted with Arvind U. Raghunathan of the Data Analytics group at MERL.

E. Editorial Review Board Memberships

- Associate Editor, IMA Journal of Numerical Analysis 2021 – present
- Associate Editor, Mathematics of Operations Research 2019 – present
- Associate Editor, Mathematical Programming 2018 – present
- Associate Editor, SIAM Journal on Optimization 2016 – present
- Associate Editor, Mathematical Programming Computation 2015 – present

F. Scholarly Presentations²

Conference Plenaries, Semi-Plenaries, and Keynotes

- [58] Frank E. Curtis. Algorithms for Deterministically Constrained Stochastic Optimization (Plenary). *International Conference on Machine Learning, Workshop on Beyond First-Order Methods in Machine Learning Systems, Virtual (Online)*, July 2021.
- [59] Frank E. Curtis. Nonconvex Optimization: Opportunities and Challenges (Public Lecture). *East Coast Optimization Meeting, Virtual (Online)*, April 2021.
- [60] Frank E. Curtis. Optimization Methods for Large-Scale Machine Learning (Keynote Lecture). *East Coast Optimization Meeting, Virtual (Online)*, April 2021.
- [61] Frank E. Curtis. New Quasi-Newton Ideas for (Non)smooth Optimization (Semi-Plenary). *International Conference on Continuous Optimization, Berlin, Germany*, August 2019.

Conference Tutorials

- [62] Frank E. Curtis and Katya Scheinberg. Optimization Methods for Supervised Machine Learning: From Linear Models to Deep Learning (Tutorial). *INFORMS Annual Meeting*, October 2017.
- [63] Léon Bottou, Frank E. Curtis, and Jorge Nocedal. Stochastic Gradient Methods for Large-Scale Machine Learning (Tutorial). *International Conference on Machine Learning, New York, New York, USA*, June 2016.

Conference Presentations (Invited)

- [64] Frank E. Curtis. Gradient Sampling Methods with Inexact Subproblem Solves and Gradient Aggregation. *SIAM Conference on Optimization, Virtual (Online)*, July 2021.
- [65] Frank E. Curtis. Gradient Sampling Methods with Inexact Subproblem Solves and Gradient Aggregation. *SIAM Conference on Computational Science and Engineering, Virtual (Online)*, March 2021.
- [66] Frank E. Curtis. SQP for Equality Constrained Stochastic Optimization. *INFORMS Annual Meeting, Virtual (Online)*, November 2020.
- [67] Frank E. Curtis. NonOpt: Non(-linear/-smooth/-convex) Optimizer. *International Conference on Continuous Optimization, Berlin, Germany*, August 2019.
- [68] Frank E. Curtis. Fully Stochastic Trust Region Algorithms Without Ratio Tests. *International Conference on Stochastic Programming, Trondheim, Norway*, August 2019.
- [69] Frank E. Curtis. Regional Complexity Analysis of Algorithms for Nonconvex Smooth Optimization. *DIMACS/TRIPODS/MOPTA, Lehigh University, Bethlehem, PA, USA*, August 2018.
- [70] Frank E. Curtis. Characterizing Worst-Case Complexity of Algorithms for Nonconvex Optimization. *International Symposium on Mathematical Programming, Bordeaux, France*, July 2018.
- [71] Frank E. Curtis. How to Characterize the Worst-Case Performance of Algorithms for Nonconvex Optimization. *US-Mexico Workshop on Optimization and its Applications, Huatulco, Oaxaca, Mexico*, January 2018.
- [72] Frank E. Curtis. Worst-Case Complexity Guarantees and Nonconvex Smooth Optimization. *Casa Matemática Oaxaca Workshop on "Beyond Convexity: Emerging Challenges in Data Science"*, October 2017.

²The slides for most talks listed here are available at <http://coral.ise.lehigh.edu/frankecurtis/talks>. Invited conference and seminar presentations about our work have also been given by my collaborators and students, which are not listed here.

- [73] Frank E. Curtis. *R*-Linear Convergence of Limited Memory Steepest Descent. *EUROPT Workshop on Advances in Continuous Optimization, Montréal, Québec, Canada*, July 2017.
- [74] Frank E. Curtis. A Trust Funnel Algorithm for Nonconvex Equality Constrained Optimization with $\mathcal{O}(\epsilon^{-3/2})$ Complexity. *SIAM Conference on Optimization, Vancouver, British Columbia, Canada*, May 2017.
- [75] Frank E. Curtis. *R*-Linear Convergence of Limited Memory Steepest Descent. *SIAM Conference on Optimization, Vancouver, British Columbia, Canada*, May 2017.
- [76] Frank E. Curtis. A Sequential Algorithm for Solving Nonlinear Optimization Problems with Chance Constraints. *Northeast Regional Conference on Optimization and Optimal Control under Uncertainty, IBM T. J. Watson Research Center, Yorktown Heights, New York, USA*, December 2016.
- [77] Frank E. Curtis. A Sequential Algorithm for Solving Nonlinear Optimization Problems With Chance Constraints. *MOPTA Conference, Bethlehem, Pennsylvania, USA*, August 2016.
- [78] Frank E. Curtis. Self-Correcting Variable-Metric Algorithms for Nonsmooth Optimization. *International Conference on Continuous Optimization, Tokyo, Japan*, August 2016.
- [79] Frank E. Curtis. A Self-Correcting Variable-Metric Algorithm for Stochastic Optimization. *International Conference on Machine Learning, New York, New York, USA*, June 2016.
- [80] Frank E. Curtis. Self-Correcting Variable Metric Algorithms. *Workshop on Nonlinear Optimization Algorithms and Industrial Applications, Fields Institute, University of Toronto, Toronto, Ontario, Canada*, June 2016.
- [81] Frank E. Curtis. Self-Correcting Variable Metric Algorithms. *US-Mexico Workshop on Optimization and its Applications, Merida, Yucatan, Mexico*, January 2016.
- [82] Frank E. Curtis. Adaptive Gradient Sampling Algorithms for Nonconvex Nonsmooth Optimization. *INFORMS Annual Meeting, Philadelphia, PA, USA*, November 2015.
- [83] Frank E. Curtis. BFGS-GS: A Quasi-Newton Gradient Sampling Algorithm for Nonconvex Nonsmooth Optimization. *International Congress on Industrial and Applied Mathematics, Beijing, China*, August 2015.
- [84] Frank E. Curtis. Handling Nonpositive Curvature in a Limited Memory Steepest Descent Method. *MOPTA Conference, Bethlehem, Pennsylvania, USA*, July 2015.
- [85] Frank E. Curtis. A Trust Region Method with a Worst-Case Iteration Complexity of $\mathcal{O}(\epsilon^{-3/2})$ for Nonconvex Smooth Optimization. *International Symposium on Mathematical Programming, Pittsburgh, Pennsylvania, USA*, July 2015.
- [86] Frank E. Curtis. Adaptive Methods for Large-Scale Nonlinear Optimization. *SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, USA*, March 2015.
- [87] Frank E. Curtis. A Trust Region Algorithm with a Worst-Case Iteration Complexity of $\mathcal{O}(\epsilon^{-3/2})$ for Nonconvex Optimization. *Foundations of Computational Mathematics Conference, Montevideo, Uruguay*, December 2014.
- [88] Frank E. Curtis. Handling Nonpositive Curvature in a Limited Memory Steepest Descent Method. *MOPTA Conference, Bethlehem, Pennsylvania, USA*, August 2014.
- [89] Frank E. Curtis. An Inexact Sequential Quadratic Optimization Method for Nonlinear Optimization. *SIAM Conference on Optimization, San Diego, California, USA*, May 2014.
- [90] Frank E. Curtis. Sequential Quadratic Optimization with Inexact Subproblem Solves. *INFORMS Optimization Society Conference, Houston, Texas, USA*, March 2014.

