Curriculum Vitae

Daniel Bienstock

Liu Family Chair in Operations Research
Dept. of IEOR, Columbia University
Joint affiliation: Applied Math, Electrical Engineering
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Research interests

My research focuses on fundamental methodological and computational aspects of optimization, with emphasis in large-scale, nonconvex and discrete optimization problems. An additional research thrust has focused on optimization problems related to analysis and operations of power transmission networks, including efficient operations, economics and risk analysis, topics which I explore in a book recently published by SIAM. Another recent research thrust concerns the use of mixed-integer programming techniques toward solving mixed-integer or purely continuous quadratically constrained quadratic programs and polynomial optimization problems. Here my particular focus concerns lifted representation of nonconvex problems as higher-dimensional convex problems. Finally, I am also interested in all aspects of high-performance computation as applied to problems arising in science and engineering, and generally problems with large societal impact.

Awards and Honors

Liu Family Chair (2018).
Fellow, Institute for Operations Research and Management Science (2013).
Semi-plenary Speaker, 2006 Mathematical Programming Sympsioum (Rio).
Plenary Speaker, 2005 SIAM Optimization Conference (Stockholm).
IBM Faculty Partnership Award (2005).
Presidential Young Investigator Award (1990 - 1995).
Zannetos Thesis Prize, M.I.T., 1985.

Recent research grants

- ARPA-E "PERFORM", PI, joint with A Capponi, G. Iyengar (Columbia), NYU and U. of Arizona. Approximately $2 million. (2020).
- ARPA-E (joint with Richard Waltz), "GO competition, challenge 2", my part approx. $200,000 (2020).
- ARPA-E (joint with several colleagues), "GO competition, challenge 1", my part approx. $250,000 (November 2018 - November 2019).
- ONR, "Practical Algorithms for Polynomial Optimization", approximately $480,000 (October 2016 - August 2020).
- DARPA, "Lagrange: Real-time control of network physical structures to bypass complexity: Optimization, Stochastics and Structure Recognition," PI, joint with J. Blanchet, V. Goyal and G. Iyengar, $782,000 (01/01/2018 - 08/30/2019).
- NSF, "Protecting Coastal Infrastructure in a Changing Climate by Integrating Optimization Modeling and Stakeholder Observations," joint with K. Mandli and G. Deodatis, approximately $500,000 (October 2017 - October 2019).

- DTRA, 'Power grid vulnerability and resilience to geographically correlated failures'", $350,000 (October 2012 - 2016. Extended through May 2020).
- DOE (joint with LANL and other colleagues), "Advanced machine learning for synchrophasor technology", my part approx. $150,000 (June 2016 - September 2019).

Service and Editorships

Director, MSOR/IE programs, IEOR Department.

Program Committee Chair, *IPCO 2020*.

Chair, *INFORMS Optimization Society*, 2019, 2020.

Editor-in-chief, *Mathematical Programming Computation* (1/2015 - 12/2018).

Program Committee, *International Symposium on Mathematical Programming 2018*.

I created the MIP series of conferences on integer programming, now on its eighteenth iteration.

Committee member, IPCO, SODA, SEA, ISCO, other conferences (multiple instances).

Nicholson Award Committee (2007 - 2010, 2015 -).

Informs Fellows Selection Committee (2015 - 2017).

Commitee member, Informs Computing Society Prize (2012-2015).

IPCO Steering Committee (2002 - 2010). Chairman (9/2007 - 2010) .

Chairman, IPCO X Organizing Committee (June 2004).

Committee Member, Beale-Orchard-Hays Prize (ISMP 2003).

Associate Editor of *Math. Programming C* (2008- 2014), *Annals of O.R.* (2011-), *Math. Programming* (1995-1999), *SIAM J. Disc. Math.* (1992 -), *Oper. Res.* (2002 - 2006), *Mgt. Science* (2002 - 2006), *Disc. Optimization* (2004 - 2012).

