

Jochen Könemann

Personal Data

Degrees

- Ph.D. in Algorithms, Combinatorics, and Optimization** 1998–2003
Carnegie Mellon University, Pittsburgh, USA
Dissertation title: *Approximation Algorithms for Minimum-Cost Low-Degree Subgraphs*
Thesis advisor: Prof. R. Ravi
- M.Sc. in Computer Science** 1993–98
University of Saarbrücken, Saarbrücken, Germany
Thesis title: *Fast Combinatorial Algorithms for Packing and Covering Problems*
Thesis advisors: Prof. Naveen Garg, Prof. K. Mehlhorn

Employment

- University of Waterloo, Waterloo, Canada** 2025 – present
Faculty of Mathematics
Dean
- University of Waterloo, Waterloo, Canada** 2013 – present
Department of Combinatorics & Optimization
Professor
- Amazon Inc., Canada** 2019 – 2025
GDS-Modeling and Optimization
Scholar and Principal Scientist
- University of Waterloo, Waterloo, Canada** 2008–13
Department of Combinatorics & Optimization
Associate Professor
- University of Waterloo, Waterloo, Canada** 2003–08
Department of Combinatorics & Optimization
Assistant Professor
- Università di Roma “La Sapienza”, Rome, Italy** 2003–04
Dipartimento di Informatica e Sistemistica
Visiting Researcher
- AT&T Research, Florham Park, USA** 2001
Internship
- Lucent Technologies (Bell Laboratories), Murray Hill, USA** 2000
Internship

Awards and Honours

- Best Paper Award** 2024
FICO Xpress (Runner Up)

Best Paper Award Symposium on Algorithmic Game Theory	2020
Discovery Accelerator Supplement Natural Sciences and Engineering Research Council of Canada	2012
Outstanding Performance Award University of Waterloo, Waterloo, Canada	2006,2008,2012,2015
Early Research Award Ministry of Research & Innovation, Ontario, Canada	2007–12
Gambrinus Fellowship Universität Dortmund, Dortmund, Germany	2007
IBM Corporation Faculty Award IBM Corp., Yorktown Heights, USA	2005
William Larimer Mellon Fellowship Carnegie Mellon University, Pittsburgh, USA	1998–2001

Research and Scholarship

Areas of Interest

Combinatorial Optimization, Approximation Algorithms, Graph and Network Algorithms, Algorithmic Game Theory, Efficient Implementations

Publications

Refereed Journal Publications & Books

- [1] M. Van Dyk and J. Könemann. Sparse dynamic discretization discovery via arc-dependent time discretizations. *Comput. Oper. Res.*, 169:106715, 2024
- [2] J. Könemann, J. Toth, and F. Zhou. On the complexity of nucleolus computation for bipartite b-matching games. *Theor. Comput. Sci.*, 998:114476, 2024
- [3] C. L. Lara, J. Könemann, Y. Nie, and C. C. de Souza. Scalable timing-aware network design via lagrangian decomposition. *Eur. J. Oper. Res.*, 309(1):152–169, 2023
- [4] J. Könemann and J. Toth. A framework for computing the nucleolus via dynamic programming. *ACM Trans. Economics and Comput.*, 11:3:1–3:21, 2023
- [5] A. Göke, J. Könemann, M. Mnich, and H. Sun. Hitting weighted even cycles in planar graphs. *SIAM J. Discret. Math.*, 36(4):2830–2862, 2022
- [6] Y. Disser, A. E. Feldmann, M. Klimm, and J. Könemann. Travelling on graphs with small highway dimension. *Algorithmica*, 83(5):1352–1370, 2021
- [7] J. Könemann, K. Pashkovich, and J. Toth. Computing the nucleolus of weighted cooperative matching games in polynomial time. *Math. Program.*, 183(1):555–581, 2020
- [8] K. Chandrasekaran, C. Gottschalk, J. Könemann, B. Peis, D. Schmand, and A. Wierz. Additive stabilizers for unstable graphs. *Discrete Optimization*, 31:56–78, 2019
- [9] S. Held, J. Könemann, and J. Vygen. Vehicle routing with subtours. *Discrete Optimization*, 33:87–100, 2019