- [91] Frank E. Curtis. A Quasi-Newton Gradient Sampling Algorithm for Nonsmooth Optimization. *PIMS Workshop on Numerical Linear Algebra and Optimization, Vancouver, British Columbia, Canada, August 2013.*
- [92] Frank E. Curtis. Sequential Quadratic Optimization with Inexact Subproblem Solves. *International Conference on Continuous Optimization, Lisbon, Portugal, July 2013.*
- [93] Frank E. Curtis. A Primal-Dual Active-Set Method for Convex Quadratic Optimization. *INFORMS Annual Meeting, Phoenix, Arizona, USA, October 2012.*
- [94] Frank E. Curtis. Infeasibility Detection and an Inexact Active-Set Method for Large-Scale Nonlinear Optimization. *International Symposium on Mathematical Programming, Berlin, Germany, August 2012.*
- [95] Frank E. Curtis. Nonconvex, Nonsmooth Optimization via Gradient Sampling. *SIAM Conference on Imaging Science, Philadelphia, Pennsylvania, USA, May 2012.*
- [96] Frank E. Curtis. Infeasibility Detection in Nonlinear Optimization. *Twelfth Copper Mountain Conference on Iterative Methods, Copper Mountain, Colorado, USA, March 2012.*
- [97] Frank E. Curtis. Nonsmooth Optimization via Gradient Sampling. *Foundations of Computational Mathematics Conference, Budapest, Hungary, July 2011.*
- [98] Frank E. Curtis. Infeasibility Detection in Nonlinear Optimization. *SIAM Conference on Optimization, Darmstadt, Hesse, Germany, May 2011.*
- [99] Frank E. Curtis. Inexact Newton Methods for Nonlinear Optimization. *SIAM Conference on Computational Science and Engineering, Reno, Nevada, USA, March 2011.*
- [100] Frank E. Curtis. Sequential Quadratic Programming with Gradient Sampling for Nonconvex Nonsmooth Constrained Optimization. *US-Mexico Workshop on Optimization and its Applications, Oaxaca City, Oaxaca, Mexico, January 2011.*
- [101] Frank E. Curtis. An Interior-Point Algorithm with Inexact Step Computations for Large-scale Nonlinear Optimization. *INFORMS Annual Meeting, Austin, Texas, USA, November 2010.*
- [102] Frank E. Curtis. A Penalty-Interior-Point Algorithm for Nonlinear Optimization. *INFORMS Annual Meeting, Austin, Texas, USA, November 2010.*
- [103] Frank E. Curtis. Sequential Quadratic Programming with Gradient Sampling for Nonconvex Nonsmooth Constrained Optimization. *Institute for Pure and Applied Mathematics Workshop II: Numerical Methods for Continuous Optimization, Los Angeles, California, USA, October 2010.*
- [104] Frank E. Curtis. A Penalty-Interior-Point Algorithm for Nonlinear Optimization. *International Conference on Continuous Optimization, Santiago, Chile, July 2010.*
- [105] Frank E. Curtis. An Interior-Point Algorithm with Inexact Step Computations for Large-Scale Optimization. *Eleventh Copper Mountain Conference on Iterative Methods, Copper Mountain, Colorado, USA, April 2010.*
- [106] Frank E. Curtis. Penalty Techniques in SQP and Interior-Point Algorithms. *INFORMS Annual Meeting, San Diego, California, USA, October 2009.*
- [107] Frank E. Curtis. An Interior-Point Algorithm with Inexact Step Computations. *INFORMS Annual Meeting, San Diego, California, USA, October 2009.*
- [108] Frank E. Curtis. Inexact Newton Methods and Nonlinear Constrained Optimization. *International Symposium on Mathematical Programming, Chicago, Illinois, USA, August 2009.*