Employment

7/89 - present. Dept. of Industrial Engineering and Operations Research, Columbia University. Associate Professor, 1990. Tenured, 1991. Full Professor, 1995. Joint appointment in Applied Physics and Applied Mathematics, May 2008. Joint appointment in Electrical Engineering, May 2018.

8/85 - 4/86. Graduate School of Industrial Administration, Carnegie Mellon University.

4/86 - 8/89. Combinatorics and Optimization Research, Bellcore.

Education

5/82. B.A., Mathematics, Brandeis University (Summa Cum Laude).

6/85. Ph.D., Operations Research, M.I.T.

Professional Societies

Informs, Mathematical Programming Society, SIAM, IEEE.

Invited and Refereed Presentations (1989-present)

1989
Oberwolfach meeting on Combinatorial Optimization – "Generalized max-flow min-cut problems in the plane".
Cornell (School of O.R.) – "Obstructions to small face covers".
Rutgers (RUTCOR) – "Obstructions to small face covers".
ORSA/TIMS meeting (New York) – "Critical edge problems".
Courant Institute – "Provably hard crossing number problems".
DIMACS meeting on Network Survivability (Rutgers) – "Graph searching, path-width and tree-width".

1990
Integer Programming and Combinatorial Optimization Conference (Waterloo) – "Provably hard crossing number problems".
Sixth Ann. Symp. on Comp. Geometry (Berkeley) – "Provably hard crossing number problems".
Cornell (School of O.R.) – "Blocking small cuts in a network".
N.Y.U. (School of Business) – "Blocking small cuts in a network".
ORSA/TIMS meeting (Philadelphia) – "New results on crossing numbers".
M.I.T. (O.R. Center) – "Searching a network for a virus".
Georgia Tech. (Indust. and Syst. Eng.) – "Blocking small cuts in a network".

1991
U. of Montreal (Comp. Science) – "Searching a network for a virus".
Carleton University (Math.) – "New results on crossing numbers".
SUNY Stony Brook (Appl. Math.) – " Lot-sizing in trees, and network design".
IBM (Yorktown Hts.) – " Computational experience with an algorithm for local access network design".

1992
Cornell (School of O.R.) – "Computational experience with some difficult integer programs".
IBM (Yorktown Hts.) – "Computational experience with OSL on a difficult routing problem in lightwave networks".
Bellcore – " Computational experience with an algorithm for local access network problems".

1993
CORE (U. C. de Louvain, Belgium) – "Computational experience with a strong formulation for a difficult network design problem".
Telecommunications Systems Conference (Vanderbilt) – "Computational experience with an algorithm for a difficult problem in lightwave networks".
DIMACS Conference on Approximation Algorithms – "Several difficult combinatorial optimization problems in telecommunications".
DIMACS Conference on Hard Combinatorial Optimization Problems – "Computational experience with a cutting-plane algorithm for a difficult multicommodity flow problem".

1994
SUNY Stony Brook (Appl. Math.) – " Computational experience with a branch-and-bound quadratic programming algorithm".
ORSA meeting (Boston) – " Capacitated Network Design: Polyhedral Structure and Computation".
ORSA meeting (Boston) – " Solving real-life ATM network design problems".
Math. Programming Symposium – " Capacitated Network Design: Polyhedral Structure and Computation".
Math. Programming Symposium – " Solving real-life ATM network design problems".
Rice University – " Capacitated Network Design: Polyhedral Structure and Computation".
New York Academy of Sciences – "Mixed-integer, multicommodity flow problems".

1995
SUNY Stony Brook (Harriman School) – "Mixed-integer, multicommodity flow problems".
IPCO '95 (Copenhagen) – " Computational experience with a branch-and-bound quadratic programming algorithm".
Northwestern University – " Computational experience with a branch-and-bound quadratic programming

algorithm".
ORSA meeting (N. Orleans) – " Computational experience with a branch-and-bound quadratic programming algorithm," "Algorithms for network design problems".
U. of Waterloo – "Algorithms for network design problems".