- [10] A. Smith and J. Könemann. Special section on the forty-sixth annual ACM symposium on theory of computing (STOC 2014). *SIAM J. Comput.*, 47(5):1807–1808, 2018
- [11] F. Eisenbrand and J. Könemann, editors. *Integer Programming and Combinatorial Optimization - 19th International Conference, IPCO 2017, Waterloo, ON, Canada, June 26-28, 2017, Proceedings*, volume 10328 of *Lecture Notes in Computer Science*. Springer, 2017
- [12] A. E. Feldmann, J. Könemann, N. Olver, and L. Sanità. On the equivalence of the bidirected and hypergraphic relaxations for steiner tree. *Math. Program.*, 160(1-2):379–406, 2016
- [13] Linda Farczadi, Konstantinos Georgiou, and Jochen Könemann. Stable marriage with general preferences. *Theory Comput. Syst.*, 59(4):683–699, 2016
- [14] J. Könemann, K. Pashkovich, and J. Toth. An elementary integrality proof of rothblum’s stable matching formulation. *Oper. Res. Lett.*, 44(6):754–756, 2016
- [15] A. Abdi, A. E. Feldmann, B. Guenin, J. Könemann, and L. Sanità. Lehman’s theorem and the directed steiner tree problem. *SIAM J. Discrete Math.*, 30(1):141–153, 2016
- [16] J. Könemann, K. Larson, and D. Steiner. Network bargaining: Using approximate blocking sets to stabilize unstable instances. *Theory Comput. Syst.*, 57(3):655–672, 2015
- [17] A. Bock, K. Chandrasekaran, J. Könemann, B. Peis, and L. Sanità. Finding small stabilizers for unstable graphs. *Math. Program.*, 154(1-2):173–196, 2015
- [18] A. Gupta, J. Könemann, S. Leonardi, R. Ravi, and G. Schäfer. Efficient cost-sharing mechanisms for prize-collecting problems. *Math. Program.*, 152(1-2):147–188, 2015
- [19] B. Guenin, J. Könemann, and L. Tunçel. *A Gentle Introduction to Optimization*. Cambridge University Press, 2014
- [20] K. Georgiou, G. Karakostas, J. Könemann, and Z. Stamirowska. Social exchange networks with distant bargaining. *Theoret. Comput. Sci.*, 554:263–274, 2014
- [21] J. Könemann, O. Parekh, and D. Pritchard. Multicommodity flow in trees: Packing via covering and iterated relaxation. *Algorithmica*, 68(3):776–804, 2014
- [22] D. Chakrabarty, J. Könemann, and D. Pritchard. Hypergraphic LP relaxations for Steiner trees. *SIAM J. Discrete Math.*, 27(1):507–533, 2013
- [23] N. Bansal, R. Khandekar, J. Könemann, V. Nagarajan, and B. Peis. On generalizations of network design problems with degree bounds. *Math. Programming*, 141(1-2):479–506, 2013
- [24] A. Bock, E. Grant, J. Könemann, and L. Sanità. The school bus problem on trees. *Algorithmica*, 67(1):49–64, 2013
- [25] J. Könemann, D. Pritchard, and K. Tan. A partition-based relaxation for Steiner trees. *Math. Programming, Series A*, 127(2):345–370, 2011
- [26] J. Könemann, O. Parekh, and D. Segev. A unified approach to approximating partial covering problems. *Algorithmica*, 59(4):489–509, 2011
- [27] Deeparnab Chakrabarty, Jochen Könemann, and David Pritchard. Integrality gap of the hypergraphic relaxation of Steiner trees: A short proof of a 1.55 upper bound. *Operations Research Letters*, 38(6):567–570, 2010
- [28] L. Fleischer, J. Könemann, S. Leonardi, and G. Schäfer. Strict cost sharing schemes for Steiner forest. *SIAM Journal on Computing*, 39(8):3616–3632, 2010