- [109] Frank E. Curtis. A Sequential Quadratic Programming Method for Nonsmooth Optimization. *MOPTA Conference, Bethlehem, Pennsylvania, USA, August 2009.*
- [110] Frank E. Curtis. Inexact Newton Methods and Nonlinear Constrained Optimization. *EPSRC Symposium Capstone Conference, Coventry, UK, July 2009.*
- [111] Frank E. Curtis. A New Penalty-SQP Method. *INFORMS Annual Meeting, Washington DC, USA, October 2008.*
- [112] Frank E. Curtis. A Matrix-free Algorithm for Optimization. *SIAM Conference on Optimization, Boston, Massachusetts, USA, May 2008.*
- [113] Frank E. Curtis. A Matrix-free Method for Equality Constrained Optimization Problems with Rank Deficient Jacobians. *Tenth Copper Mountain Conference on Iterative Methods, Copper Mountain, Colorado, USA, April 2008.*
- [114] Frank E. Curtis. Infeasibility Detection in Nonlinear Programming. *INFORMS Optimization Society Conference, Atlanta, Georgia, USA, March 2008.*
- [115] Frank E. Curtis. Matrix-free Optimization. *International Conference on Continuous Optimization, Hamilton, Ontario, Canada, August 2007.*
- [116] Frank E. Curtis. Negative Curvature and Nonlinear Constrained Optimization. *SIAM Conference on Computational Science and Engineering, Costa Mesa, California, USA, February 2007.*
- [117] Frank E. Curtis. Inexact Primal-Dual Methods for Equality Constrained Optimization. *US-Mexico Workshop on Optimization and its Applications, Hualtulco, Oaxaca, Mexico, January 2007.*
- [118] Frank E. Curtis. General-Purpose Optimization Techniques for PDE-Constrained Optimization. *INFORMS Annual Meeting, Pittsburgh, Pennsylvania, USA, November 2006.*
- [119] Frank E. Curtis. Inexact SQP Methods for Equality Constrained Optimization. *International Symposium on Mathematical Programming, Rio de Janeiro, Brazil, August 2006.*
- [120] Frank E. Curtis. Matrices A Satisfying $A^2 = J$. *SIAM Conference on Linear Algebra, Williamsburg, Virginia, USA, July 2003.*
- [121] Frank E. Curtis. Matrices A Satisfying $A^2 = J$. *Verizon Undergraduate Research Symposium, Williamsburg, Virginia, USA, September 2002.*

Seminars at Universities and Research Centers (Invited)

- [122] Frank E. Curtis. SQP Methods for Constrained Stochastic Optimization. *One World Optimization Seminar, Virtual (Online), March 2021.*
- [123] Frank E. Curtis. SQP Methods for Constrained Stochastic Optimization. *Department of Mathematical Sciences, Rensselaer Polytechnic Institute, September 2020.*
- [124] Frank E. Curtis. SQP Methods for Constrained Stochastic Optimization. *Argonne National Laboratory, Lemont, IL, USA, July 2020.*
- [125] Frank E. Curtis. Characterizing the Worst-Case Performance of Algorithms for Nonconvex Optimization. *Courant Institute, New York University, May 2018.*
- [126] Frank E. Curtis. Characterizing the Worst-Case Performance of Algorithms for Nonconvex Optimization. *Department of Applied Mathematics and Statistics, Johns Hopkins University, April 2018.*

- [127] Frank E. Curtis. Characterizing the Worst-Case Performance of Algorithms for Nonconvex Optimization. *Department of Management Science & Information Systems, Rutgers Business School*, March 2018.
- [128] Frank E. Curtis. Algorithms for Nonsmooth Optimization (Tutorial). *Center for Optimization and Statistical Learning, Northwestern University*, February 2018.
- [129] Frank E. Curtis. Second-Order Methods for Stochastic and Nonsmooth Optimization. *Department of Industrial Engineering and Operations Research, Columbia University, New York, New York, USA*, October 2017.
- [130] Frank E. Curtis. Second-Order Methods for Stochastic and Nonsmooth Optimization. *Epstein Department of Industrial and Systems Engineering, University of Southern California, Los Angeles, California, USA*, October 2017.
- [131] Frank E. Curtis. Stochastic Optimization Algorithms Beyond SG. *ExxonMobil Research, Annandale, New Jersey, USA*, July 2017.
- [132] Frank E. Curtis. Stochastic Optimization Algorithms Beyond SG. *Google Research, New York, New York, USA*, November 2016.
- [133] Frank E. Curtis. Recent Adaptive Methods for Nonlinear Optimization. *ExxonMobil Research, Annandale, New Jersey, USA*, July 2015.
- [134] Frank E. Curtis. A Trust Region Algorithm with Improved Iteration Complexity for Nonconvex Smooth Optimization. *Computational Mathematics and Applications Seminar, Mathematical Institute, University of Oxford, Oxford, UK*, May 2015.
- [135] Frank E. Curtis. Inexact Newton Methods for Large-Scale Nonlinear Optimization. *IBM T. J. Watson Research Center, Yorktown Heights, New York, USA*, November 2013.
- [136] Frank E. Curtis. Nonsmooth Constrained Optimization via Gradient Sampling. *NSF RTG Symposium, Courant Institute of Mathematical Sciences, New York University, New York, NY, USA*, September 2012.
- [137] Frank E. Curtis. An Inexact Active-Set Method for Large-Scale Optimization. *School of Mathematics, University of Edinburgh, Edinburgh, Scotland*, August 2012.
- [138] Frank E. Curtis. Nonconvex, Nonsmooth Optimization by Gradient Sampling. *Department of Applied Mathematics and Statistics, Johns Hopkins University, Baltimore, Maryland, USA*, April 2012.
- [139] Frank E. Curtis. Nonconvex, Nonsmooth Optimization by Gradient Sampling. *Department of Industrial Engineering and Management Science, Northwestern University, Evanston, Illinois, USA*, March 2012.
- [140] Frank E. Curtis. An Inexact Newton Method for Large-Scale Nonlinear Optimization. *Instituto Tecnológico Autnomo de Mxico, Mxico City, Distrito Federal, Mxico*, April 2011.
- [141] Frank E. Curtis. An Inexact Newton Methods for Large-scale Nonlinear Optimization. *Department of Mathematics and Statistics, University of Guelph, Guelph, Ontario, Canada*, November 2010.
- [142] Frank E. Curtis. Inexact Newton Methods for Nonlinear Constrained Optimization. *Department of Mathematics, Lehigh University, Bethlehem, Pennsylvania, USA*, November 2009.
- [143] Frank E. Curtis. PDE-Constrained and Nonsmooth Optimization. *COR@L Seminar, Lehigh University, Bethlehem, Pennsylvania, USA*, October 2009.
- [144] Frank E. Curtis. Inexact Newton Methods and PDE-Constrained Optimization. *Computer Sciences Department, University of Wisconsin at Madison, Madison, Wisconsin, USA*, April 2009.