1996

Artemis meeting (Aussois, France) – "Combinatorial algorithms for network design problems".
Network day (DIMACS) - "Combinatorial algorithms for network design problems".
ORSA meeting (Atlanta) - "Combinatorial algorithms for network design problems".
Northwestern University - "Combinatorial algorithms for network design problems".

1997

IBM (Yorktown Hts) - "Computational experiments with a network design algorithm using ϵ-approximate linear programs."
ISMP '97 (Lausanne, Switzerland) -"Computational experiments with a network design algorithm using ϵ-approximate linear programs."
ISMP '97 (Lausanne, Switzerland) -"Network design with flow-survivability constraints."
ISMP '97 (Lausanne, Switzerland) -"Computational experience with an ATM network layout procedure."
Berlin -"Computational experiments with a network design algorithm using ϵ-approximate linear programs."
Lucent -"Computational experiments with a network design algorithm using ϵ-approximate linear programs."

1998

Cornell -"Computational experiments with a network design algorithm using ϵ-approximate linear programs."
INFORMS-"Polyhedral structure of survivable network design problems."
DIMACS-"Solving LP relaxations of large-scale network design problems"

1999

Oberwolfach - "Solving LP-relaxations of large-scale network design problems."
DIMACS Workshop on Logistics -"Solution of an airline maintenance scheduling problem."
IBM -"Solution of an airline maintenance scheduling problem."
IBM (Gomory meeting) -"Epsilon-approximate LP solutions: new bounds and computation"

2000

Symposium on Discrete Algorithms (SODA) -"Epsilon-approximate LP solutions: new bounds and computation".
Boca Telecomm. Conference -"Approximately solving linear programs: a tutorial".
Optimization Days (Stockholm) -"Approximately solving linear programs: a tutorial".
Telecommunications Coference (Salerno, Italy) -"Solving practical network design problems: theory and practice".
CORE Lecture Series (CORE, Belgium) -"Approximately solving large-scale linear programs" (five three hour lectures).

2001

MIT -"Approximation Algorithms for Linear Programming: From Theory to Growing Practice".
CMU -"Approximation Algorithms for Linear Programming: From Theory to Growing Practice".
UNC -"Approximation Algorithms for Linear Programming: From Theory to Growing Practice".
Donet Summer School/IPCO - 4-hour tutorial on approximation algorithms for large-scale linear programming.
Ga. Tech. -"Approximation Algorithms for Linear Programming: From Theory to Growing Practice".

2002

INFORMS Telecomm. Conference - Tutorial on approximate routing algorithms.
Royal Technical Institute, Stockholm - Faculty opponent for Mikael Prytz's thesis defense.
APMOD'02 (Italy) - "Combined pricing and network design."
Integer Programming Conference in honor of Egon Balas - "Subset algebra lifting algorithms for 0-1 Integer Programming."

Bell Laboratories - "Subset algebra lifting algorithms."
IMA Tutorial on Supply-Chain Optimization - "Large-scale Linear Programming."
IMA Workshop on Integer Programming - "Subset algebra lifting algorithms."
Lehigh University - "Subset algebra lifting algorithms."

2003

ZIB (Berlin Algorithms Day) - "Subset algebra lifting algorithms.".
GSIA, Carnegie Mellon - "Subset algebra lifting algorithms."
MIT - "High-Performance Network Design."
Rutgers - "Subset algebra lifting algorithms."
DIMACS Workshop on Geometric Optimization - "New Trends in Linear and Integer Programming."
ISMP 2003 (Copenhagen) - "Subset algebra lifting algorithms."
INFORMS Atlanta - "Combined network design and pricing"
U. of Buffalo - "Combined network design and pricing"
IBM (Yorktown Hts.) - "Concurrent flows in $O(1/\epsilon)$ iterations."
IBM (Yorktown Hts.) - "Subset algebra lifting algorithms."