- [29] F. Grandoni, J. Könemann, and A. Panconesi. Distributed weighted vertex cover via maximal matchings. *ACM Trans. Alg.*, 5(1), 2008
- [30] F. Grandoni, J. Könemann, A. Panconesi, and M. Sozio. Primal-dual based distributed algorithms for vertex cover with semi-hard capacities. *SIAM J. Comput.*, 38(3):825–840, 2008
- [31] J. Cheriyan, H. Karloff, R. Khandekar, and J. Könemann. On the integrality ratio for tree augmentation. *Operations Research Letters*, 36(4):399–401, 2008
- [32] J. Könemann, S. Leonardi, G. Schäfer, and S. H. M. van Zwam. A group-strategyproof cost sharing mechanism for the Steiner forest game. *SIAM J. Comput.*, 37(5):1319–1341, 2008
- [33] L. Becchetti, J. Könemann, S. Leonardi, and M. Pál. Sharing the cost more efficiently: Improved approximation for multicommodity rent-or-buy. *ACM Trans. Alg.*, 3(2), 2007
- [34] N. Garg and J. Könemann. Faster and simpler algorithms for multicommodity flow and other fractional packing problems. *SIAM J. Comput.*, 37(2):630–652, 2007
- [35] R. Engelberg, J. Könemann, S. Leonardi, and J. Naor. Cut problems in graphs with a budget constraint. *J. Discrete Algorithms*, 5(2):262–279, 2007
- [36] E. Althaus, S. Funke, S. Har-Peled, J. Könemann, E. Ramos, and M. Skutella. Approximating k -hop minimum-spanning trees. *Operations Research Letters*, 33(2):115–120, 2005
- [37] J. Könemann and R. Ravi. Primal-dual meets local search: Approximating MST’s with nonuniform degree bounds. *SIAM J. Comput.*, 34(3):763–773, 2005
- [38] J. Könemann, Asaf Levin, and Amitabh Sinha. Approximating the degree-bounded minimum diameter spanning tree problem. *Algorithmica*, 41(2):117–129, 2004
- [39] J. Könemann, Y. Li, O. Parekh, and A. Sinha. Approximation algorithms for edge-dilation k -center problems. *Operations Research Letters*, 32(5):491–495, 2004
- [40] G. Even, N. Garg, J. Könemann, R. Ravi, and A. Sinha. Min-max tree covers of graphs. *Operations Research Letters*, 32(4):309–315, 2004
- [41] N. Bansal, K. Damdhere, J. Könemann, and A. Sinha. Non-clairvoyant scheduling for mean slowdown. *Algorithmica*, 40(4):305–318, 2004
- [42] J. Könemann, G. Konjevod, O. Parekh, and A. Sinha. Improved approximations for tour and tree covers. *Algorithmica*, 38(3):441–449, 2003
- [43] J. Könemann and R. Ravi. A matter of degree: Improved approximation algorithms for degree-bounded minimum spanning trees. *SIAM J. Comput.*, 31(6):1783–1793, 2002

Refereed Conference Publications

- [44] M. Van Dyk, K. Klause, J. Könemann, and N. Megow. Fast combinatorial algorithms for efficient sortation. In *Integer Programming and Combinatorial Optimization - 25th International Conference, IPCO 2024, Wrocław, Poland, July 3-5, 2024, Proceedings*, volume 14679 of *Lecture Notes in Computer Science*, pages 418–432. Springer, 2024
- [45] A. Göke, J. Könemann, M. Mnich, and H. Sun. Hitting weighted even cycles in planar graphs. In Mary Wootters and Laura Sanità, editors, *Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques, APPROX/RANDOM 2021, August 16-18, 2021, University of Washington, Seattle, Washington, USA (Virtual Conference)*, volume 207 of *LIPICs*, pages 25:1–25:23. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021