- [145] Frank E. Curtis. An Inexact Newton Method for Optimization. *Department of Industrial and Systems Engineering, Lehigh University, Bethlehem, Pennsylvania, USA*, February 2009.
- [146] Frank E. Curtis. An Inexact Newton Method for Optimization. *Division of Applied Mathematics, Brown University, Providence, Rhode Island, USA*, February 2009.
- [147] Frank E. Curtis. An Inexact Newton Method for Optimization. *School of Industrial Engineering, Purdue University, West Lafayette, Indiana, USA*, February 2009.
- [148] Frank E. Curtis. An Inexact Newton Method for Nonlinear Constrained Optimization. *Courant Institute of Mathematical Sciences, New York University, New York, New York, USA*, January 2009.
- [149] Frank E. Curtis. Matrix-free Primal-Dual Methods and Infeasibility Detection in Nonlinear Programming. *IBM T. J. Watson Research Center, Yorktown Heights, New York, USA*, April 2008.
- [150] Frank E. Curtis. Numerical Methods for PDE-Constrained Optimization. *Courant Institute of Mathematical Sciences, New York University, New York, USA*, March 2007.
- [151] Frank E. Curtis. Inexact Methods for PDE-Constrained Optimization. *Tepper School of Business, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA*, February 2007.
- [152] Frank E. Curtis. Inexact Methods for PDE-Constrained Optimization. *Department of Mathematics and Computer Science, Emory University, Atlanta, Georgia, USA*, February 2007.
- [153] Frank E. Curtis. Inexact Methods for PDE-Constrained Optimization. *Department of Statistics and Operations Research, University of Carolina at Chapel Hill, Chapel Hill, North Carolina, USA*, February 2007.

Organized Conferences

- Modeling and Optimization: Theory and Applications (MOPTA)
 - Bethlehem, PA, USA: 2015, 2014, 2013 (Chair of Organizing Committee), 2012, 2011, 2010.
- U.S.-Mexico Workshop on Optimization and its Applications
 - Mérida, Yucatán, Mexico: 2016.

Organized Conference Workshops

- International Conference on Machine Learning
 - “Optimization Methods for the Next Generation of Machine Learning,” New York, New York, USA, 2016.

Organized Conference Clusters

- INFORMS Annual Meeting
 - “Emerging Topics: AI and ML,” Seattle, Washington, USA, 2019.
 - “Nonlinear Programming,” Phoenix, Arizona, USA, 2012.
 - “Nonlinear Programming,” Charlotte, North Carolina, USA, 2011.
- International Conference on Continuous Optimization (ICCOPT)
 - “Nonlinear Optimization,” Lisbon, Portugal, 2013.
- International Symposium on Mathematical Programming (ISMP)

- "Nonlinear Programming," Pittsburgh, Pennsylvania, 2015.

Organized Conference Sessions and Minisymposia

- INFORMS Annual Meeting
 - "Nonconvex and Nonsmooth Optimization," one session, virtual, 2020.
 - "Nonlinear and Nonsmooth Methods," one session, virtual, 2020.
 - "Nonlinear Optimization Algorithms," one session, Houston, Texas, USA, 2017.
 - "Nonlinear Optimization Algorithms," two sessions, Nashville, Tennessee, USA, 2016.
 - "Nonlinear Optimization Algorithms," session, Philadelphia, Pennsylvania, USA, 2015.
 - "Large-scale Nonlinear Optimization Algorithms," session, San Francisco, California, USA, 2014.
 - "Nonlinear Optimization Algorithms," session, Minneapolis, Minnesota, USA, 2013.
 - "Algorithms for Nonlinear Optimization," session, Phoenix, Arizona, USA, 2012.
 - "Algorithms for Nonlinear Optimization," session, Charlotte, North Carolina, USA, 2011.
 - "Applications of Nonlinear Optimization," session, Charlotte, North Carolina, USA, 2011.
 - "Large-Scale/PDE-Constrained Optimization," session, Austin, Texas, USA, 2010.
- INFORMS Optimization Society Conference
 - "Nonlinear Optimization," session, Coral Gables, Florida, USA, 2012.
- International Conference on Continuous Optimization (ICCOPT)
 - "Nonlinear Optimization Algorithms," two sessions, Tokyo, Japan, 2016.
- International Symposium on Mathematical Programming (ISMP)
 - "Nonlinear Optimization (I – V)," five sessions, Berlin, Germany, 2012.
- Modeling and Optimization: Theory and Applications (MOPTA)
 - "Nonlinear Optimization Algorithms," session, Bethlehem, Pennsylvania, USA, 2019.
 - "Nonlinear Optimization Algorithms," session, Bethlehem, Pennsylvania, USA, 2015.
 - "Nonlinear Optimization," session, Bethlehem, Pennsylvania, USA, 2012.
 - "Nonlinear Programming," session, Bethlehem, Pennsylvania, USA, 2011.
- SIAM Conference on Optimization
 - "Algorithms at the Intersection of Nonlinear, Stochastic, and Mixed-Integer Optimization," two minisymposia, Vancouver, British Columbia, Canada, 2017.
 - "Large-Scale, Distributed, and Multilevel Optimization Algorithms," minisymposium, San Diego, California, USA, 2014.
 - "Stochastic, Noisy, and Mixed-Integer Nonlinear Optimization," minisymposium, San Diego, California, USA, 2014.
 - "Advanced Algorithms for Constrained Nonlinear Optimization," minisymposium, San Diego, California, USA, 2014.
 - "Modern Sequential Quadratic Algorithms for Nonlinear Optimization," minisymposium, San Diego, California, USA, 2014.
 - "Nonlinear Constrained Optimization," minisymposium, Boston, Massachusetts, USA, 2008.

Conference Program Committee Membership

- International Symposium on Mathematical Programming (ISMP), Bordeaux, France, 2018.