2004

Lehigh University - "Subset algebra lifting algorithms."
Oberwolfach (Math. in the Supply Chain) - "Modeling the Lucent supply chain."
STOC 2004 (Chicago) - "Concurrent flows in $O(1/\epsilon)$ iterations."
France Télécom (Paris) - "Large-scale routing algorithms – the state of the art"
France Télécom (Paris) - "Lift-and-project algorithms for integer programming".
University of Chemnitz - "Tree-width and the Sherali-Adams operator."

2005

IBM (Yorktown Hts.) - "Large scale routing algorithms."
Plenary talk, SIAM Conference on Optimization (Stockholm) - "Discrete Optimization and Network Design".
Cornell - "New algorithms for the maximum throughput problem".
IMA - "Optimization and Robust Power Grids".
National Science Foundation - "Optimization and Robust Power Grids".
INFORMS (San Francisco) - "Computing robust basestock levels."

2006

Georgia Tech - "Computing robust basestock levels."
Oberwolfach - "New algorithms for the maximum throughput problem".
NSF Workshop on Adaptive Dynamic Programming (Mexico) - "Optimization and Robust Power Grids".
INFORMS Practice conference - "Robust optimization in supply-chain".
Semi-plenary speaker, 2006 Mathematical Programming Symposium (Rio).
MIT - "Experiments in Robust Portfolio Optimization".
INFORMS Boston Chapter - "Optimization and Robust Power Grids".
U. of Wisconsin - "Experiments in Robust Portfolio Optimization".
Duke University - "Experiments in Robust Portfolio Optimization".

2007

Tech. University Berlin - "Experiments in Robust Portfolio Optimization".
Carisma meeting (London) - "Experiments in Robust Portfolio Optimization".
MIP Meeting (Montreal) - "Experiments in Robust Portfolio Optimization".
Informs 2007 - "The attack problem in power grids".
Informs 2007 - "Experiments in Robust Portfolio Optimization'.
McGill University – "The attack problem in power grids".
Lehigh University - "The attack problem in power grids".
Lehigh University - "Experiments in Robust Portfolio Optimization'.

2008

Informs Optimization Conference – "The attack problem in power grids".
Carisma meeting (London) - "Experiments in Optimal Trade Execution".
U. of Rome - "New results on knapsack problems.".
Informs 2008 - "New results on knapsack problems.".
Informs 2008 - "Finding weaknesses in power grids.".

2009

U. of Wisconsin - "The N-k problem in power grids."
U. of Washington - "New results on knapsack problems.".
Ohio State University - "The N-k problem in power grids."
Plenary speaker, International Network Optimization Conference (Pisa, Italy, April 2009).
Invited speaker, Laurence Wolsey birthday celebration (CORE, Belgium, May 2009).
MIP '09 - "Eigenvalue techniques in nonconvex optimization."
Los Alamos Nat'l Lab - "Continuing work on power grid problems."
Alcatel-Lucent - "Continuing work on power grid problems."
Cornell - "Eigenvalue techniques in nonconvex optimization."
Georgia Tech - "Eigenvalue techniques in nonconvex optimization."
CMU - "Eigenvalue techniques in nonconvex optimization."
Texas A & M - "Continuing work on power grid problems."

2010

U. of Florida - "Continuing work on power grid problems."
Berkeley DOE meeting (plenary) – "Continuing work on power grid problems."
EWMINLP10 (Marseille) - "Eigenvalue techniques in nonconvex optimization."
CORE (Belgium) - "A new LP algorithm for precedence constrained production scheduling."
IPCO (Lausanne) - "Eigenvalue techniques in nonconvex optimization."
IPCO (Lausanne) - "A new LP algorithm for precedence constrained production scheduling."
Snowbird DOE-SIAM meeging - "Optimal control of cascading power grid failures."
Informs 2010 - "Eigenvalue techniques in nonconvex optimization."
Informs 2010 - "A new LP algorithm for precedence constrained production scheduling."