- [46] J. Könemann, J. Toth, and F. Zhou. On the complexity of nucleolus computation for bipartite b-matching games. In Ioannis Caragiannis and Kristoffer Arnsfelt Hansen, editors, *Algorithmic Game Theory - 14th International Symposium, SAGT 2021, Aarhus, Denmark, September 21-24, 2021, Proceedings*, volume 12885 of *Lecture Notes in Computer Science*, pages 171–185. Springer, 2021
- [47] J. Könemann and J. Toth. A general framework for computing the nucleolus via dynamic programming. In *Proceedings, Symposium on Algorithmic Game Theory*, 2020
- [48] J. Könemann, K. Pashkovich, and N. Tofigzade. On the approximability of the stable matching problem with ties of constant size up to the integrality gap. In *Proceedings, Symposium on Algorithmic Game Theory*, 2020. Awarded SAGT’20 Best paper prize.
- [49] J. Könemann, K. Pashkovich, and J. Toth. Computing the nucleolus of weighted cooperative matching games in polynomial time. In *Integer Programming and Combinatorial Optimization - 20th International Conference, IPCO 2019, Ann Arbor, MI, USA, May 22-24, 2019, Proceedings*, pages 413–426, 2019
- [50] S. Fiorini, M. Groß, J. Könemann, and L. Sanità. Approximating weighted tree augmentation via chvátal-gomory cuts. In *Proceedings of the Twenty-Ninth Annual ACM-SIAM Symposium on Discrete Algorithms, SODA 2018, New Orleans, LA, USA, January 7-10, 2018*, pages 817–831, 2018
- [51] J. Könemann, N. Olver, K. Pashkovich, R. Ravi, C. Swamy, and J. Vygen. On the integrality gap of the prize-collecting steiner forest LP. In *Approximation, Randomization, and Combinatorial Optimization. Algorithms and Techniques, APPROX/RANDOM 2017, August 16-18, 2017, Berkeley, CA, USA*, pages 17:1–17:13, 2017
- [52] A. E. Feldmann, J. Könemann, K. Pashkovich, and L. Sanità. Fast approximation algorithms for the generalized survivable network design problem. In *27th International Symposium on Algorithms and Computation, ISAAC 2016, December 12-14, 2016, Sydney, Australia*, pages 33:1–33:12, 2016
- [53] Z. Friggstad, J. Könemann, and M. Shadravan. A logarithmic integrality gap bound for directed steiner tree in quasi-bipartite graphs. In *15th Scandinavian Symposium and Workshops on Algorithm Theory, SWAT 2016, June 22-24, 2016, Reykjavik, Iceland*, pages 3:1–3:11, 2016
- [54] H. Efsandiari, M. T. Hajiaghayi, J. Könemann, H. Mahini, D. L. Malec, and L. Sanità. Approximate deadline-scheduling with precedence constraints. In *Algorithms - ESA 2015 - 23rd Annual European Symposium, Patras, Greece, September 14-16, 2015, Proceedings*, pages 483–495, 2015
- [55] Andreas Emil Feldmann, Wai Shing Fung, Jochen Könemann, and Ian Post. A $(1+\epsilon)$ -embedding of low highway dimension graphs into bounded treewidth graphs. In *In Proc., International Colloquium on Automata, Languages, and Programming*, pages 469–480, 2015
- [56] A. Bock, K. Chandrasekaran, J. Könemann, B. Peis, and L. Sanità. Finding small stabilizers for unstable graphs. In *Proceedings, MPS Conference on Integer Programming and Combinatorial Optimization*, pages 150–161, 2014
- [57] Z. Friggstad, J. Könemann, Y. Kun-Ko, A. Louis, M. Shadravan, and M. Tulsiani. Linear programming hierarchies suffice for directed Steiner tree. In *Proceedings, MPS Conference on Integer Programming and Combinatorial Optimization*, pages 285–296, 2014
- [58] A. Feldmann, J. Könemann, N. Olver, and L. Sanità. On the equivalence of the bidirected and hypergraphic relaxations for Steiner tree. In *Proceedings, Int. Workshop on Approx. Alg. for Comb. Opt. Problems*, 2014
- [59] L. Farczadi, C. Georgiou, and J. Könemann. Stable marriage with general preferences. In *Proceedings, Symposium on Algorithmic Game Theory*, 2014