Invited Conference Panelist

- SIAM Conference on Optimization
 - “Forward Looking Panel Discussion,” San Diego, California, USA, May 2014.

G. Teaching and Research Advising

Courses Taught (Lehigh University)

- IE172 *Algorithms for Systems Engineering* S-'11
 This course (now ISE172), which may be used as a required course for ISE majors, introduces students to rigorous computer programming principles in the context of algorithms for solving common problems in Operations Research. When I taught the course, it involved a 3-hour weekly computer lab session that I supervised personally.
- IE220 *Introduction to Operations Research* F-'09, F-'10, F-'11
 This course used to be required for all undergraduate students in our department; it introduced students to basic tools used in deterministic and stochastic operations research, including linear programming, integer programming, nonlinear programming, stochastic processes, Markov Chains, and queueing theory. The course has since been split into the new ISE230 and ISE240 courses.
- ISE230 *Introduction to Stochastic Models in OR* S-'21, F-'21
 This course is required for all undergraduate students in our department; it introduces students to basic tools used in stochastic operations research, including optimization under uncertainty, decision analysis, game theory, Markov chains, queueing theory, and Markov decision processes.
- ISE401 *Convex Analysis* S-'14, F-'14, F-'15, F-'16, F-'18, F-'19, F-'20, F-'21
 This course (formally IE496: *Convex Analysis and Optimization*) was introduced as a new course of my design; it introduces the mathematics of convex analysis with emphasis on the theoretical principles underlying convex optimization problems, duality, and minimax theory. The course is now required for all first-year Ph.D. students in our department.
- ISE402 *Applied Models in Operations Research* S-'20
 This course is required for all doctoral students in our department; it introduces students to various deterministic and stochastic modeling paradigms in operations research.
- ISE409 *Time Series Analysis* S-'10, F-'11, S-'13, S-'14, S-'15
 This course (formerly IE409) is a graduate-level course on the mathematical analysis of time series. The course includes a rigorous treatment of discrete time stochastic processes and their use in modeling, analyzing, and forecasting univariate and multivariate time series.
- ISE417 *Nonlinear Optimization* F-'10, S-'12, F-'13, S-'15, S-'16, S-'17, S-'19
 This course (formerly IE417: *Nonlinear Programming*) is a Ph.D.-level course designed to introduce the theoretical principles underlying nonlinear optimization problems and the algorithms designed to solve them. I have taught this course every time that it has been offered since my arrival at Lehigh. It is now a required course for all first-year Ph.D. students in ISE.

- IE496 *Numerical Methods for Optimal Control* F-'12
 This course was introduced as a new course of my design; it covers the fundamental mathematical principles underlying optimal control problems, as well as numerical optimization methods that may be applied to solve them.

Courses Co-Taught or Advised (Lehigh University)

- IE122 *Software Tools* F-'09, F-'10, F-'11
 This course used to be a co-requisite of IE220; it introduced the modeling language AMPL and covered functionality of Matlab, Excel, and Visual Basic for Applications that may be used to solve Operations Research problems. The course was taught by a graduate student, but was supervised by me when I taught IE220. This course was no longer offered once IE220 split.
- Engr005 *Introduction to Engineering Practice* F-'12, F-'15, F-'16
 This course (formerly Engr098) is required by all freshman engineering students; the course itself has been taught by Prof. Keith Gardiner, but I led the ISE department projects.
- Engr495 *Technical Writing for Scientists and Engineers* S-'12 – present
 This course was initially created due to the efforts of a former Lehigh student (Ana Alexandrescu), the former Director of ESL (Tim Bonner), and myself. In addition, during the first semester in which the course was held, I worked with one of the instructors (Ana Maria Ferraro) to design the course and helped review completed assignments by ISE students. Since that time, I have worked with each instructor to tailor the course for ISE students.

Courses Taught (Columbia University)

- *Convex Optimization*, Spring 2018

Courses Taught (New York University)

- *Calculus II*, Spring 2009
- *Linear Algebra*, Fall 2008
- *Nonlinear Optimization*, Spring 2008
- *Elementary Statistics*, Fall 2007

Teaching/Tutoring/Grading Activities Prior to Professorships and Instructorships

- *Engineering Analysis I*, Teaching Assistant, McCormick School of Engineering and Applied Science, Northwestern University, Fall 2006
- *Mathematical Programming I*, Grader, Industrial Engineering and Management Sciences, Northwestern University, Fall 2006
- *Bits and Blocks*, Teacher, Center for Talent Development, Northwestern University, July 2006
- *Numerical Methods for Engineers*, Teaching Assistant, Electrical Engineering and Computer Science, Northwestern University, Spring 2006
- *Deterministic Models*, Teaching Assistant, Industrial Engineering and Management Sciences, Northwestern University, Spring 2005
- *Mathematical Statistics*, Tutor, Chicago Tutor Consortium, Fall 2004
- *Business Calculus*, Tutor, Office of Multicultural Affairs, College of William and Mary, 1997 – 1999

Teaching Evaluations Summary (Lehigh University)

Starting in Fall 2018, Lehigh University asks students to evaluate instructor effectiveness by asking them to score their level of agreement with the various statements (with 1 = disagree strongly, 2 = disagree somewhat, 3 = neutral, 4 = agree somewhat, and 5 = agree strongly), including the following:

1. Instructor presented content in an organized manner.
2. The instructor's teaching methods contributed to my understanding of the course material.
6. The course increased my knowledge of the subject matter.

Below are some of my average scores as compared to department, college, and university averages.