2011

Brookhaven Nat'l Lab - "Computational Math of the Power Grid.
Telcordia - "Computational Math of the Power Grid.
SIAM Conference on Optimization (Darmstadt) - "The N-K problem with AC power flows."
FERC (Washington, DC) - "Online Control of Cascading Power Failures."
IEEE Power Engineering Society Nat'l Meeting - "Online Control of Cascading Power Failures."
SIAM Conference on Computational Science and Engineering (Reno) - "Online Control of Cascading Power Failures."
DOE P.I. Meeting - "Online Control of Cascading Power Failures."
Informs Nat'l Meeting - "Convex Optimization over Non-Convex Domains."
Informs Nat'l Meeting - "Mitigating the Impact of a Pandemic Through Robust Optimization."
Joint CDC-IEEE meeting - "Online Control of Cascading Power Failures."

2012

Aussois - "Convex Optimization over Non-Convex Domains." (A. Michalka).
Santa Fe conference on complex systems - "Online Control of Cascading Power Failures."
Federal Energy Regulatory Commission - "Chance-constrained optimal power flow."
STOC Workshop on Computational Sustainability - "Computational Challenges in Power Grid Modeling: Strong Algorithms for Power Flows and Understanding Cascades."
ISMP Berlin - "Convex Optimization over Non-Convex Domains."
ISMP Berlin - "Chance-constrained optimal power flow."

Informs Nat'l Meeting - "Strong formulationes over Non-Convex Domains."

Informs Nat'l Meeting - "Chance-constrained DC-OPF"

2013

USC - "Mitigating the Impact of a Pandemic Through Robust Optimization."
National Research Council Workshop on the Resiliency of the Electric Power Delivery System in Response to Terrorism and National Disasters – "Simulation and Control of Cascades."
SIAM Conference on Computational Science and Engineering - "Analysis of geographically correlated power grid cascades."
DIMACS Workshop on Energy Infrastructure - "Chance-constrained optimal power flow."
Federal Energy Regulatory Commission - "Synchronization aware OPF."
2013 IREP Symp. - "Synchronization-Aware and Algorithm-Efficient Chance Constrained OPF."
Allerton Conference - "Stochastic control of power line temperature."
MIT - "Convex Optimization over Non-Convex Domains."
Informs Nat'l Meeting - "Cutting planes for Convex Optimization over Non-Convex Domains."
U. Michigan - "Chance-constrained optimization problems in the power grid."
CDC - "Stochastic control of power line temperature."

2014

SODA - "Polynomial solvability of variants of the trust-region subproblem."
INFOCOM - "Power Grid Vulnerability to Geographically Correlated Failures - Analysis and Control Implications"
MINLP - "Recent results on solving QCQPs, and related problems."
FERC - "Multi-time-step Chance Constrained Generation Re-dispatch."
MIP - "Solving QCQPs."
IEEE PES - "Efficient Direct Test for Dynamics Following a Cleared Fault."
MOPTA - "Solving QCQPs."
INFORMS - "Solving QCQPs", "A new relaxation for AC-OPF."
Rutgers - "Modeling the power grid".
PGMO'14 (École Polytechnique) - "Solving QCQPs."
Waterloo - "A new LP formulation for polynomial optimization."

2015

LANL Winter School - "Optimization Fundamentals of OPF Problems."
LANL Winter School - "A new LP formulation for polynomial optimization."
Princeton - "A new LP formulation for polynomial optimization."
FERC - "Identifying and controllying risky contingencies of transmission systems"
ISMP - "LP formulations for mixed-integer polynomial optimization problems"
GraphEx - "Sample average approximation and cascading failures of power grids"
PES - "On linear relaxations of OPF problems"
Ga. Tech - "LP formulations for mixed-integer polynomial optimization problems"
JHU - "LP formulations for mixed-integer polynomial optimization problems"
CMO-BIRS (Oaxaca) - Opening talk: "Exploiting structured sparsity in mixed-integer polynomial optimization"
Montreal - "Exploiting structured sparsity in mixed-integer polynomial optimization"