- [60] J. Könemann, S. Sadeghian Sadeghabad, and L. Sanità. An $O(\log n)$ -approximation algorithm for node weighted prize collecting Steiner tree. In *Proceedings, IEEE Symposium on Foundations of Computer Science*, 2013
- [61] L. Farczadi, K. Georgiou, and J. Könemann. Network bargaining with general capacities. In *Proceedings, European Symposium on Algorithms*, pages 433–444, 2013
- [62] J. Könemann, S. Sadeghian Sadeghabad, and L. Sanità. Better approximation algorithms for technology diffusion. In *Proceedings, European Symposium on Algorithms*, pages 637–646, 2013
- [63] K. Georgiou, G. Karakostas, J. Könemann, and Z. Stamirowska. Social exchange networks with distant bargaining. In *Proceedings, Int. Computing & Combinatorics Conf.*, pages 29–40, 2013
- [64] J. Könemann, K. Larson, and D. Steiner. Network bargaining: Using approximate blocking sets to stabilize unstable instances. In *Proceedings, Symposium on Algorithmic Game Theory*, 2012
- [65] T. Chan, E. Grant, J. Könemann, and M. Sharpe. Weighted capacitated, priority, and geometric set cover via improved quasi-uniform sampling. In *Proceedings, ACM-SIAM Symposium on Discrete Algorithms*, pages 1576–1585, 2012
- [66] A. Bock, E. Grant, J. Könemann, and L. Sanità. The school bus problem in trees. In *Proceedings, Int. Symp. on Algorithms and Computation*, pages 10–19, 2011
- [67] N. Bansal, R. Khandekar, J. Könemann, V. Nagarajan, and B. Peis. On generalizations of network design problems with degree bounds. In *Proceedings, MPS Conference on Integer Programming and Combinatorial Optimization*, pages 110–123, 2010
- [68] D. Chakrabarty, E. Grant, and J. Könemann. On column-restricted and priority covering integer programs (extended abstract). In *Proceedings, MPS Conference on Integer Programming and Combinatorial Optimization*, pages 355–368, 2010
- [69] D. Chakrabarty, J. Könemann, and D. Pritchard. Hypergraphic lp relaxations for Steiner trees. In *Proceedings, MPS Conference on Integer Programming and Combinatorial Optimization*, pages 383–396, 2010
- [70] J. Könemann, O. Parekh, and D. Pritchard. Max-weight integral multicommodity flow in spiders and high-capacity trees. In *Proceedings, Workshop on Approx. and Online Alg.*, pages 1–14, 2008
- [71] A. Gupta, J. Könemann, S. Leonardi, R. Ravi, and G. Schäfer. An efficient cost-sharing mechanism for the prize-collecting Steiner forest problem. In *Proceedings, ACM-SIAM Symposium on Discrete Algorithms*, pages 1153–1162, 2007
- [72] J. Könemann, O. Parekh, and D. Segev. A unified approach to approximating partial covering problems. In *Proceedings, European Symposium on Algorithms*, pages 468–479, 2006
- [73] L. Fleischer, J. Könemann, S. Leonardi, and G. Schäfer. Simple cost sharing schemes for multi-commodity rent-or-buy and stochastic Steiner tree. In *Proceedings, ACM Symp. on Theory of Computing*, pages 663–670, 2006
- [74] R. Engelberg, J. Könemann, S. Leonardi, and J. Naor. Cut problems in graphs with a budget constraint. In *Proceedings, Latin American Th. Informatics Symp.*, pages 435–446, 2006
- [75] J. Könemann, S. Leonardi, G. Schäfer, and S. van Zwam. From primal-dual to cost shares and back: A stronger LP relaxation for the Steiner forest problem. In *Proceedings, International Colloquium on Automata, Languages and Processing*, pages 930–942, 2005

- [76] F. Grandoni, J. Könemann, A. Panconesi, and M. Sozio. Primal-dual based distributed algorithms for vertex cover with semi-hard capacities. In *Proceedings, ACM Symposium on Principles of Distributed Computing*, pages 118–125, 2005
- [77] F. Grandoni, J. Könemann, and A. Panconesi. Distributed weighted vertex cover via maximal matchings. In *Proceedings, Int. Computing & Combinatorics Conf.*, pages 839–848, 2005
- [78] J. Könemann, S. Leonardi, and G. Schäfer. A group-strategyproof mechanism for Steiner forests. In *Proceedings, ACM-SIAM Symposium on Discrete Algorithms*, pages 612 – 619, 2005
- [79] L. Becchetti, J. Könemann, S. Leonardi, and M. Pál. Sharing the cost more efficiently: Improved approximation for multicommodity rent-or-buy. In *Proceedings, ACM-SIAM Symposium on Discrete Algorithms*, pages 375–384, 2005
- [80] J. Könemann and R. Ravi. Quasi-polynomial time approximation algorithm for low-degree minimum-cost Steiner trees. In *Proceedings, Found. of Software Tech. and Theoretical CS*, 2003
- [81] G. Even, N. Garg, J. Könemann, R. Ravi, and A. Sinha. Covering graphs using trees and stars. In *Proceedings, Int. Workshop on Approx. Alg. for Comb. Opt. Problems*, 2003
- [82] J. Könemann, A. Levin, and A. Sinha. Approximating the degree-bounded minimum-diameter spanning tree problem. In *Proceedings, Int. Workshop on Approx. Alg. for Comb. Opt. Problems*, 2003
- [83] J. Könemann and R. Ravi. Primal-dual meets local search: Approximating MST’s with nonuniform degree bounds. In *Proceedings, ACM Symp. on Theory of Computing*, pages 389–395, 2003
- [84] N. Bansal, K. Damdhere, J. Könemann, and A. Sinha. Non-clairvoyant scheduling for mean slowdown. In *In Proceedings, International Symposium on Theoretical Aspects of Computer Science*, 2003
- [85] F. Eisenbrand, S. Funke, N. Garg, and J. Könemann. A combinatorial algorithm for computing a maximum independent set in a t -perfect graph. In *Proceedings, ACM-SIAM Symposium on Discrete Algorithms*, pages 517–522, 2003
- [86] J. Könemann, Y. Li, O. Parekh, and A. Sinha. Approximation algorithms for edge-dilation k -center problems. In *Proceedings, Scandinavian Workshop on Algorithm Theory*, 2002
- [87] J. Könemann and R. Ravi. A matter of degree: Improved approximation algorithms for degree-bounded minimum spanning trees. In *Proceedings, ACM Symp. on Theory of Computing*, pages 537–546, 2000
- [88] N. Garg and J. Könemann. Faster and simpler algorithms for multicommodity flow and other fractional packing problems. In *Proceedings, IEEE Symposium on Foundations of Computer Science*, pages 300–309, 1998
- [89] C. Burnikel, J. Könemann, K. Mehlhorn, S. Näher, S. Schirra, and C. Uhrig. Exact geometric computation in LEDA. In *Proceedings, Symposium on Computational Geometry*, pages C18–C19, 1995