Course	Semester	# Surveyed (# Enrolled)	1. (Instructor organization)				2. (Teaching methods)				6. ("Increased my knowledge")			
			me	Dept.	Coll.	Univ.	me	Dept.	Coll.	Univ.	me	Dept.	Coll.	Univ.
ISE 230	S 2021	11 (17)	4.91	4.62	4.37	4.49	5.00	4.57	4.24	4.38	5.00	4.73	4.50	4.59
ISE 401	F 2020	9 (10)	4.78	—	—	—	4.78	—	—	—	4.78	—	—	—
ISE 402	S 2020	no evaluations due to COVID-19 pandemic												
ISE 401	F 2019	9 (10)	5.00	4.51	4.26	4.41	5.00	4.37	4.11	4.26	5.00	4.57	4.42	4.51
ISE 417	S 2019	14 (17)	5.00	4.48	4.33	4.46	4.93	4.30	4.16	4.32	4.93	4.57	4.46	4.56
ISE 401	F 2018	20 (23)	5.00	4.54	4.33	4.44	5.00	4.35	4.14	4.30	5.00	4.61	4.41	4.53

Prior to Fall 2018, Lehigh University asked students various questions to evaluate instructor effectiveness and course quality. Below are the average scores (on a scale of 1 to 5, with 5 being best) that I received on three of these questions as compared to department and college averages.

Course	Semester	# Surveyed (# Enrolled)	Instructor's Teaching			Quality of Course			"Learned a lot"		
			Course	Dept.	College	Course	Dept.	College	Course	Dept.	College
ISE417	S 2017	10 (10)	4.90	4.26	4.29	4.90	4.29	4.32	4.70	4.24	4.30
ISE401	F 2016	10 (11)	4.90	4.25	4.18	4.90	4.31	4.22	4.80	4.26	4.20
ISE417	S 2016	10 (10)	4.90	4.36	4.25	4.90	4.38	4.28	5.00	4.34	4.27
ISE401	F 2015	8 (9)	4.88	4.33	4.18	4.88	4.38	4.22	5.00	4.33	4.22
ISE417	S 2015	12 (13)	4.92	4.38	4.23	4.92	4.43	4.26	4.83	4.44	4.28
ISE409	S 2015	16 (17)	4.63	4.38	4.23	4.69	4.43	4.26	4.81	4.44	4.28
ISE496	F 2014	9 (10)	4.44	4.05	4.07	4.44	4.14	4.15	4.56	4.02	4.15
ISE496	S 2014	15 (15)	4.80	4.37	4.26	4.87	4.40	4.26	4.80	4.32	4.26
ISE409	S 2014	14 (14)	4.79	4.37	4.26	4.71	4.40	4.26	4.71	4.32	4.26
IE417	F 2013	18 (20)	5.00	4.07	4.17	5.00	4.12	4.18	4.89	4.01	4.17
IE409	S 2013	8 (8)	5.00	4.38	4.31	5.00	4.41	4.32	4.75	4.31	4.28
IE496	F 2012	3 (4)	5.00	4.25	4.25	5.00	4.24	4.26	5.00	4.31	4.30
IE417	S 2012	7 (7)	5.00	4.40	4.34	5.00	4.40	4.35	5.00	4.32	4.32
IE409	F 2011	30 (38)	4.43	4.32	4.17	4.57	4.31	4.19	4.33	4.07	4.17
IE220	F 2011	18 (24)	4.72	4.32	4.17	4.78	4.31	4.19	4.72	4.07	4.17
IE172	S 2011	12 (14)	4.50	4.17	4.28	4.42	4.21	4.29	4.33	4.05	4.23
IE417	F 2010	16 (18)	4.88	4.37	4.17	4.81	4.38	4.20	4.88	4.17	4.19
IE220	F 2010	16 (24)	4.69	4.37	4.17	4.63	4.38	4.20	4.69	4.17	4.19
IE409	S 2010	8 (12)	4.75	4.28	4.22	4.75	4.30	4.22	4.50	4.17	4.16
IE220	F 2009	17 (19)	4.59	4.18	4.20	4.65	4.24	4.24	4.65	4.04	4.20

Teaching Evaluations Summary (Columbia University)

*Course evaluation average scores (scale of 1 to 5).

Course	Semester	# Surveyed (# Enrolled)	Course: Overall Quality	Instructor: Overall Quality
EEORE6616	S 2018	16 (32)	4.69	4.69

Postdoctoral Advisees

- Michael O'Neill (Ph.D. University of Wisconsin, Madison)

2020 – present

- Albert S. Berahas (Ph.D. Northwestern University)

2018 – 2020

Ph.D. Student Advisees

- Qi Wang, Department of ISE, Lehigh University 2020 – present
- Minhan Li, Department of ISE, Lehigh University 2019 – present
- Baoyu Zhou, Department of ISE, Lehigh University 2018 – present
- Mertcan Yetkin, Department of ISE, Lehigh University 2016 – present
- Rui Shi, Department of ISE, Lehigh University 2015 – 2020
Research: *Stochastic Trust Region Algorithms*
Notes : Graduated Spring 2020
- Mohammadreza Samadi, Department of ISE, Lehigh University 2013 – 2018
Research: *Efficient Trust Region Methods for Nonconvex Optimization*
Notes : Graduated Fall 2018
- Wei Guo, Department of ISE, Lehigh University 2011 – 2017
Research: *Limited Memory Steepest Descent Methods for Nonlinear Optimization*
Notes : Graduated Spring 2017
- Zheng Han, Department of ISE, Lehigh University 2010 – 2015
Research: *Primal-Dual Active-Set Methods in Nonlinear Optimization*
Notes : Graduated Summer 2015
- Xiaocun Que, Department of ISE, Lehigh University 2009 – 2015
Research: *Randomized Algorithms for Nonconvex Nonsmooth Optimization*
Notes : Graduated Fall 2015
- Hao Wang, Department of ISE, Lehigh University 2009 – 2015
Research: *Practical Enhancements in Sequential Quadratic Optimization: Infeasibility Detection, Subproblem Solvers, and Penalty Parameter Updates*
Notes : Graduated Spring 2015
- Jiaxin Liu, Department of ISE, Lehigh University 2010 – 2013
Research: *Sensitivity Analysis in Second Order Cone Optimization*
Notes : Co-advised by Prof. Terlaky; left program prior to completing proposal

Doctoral Committee Membership (not including Ph.D. student advisees)