2016

Aussois - "Exploiting structured sparsity in mixed-integer polynomial optimization"
Ga. Tech - "Operations research problems in power engineering"
Berkeley - "Operations research problems in power engineering"
U. of Illinois - "Recent results on polynomial optimization problems"
CWI, Amsterdam - "Operations research problems in power engineering"
FERC – "Robust optimization of batteries"
IMA – "Overview of Polynomial Optimization Problems"
U. of Michigan – "Robust optimization of batteries"

2017
LANL Winter School – "Robust optimization of batteries"
Clemson University – "Robust optimization of batteries"
ACM Sigmetrics workshop – "Computing undetectable attacks on power grids"
SIAM Optimization Conference – "S-free Sets for Polynomial Optimization and Oracle-Based Cuts"
SIAM Optimization Conference – Tutorial (joint with P. Van Hentenryck) "New Developments on Optimal Power Flow Problems"
Reconnect Workshop on Reliability of the Power Grid – three talks on structure and resiliency of the power grid.
Porquerolles workshop (France) – Plenary talk: "S-free Sets for Polynomial Optimization and Oracle-Based Cuts"
ODS 2017 (Sorrento, Italy) – Plenary talk: "Robust network control and disjunctive programming"
USC – "Robust network control through disjunctive programming"
Ga. Tech – "Controlling variability in power systems"

2018
Aussois – "S-free Sets for Polynomial Optimization and Oracle-Based Cuts" (talk by G. Muñoz)
SIAM WNS 18 – "Stochastic defense against ideal grid attacks" (talk by M. Escobar)
PSCC 18 – "Variance-aware optimal power flow"
Tel Aviv workshop on optimization and discrete geometry – 'Easier derivation of bounded pitch inequalities for set covering problems"
ISMP 18 – "Using Integer Programming to Train Neural Networks"
CMU (Tepper) – "Two applications of disjunctive programming"
MOPTA 18 plenary – "Variability in power systems: stochastic defense against ideal grid attacks"
U. Chicago Booth – "Big data problems in power grids."
Duke CS – "Principled deep neural network training through linear programming"
Triangle lecture in combinatorics – "Approximate Nonconvex Optimization and Treewidth"

2019
IPCO 2019 – "Outer-Product-Free Sets for Polynomial Optimization".
Powertech '19 – "Learning from power system data stream: phasor-detective approach"
Oberwolfach – "Solving nonconvex optimization problems."
INFORMS '19 – "Principled deep neural network training through linear programming", "Stochastic defense against complex grid attacks."
Balas memorial – "Solving nonconvex optimization problems."

2020
CTW 2020 (Ischia) – Plenary, "Numerically hard algebraic optimization problems."
New York Scientific Data Summit – "Risk in Power Systems."
Cornell – "Complexity and Exactness in Polynomial Optimization."
INFORMS – several talks.
U. of Arizona – "Complexity and Exactness in Polynomial Optimization."

2021
U. of Erlangen – "Complexity and Exactness in Polynomial Optimization."

Doctoral Students
Phil Dinenis.
Mauro Escobar (Ph.D. July 2019).
Apurv Shukla.
Gonzalo Muñoz (Ph.D. July 2017).
Sean Harnett (Ph.D. March 2016).
Alexander Michalka (Ph.D. August 2013).
Cecilia Zenteno (Ph.D. July 2012).
Aron Ahmadia (co-advised with David Keyes) (Ph.D. March 2010).

Abhinav Verma (Ph.D. December 2009).
Nuri Özbay.(Ph.D. May 2006).
Anton Riabov (Ph.D., May 2004)
Mark Zuckerberg (Ph.D., February 2004).
O. Raskina (Ph.D., December 2002).
Thomas Odenthal (Ph.D. May 1999).
Gabriella Muratore (Ph.D. April. 1999).
Yunhee Jang (Ph.D. June 1996).
Oktay Günlük (Ph.D. June 1994).
Nicole Diaz (Ph.D. May 1992).

Courses Taught (1989-present)

IEOR 3608 (Intro. to Mathematical Programming, 7 terms)
IEOR 6605 (Network Flows, 12 terms)
IEOR 6604 (Optimization II, 4 terms)
IEOR 4004 (Introduction to deterministic models, 6 terms)
IEOR 4100 (Computer Graphics for IEOR Applications, 5 terms)
IEOR 4500 (Applications Programming for Financial Engineering, 22 terms)
IEOR 4600 (Applied Integer Programming, 8 terms)
IEOR 6603 (Combinatorial Optimization, 9 terms)
IEOR 6608 (Integer Programming, 6 terms)
IEOR 4007 (Optimization in Financial Engineering, 1 term)
IEOR 4739 (Computational methods for Financial Engineering, 3 terms)
CSOR 4231 (Analysis of Algorithms I, 1 term)
IEOR 8100 (Topics in Discrete Optimization, 1 term)
IEOR 8100 (Computational Math of the Power Grid, 1 term)

Publications

Books

Electrical Transmission System Cascades and Vulnerability: An Operations Research Viewpoint, ISBN 978-1-611974-15-7. SIAM-MOS Series on Optimization (2015).
Potential Function Methods for Approximately Solving Linear Programming Problems, Theory and Practice, ISBN 1-4020-7173-6. Kluwer Academic Publishers, Boston (2002).

Special Volumes

Analytic Research Foundations for the Next-Generation Electric Grid (coauthor), *The National Academies Press* (2016).

Journal and Conference Publications

1. Complexity, Exactness and Rationality in Polynomial Optimization, with A. del Pia and R. Hildebrand, to appear, *IPCO 2021*.
2. Pitch, extension complexity, and covering problems, with Y. Faenza and X. Zhang, *Operations Research Letters* **49** (2021), 357 – 364.
3. Mathematical programming formulations for the alternating current optimal power flow problem, with M. Escobar, C. Gentile and L. Liberti, *4OR* **3** (2020), 249 – 292.

4. A methodological framework for determining an optimal coastal protection strategy against storm surges and sea level rise, with Yuki Miura, Huda Qureshi, Chanyang Ryoo, Philip C Dinenis, Jiao Li, Kyle T Mandli, George Deodatis, Heather Lazrus, and Rebecca Morss, *Natural Hazards* (2021), 1–23.

5. Outer-product-free sets for polynomial optimization and oracle-based cuts, with C. Chen and G. Muñoz, *Mathematical Programming* (online, 2020), 1 – 44.

6. On inequalities with bounded coefficients and pitch for the min knapsack polytope, with Yuri Faenza, Igor Malinović, Monaldo Mastrolilli, Ola Svensson and Mark Zuckerberg, *Discrete Optimization* (online, 2020), 1 – 19.

7. Strong NP-hardness of AC power flows feasibility, with A. Verma. *Operations Research Letters* **47** (2019), 494 – 501.

8. Stochastic defense against complex grid attacks, with M. Escobar. *IEEE Trans. Control Network Systems* **7** (2020) 842 – 854 (early access, 2019).

9. Variance-Aware Optimal Power Flow, with A. Shukla, *IEEE Trans. Control Network Systems* **6** (2019) 1185–1196. Also see *Proc. PSCC 2018*.

10. Chance-Constrained Unit Commitment With N-1 Security and Wind Uncertainty (with K Sundar, H Nagarajan, L Roald, S Misra, R Bent), *IEEE Trans. Control Network Systems* **6** (2019), 1062 – 1074.

11. Learning from power system data stream: phasor-detective approach, with M. Escobar and M. Chertkov, *IEEE Powertech '19* (2019) 1–6.

12. Outer-Product-Free Sets for Polynomial Optimization and Oracle-Based Cuts, with C. Chen and G. Muñoz, in *Integer Programming and Combinatorial Optimization* 2019 (Lodi and Nagarajan, eds.), pp. 72 – 87. (Also see: Mathematical Programming 183, 105-148 (2020))**Winner, 2017 MIP Workshop poster award**,

13. Non-Stationary Streaming PCA, with A. Shukla and S. Yun, *Proc NIPS Time Series Workshop* (2017), submitted.

14. Principled Deep Neural Network Training through Linear Programming, with G. Muñoz and S. Pokutta, arXiv:1810.0321, submitted.