- Zheng Shi, Department of Industrial and Systems Engineering, Lehigh University 2021 – present
- Suyun Liu, Department of Industrial and Systems Engineering, Lehigh University 2020 – present
- Secil Sozuer, Department of Industrial and Systems Engineering, Lehigh University 2019 – present
- Xin Shi, Department of Industrial and Systems Engineering, Lehigh University 2019 – present
- Suresh Bolusani, Department of ISE, Lehigh University 2016 – present
- Jonathan Grant-Peters, Wolfson College, University of Oxford 2021
Research: *Non-Smooth Optimization Applied to Improving Steam Engine Turbines*
Advisor : Raphael Hauser

- Wenbo Gao, Industrial Engineering and Operations Research, Columbia University 2020
 Research: *Convex Optimization and Extensions, with a View Toward Large-Scale Problems*
 Advisor : Donald Goldfarb
- Majid Jahani, Department of Industrial and Systems Engineering, Lehigh University 2019 – 2021
 Research: *Efficient and Scalable Optimization Methods for Training Large-scale Machine Learning Models*
 Advisor : Martin Takáč
- Liyuan Cao, Department of Industrial and Systems Engineering, Lehigh University 2019 – 2021
 Research: *Model-Based Derivative Free Optimization Methods and Analysis of Stochastic Nonlinear Optimization*
 Advisor : Katya Scheinberg
- Xin Shi, Department of Industrial and Systems Engineering, Lehigh University 2019 – 2020
 Research: *Advanced Optimization Methods for Problems in Power Systems and Polynomial Optimization*
 Advisor : Luis Zuluaga
- Azam Asl, Department of Computer Science, New York University 2017 – 2020
 Research: *Behavior of the Limited-Memory BFGS Method on Nonsmooth Optimization Problems in Theory and Practice*
 Advisor : Michael Overton
- Tianyi Chen, Department of Applied Mathematics and Statistics, Johns Hopkins 2018
 Research: *A Fast Reduced-Space Algorithmic Framework for Sparse Optimization*
 Advisor : Daniel P. Robinson
- Lam Nguyen, Department of ISE, Lehigh University 2017 – 2018
 Research: *A Service System with On-demand Agents, Stochastic Gradient Algorithms and SARAH Algorithm*
 Advisor : Katya Scheinberg
- Xi He, Department of ISE, Lehigh University 2017 – 2018
 Research: *Distributed Algorithms in Large-scaled Empirical Risk Minimization: Non-convexity, Adaptive Sampling, and Matrix-free Second-order Methods*
 Advisor : Martin Takáč
- Wei Xia, Department of ISE, Lehigh University 2017 – 2018
 Research: *Solution Techniques For Non-convex Optimization Problems*
 Advisor : Luis Zuluaga
- Afshin OroojlooyJadid, Department of ISE, Lehigh University 2017 – 2018
 Research: *Application of Machine Learning in Supply Chains*
 Advisor : Lawrence V. Snyder
- Chenxin Ma, Department of ISE, Lehigh University 2017 – 2018
 Research: *Distributed Methods for Composite Optimization: Communication Efficiency, Load-Balancing and Local Solvers*
 Advisor : Martin Takáč
- MirSaleh Bahavarnia, Department of MEM, Lehigh University 2016 – 2018
 Research: *Sparsity-Promoting Optimal Controller Design*
 Advisor : Nader Motee

- Hiva Ghanbari, Department of ISE, Lehigh University 2016 – 2018
 Research: *Optimization Algorithms for Machine Learning Problems*
 Advisor : Katya Scheinberg
- Jie Liu, Department of ISE, Lehigh University 2015 – 2018
 Research: *Recent Advances in Randomized Methods for Big Data Optimization*
 Advisor : Martin Takáč
- Nitish Keskar, Department of IEMS, Northwestern University 2016 – 2017
 Research: *Second-Order Methods for Stochastic and Nonsmooth Optimization*
 Advisor : Andreas Wächter
- Miao Bai, Department of ISE, Lehigh University 2015 – 2017
 Research: *Optimization of Surgical Appointment Scheduling in Multiple Operating Rooms
with Post Anesthesia Care Unit Constraints*
 Advisor : Robert Storer
- Matt Menickelly, Department of ISE, Lehigh University 2015 – 2017
 Research: *Random Models in Nonlinear Optimization*
 Advisor : Katya Scheinberg
- Hao Jiang, Department of Applied Mathematics and Statistics, Johns Hopkins 2011 – 2016
 Research: *Adaptive Augmented Lagrangian Methods for Large-Scale Nonlinear Optimization*
 Advisor : Daniel P. Robinson
- Xiaocheng Tang, Department of ISE, Lehigh University 2013 – 2015
 Research: *Big Data Optimization in Machine Learning*
 Advisor : Katya Scheinberg
- Yunfei Song, Department of ISE, Lehigh University 2013 – 2015
 Research: *Optimization Theory and Dynamical Systems:
Invariant Sets and Invariance Preserving Discretization Methods*
 Advisor : Tamás Terlaky
- Mohsen Moarefdoost, Department of ISE, Lehigh University 2013 – 2015
 Research: *Optimization Models for Electricity Networks and Renewable Energy under Uncertainty*
 Advisor : Lawrence V. Snyder
- Xi Bai, Department of ISE, Lehigh University 2013 – 2015
 Research: *Enhanced First-Order Methods in Convex and Nonconvex Optimization*
 Advisor : Katya Scheinberg
- Tim Mitchell, Department of Computer Science, New York University 2014
 Research: *Robust and Efficient Methods for Approximation and Optimization of Stability Measures*
 Advisor : Michael L. Overton
- Murat Mut, Department of ISE, Lehigh University 2011 – 2014
 Research: *Curvature as a Complexity Bound in Interior-Point Methods*
 Advisor : Tamás Terlaky
- Robert Howley, Department of ISE, Lehigh University 2012 – 2013
 Research: *Optimization Methods in Statistics*
 Advisors: Robert H. Storer and Luis Zuluaga
- Serdar Yildiz, Department of ISE, Lehigh University 2012 – 2013
 Research: *Improvements to Methods for Branching and Cutting in Integer Programming*
 Advisor : Theodore K. Ralphs