15. Simpler derivation of bounded pitch inequalities for set covering and knapsack sets, with M. Zuckerberg, arXiv 1806.07435.

16. LP formulations for polynomial optimization problems (with G. Muñoz), arXiv 1501.00288, *SIAM J. Optimization* **28** (2018), 1121–1150. **Winner, 2016 Informs Optimization Society Student Paper Prize; Winner, 2015 MIP Workshop poster award**.

17. Robust linear control of storage in transmission systems, and extensions to robust network control problems, with G. Muñoz, S. Yang and C. Matke. Proc. CDC '17. Also see arXiv:1610.09432.

18. Unit commitment with N-1 security and wind uncertainty, (with K. Sundar, H. Nagarajan, M. Lubin, L. Roald, S. Misra and R. Bent). *PSCC '16*, 1–7.

19. Analyzing Vulnerability of Power Systems with Continuous Optimization Formulations (with S. Harnett, T. Kim and S. Wright). *IEEE Trans. Network Science and Eng.* **3** (2016), 132 – 146.

20. A note on polynomial solvability of the CDT problem (2013). arXiv:1406.6429. Appeared online in: *SIAM J. Optimization* **26** (2016) 486–496.

21. Stochastic models and control for electrical power line temperature (with J. Blanchet and J. Li), *Energy Systems* **7** (2016) 173 – 192. An earlier version of this work appeared in *Proc. 51st Annual Allerton Conference on Communication, Control and Computing* (2013), 1344-1348.

22. Temperature-based instanton analysis: Identifying vulnerability in transmission networks, with J. Kersulis, I. Hiskens, M. Chertkov and S. Backhaus, *2015 PowerTech*, 1-6.

23. On linear relaxations of OPF problems (with G. Muñoz), arXiv:1411.1120. *Proc. PES-GM '15.*

24. Chance-constrained DC-OPF (with M. Chertkov and S. Harnett), *SIAM Review* **56** (2014), 461 – 495.

25. Approximation Algorithms for the Incremental Knapsack Problem via Disjunctive Programming (with C. Ye and J. Sethuraman), aXiv:1311.4563.

26. Polynomial solvability of variants of the trust-region subproblem (with A. Michalka), *Proc.* 25^{th} *ACM-SIAM Symp. on Discrete Algorithms (SODA 2014)*, 380 – 390.

27. Strong formulations for convex functions over nonconvex sets (with A. Michalka), *SIAM J. Optimization* **24** (2014), 643-677.

28. Synchronization-Aware and Algorithm-Efficient Chance Constrained Optimal Power Flow (with R. Bent and M. Chertkov), Proc. 2013 IREP Symp. on Bulk Power System Dynamics and Control (Rethymnon, Greece).

29. Power line control under uncertainty of ambient temperature (with J. Blanchet and J. Li), CDC '13.

30. Robust modeling of probabilistic uncertainty in smart grids: Data ambiguous chance constrained optimum power flow, with M. Chertkov and S. Harnett, *Proc 2013 CDC*, 4335-4340.

31. Models for managing the impact of an epidemic (with A.C. Zenteno), arXiv:1507.08648.

32. Sensitivity Analysis of Power Grid Vulnerability to Large-Scale Cascading Failures (with A. Bernstein, D. Hay, M. Uzunoglu and G. Zussman), *ACM Performance Evaluation Review, Special issue of papers from ACM Greenmetrics12*, Vol. 40, No. 3 (Dec. 2012), pp. 33 –37. Also see: Power Grid Vulnerability to Geographically Correlated Failures - Analysis and Control Implications, *INFOCOM '14.*

33. Optimal control of cascading power grid failures, Proc. 2011 IEEE PES Meeting, Proc. 2011 joint CDC-IEEE meeting.

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