- Julio César Góez, Department of ISE, Lehigh University 2010 – 2013
 Advisor : *Mixed Integer Second Order Cone Optimization Disjunctive Conic Cuts*
 Research: Tamás Terlaky
- Daniel Scansaroli, Department of ISE, Lehigh University 2009 – 2012
 Research: *Stochastic Modeling with Temporally Dependent Gaussian Processes*
 Advisor : Vladimir Dobrić and Robert H. Storer
- Camilo Mancilla, Department of ISE, Lehigh University 2009 – 2011
 Research: *Stochastic Scheduling of Operating Rooms*
 Advisor : Robert H. Storer

Master Student Advisees (for Masters Theses)

- Baoyu Zhou, Department of ISE, Lehigh University 2017 – 2018
 Research: *Quadratic Optimization for Nonsmooth Optimization Algorithms: Theory and Numerical Experiments*
- Jingxuan Liu, Department of ISE, Lehigh University 2015
 Research: *Multivariate Time Series Study of Foreign Currency Exchange Rates*
- Wenda Zhang, Department of ISE, Lehigh University 2013 – 2014
 Research: *A Subproblem Algorithm for an Adaptive Augmented Lagrangian Method*

Undergraduate Student Advisees (for Senior Theses)

- Yan (Mandy) Liu, Department of ISE, Lehigh University 2010 – 2012
 Research: *Numerical Optimizatoin Methods in Machine Learning*

H. Service

University Service (Lehigh University)

- Graduate and Research Committee 2016 – 2019
- SmartCities Workshop Participant 2016
- Frank Hook Assistant Professorship Award Committee 2014 – 2015
- English as a Second Language (ESL) Program, Strategic Planning Committee 2013
- Future of the Internet, Media/Entertainment and Mobility, Symposium Participant 2013
- University Academic Symposium, Graduate Poster Selection Committee 2013

College Service (P.C. Rossin College of Engineering and Applied Science, Lehigh University)

- Foundations of Data Science Faculty Search (Co-Chair) 2018 – 2019
- Dean Envisioning Team Member 2016 – 2017
- First Year Advisor 2010 – 2017
- Dean Search Committee 2014 – 2016
- Engineering Day Advisor 2009 – 2010

Department Service (Industrial and Systems Engineering, Lehigh University)

- ISE Director of Graduate Studies 2018 – present
- OptML Affiliated Faculty 2015 – present
- INFORMS Chapter Advisor 2014 – present
- PhD Search Committee 2012 – present
- COR@L Affiliated Faculty 2009 – present
- PhD Program Committee 2009 – present
- ISE Chair Search Committee (Chair) 2017 – 2018
- PhD Program Director 2016 – 2017
- Van Hoesen Family Best Paper Award Committee (Chair) 2016, 2020
- PoP Search Committee 2015 – 2016
- ISE Council Advisor 2009 – 2016
- Undergraduate Curriculum Subcommittee 2015
- ISE Seminar Organizer 2010 – 2012
- Masters Student Application Committee 2010 – 2012
- ISE Junior Faculty Search Committee 2011

Professional Service

- Nominating Committee Member, SIAM Activity Group on Optimization 2016
- Vice Chair for Nonlinear Programming, INFORMS Optimization Society 2010 – 2012

Professional Affiliations

- Institute of Industrial Engineers (IIE)
- Institute for Operations Research and Management Sciences (INFORMS) (current)
- Mathematical Optimization Society (MOS) (current)
- Phi Beta Kappa (current)
- Sigma Xi
- Society for Industrial and Applied Mathematics (SIAM) (current)

Publishers reviewed for (# books and/or chapters reviewed, not including revisions reviewed)

- MOS-SIAM (1)
- SIAM (1)
- Springer (1)

Journals reviewed for (# articles reviewed, not including revisions reviewed)

- Advances in Applied Mathematics and Mechanics (1)
- Advances in Computational Mathematics (1)
- Applied Mathematics and Computation (1)
- Computational Optimization and Applications (16)
- European Journal on Computational Optimization (1)
- European Journal of Operational Research (4)
- IEEE Transactions on Automatic Control (1)
- IEEE Transactions on Signal Processing (1)
- IMA Journal on Numerical Analysis (6)
- INFORMS Journal on Optimization (2)
- International Journal of Computer Mathematics (1)
- Inverse Problems (1)
- Journal of Applied Mathematics and Computing (1)
- Journal of Global Optimization (2)
- Journal of Industrial and Management Optimization (1)
- Journal of Machine Learning Research (1)
- Journal of Optimization Theory and Applications (7)
- Mathematical Programming (16)
- Mathematical Programming, Series B (3)
- Mathematical Programming Computation (2)
- Mathematics of Operations Research (3)
- Numerical Algorithms (4)
- Optimization and Engineering (5)
- Optimization Letters (2)
- Optimization Methods and Software (9)
- Set-Valued and Variational Analysis (1)
- SIAM Journal on Imaging Sciences (1)
- SIAM Journal on Mathematics of Data Science (1)
- SIAM Journal on Numerical Analysis (3)
- SIAM Journal on Optimization (34)

- SIAM Journal on Scientific Computing (3)
- SIAM Review: Research Spotlights (1)
- Statistics and Computing (2)
- Transactions on Mathematical Software (1)

Conferences reviewed for (# conferences)

- AISTATS (1)
- COLT: Conference on Learning Theory (1)
- ESAIM: Control, Optimisation, and Calculus of Variations (1)
- ICML: International Conference on Machine Learning (3)
- IEEE Transactions on Automatic Control (1)
- NeurIPS: Neural Information Processing Systems (1)

Award committees reviewed for (# awards)

- Best Student Paper Prize, INFORMS Computing Society (3)
- Best Student Paper Prize, INFORMS Optimization Society (2)
- JFIG Best Paper Prize, INFORMS (1)
- Nicholson Prize, INFORMS (2)
- Young Researcher Prize, INFORMS Optimization Society (1)

U.S. Federal Granting Agencies reviewed for

- U.S. National Science Foundation 2018 – present
- U.S. Department of Energy 2012 – present

Foreign Granting Agencies reviewed for

- Austrian Academy of Sciences 2015
- Czech Science Foundation 2015, 2017
- Research Grants Council (RGC) of Hong Kong 2014, 2019