Invited Lectures (since 2010)

Jul, 2024 *Dynamic Discretization Discovery for Region-Based Networks*. Invited Talk at International Symposium for Mathematical Programming

May, 2023 *Faster Solutions of Very Large Timing Optimization Problems Using Dynamic Discretization Discovery*. Invited Talk at SIAM Conference on Optimization

- Sep, 2021** *Size Reduction Techniques for Timing Aware Network Models.* Invited Talk at Informs Annual Meeting
- Jan, 2019** *Approximate Network Design via Mathematical Programming.* Invited Talk at Amazon Research, Seattle, USA
- Jan, 2019** *Matching Games: From Bargaining to the Nucleolus.* Invited plenary talk at Aussois Combinatorial Optimization Workshop, Aussois, France
- July, 2018** *Improved Approximation for Tree Augmentation via Chvatal Gomory Cuts.* Invited talk at 23rd International Symposium on Mathematical Programming, Bordeaux, France
- May, 2018** *Improved Approximation for Tree Augmentation via Chvatal Gomory Cuts.* Invited talk at 9th Workshop for Flexible Network Design, University of Maryland, Maryland, USA
- June, 2017** *Improved Approximation for Tree Augmentation via Chvatal Gomory Cuts.* Invited plenary talk at 13th Workshop on Models and Algorithms for Planning and Scheduling Problems, Seon-Seebruck, Germany
- July, 2016** *Aproximate Price Collecting Network Design.* Invited plenary talk Symposium for Discrete Mathematics, Berlin, Germany
- May, 2016** *Network Bargaining – Where Bargaining & Matching Theory Meet.* Invited main talk at Lond School of Economics, London, United Kingdom
- Apr, 2016** *Approximate Deadline Scheduling with Precedence Constraints.* Invited main talk at Colloquium of Research Area KL "Algorithms & Complexity" of the Hausdorff Center for Mathematics, Bonn, Germany
- Mar, 2016** *Network Bargaining – Where Bargaining & Matching Theory Meet.* Invited talk in CWI, Amsterdam, The Netherlands
- Jan, 2016** *Network Bargaining – Where Bargaining & Matching Theory Meet.* Invited talk in Graduate Colloquium at TU Berlin, Germany
- Nov, 2015** *Aproximate Price Collecting Network Design.* Talk at the Hausdorff Institute, Bonn, Germany
- Sep, 2015** *Approximate Deadline Scheduling with Precedence Constraints.* Invited Talk at workshop "Efficient algorithms in game theory, optimization and data science", Aachen, Germany
- Sep, 2015** *Approximate Deadline Scheduling with Precedence Constraints.* Invited Talk at ESA'15, Patras, Greece
- Sep, 2015** *Recent News for an old Steiner Tree Formulation.* Invited **Plenary Talk** at Algo'15 Meeting, Patras, Greece
- Jul, 2015** *Approximate Deadline Scheduling with Precedence Constraints.* Invited Talk at ISMP'15, Pittsburgh, Greece
- Sep, 2015** *Recent News for an old Steiner Tree Formulation.* Invited Talk at University of Michigan, Michigan, USA
- Apr, 2015** *Approximate Deadline Scheduling with Precedence Constraints.* Invited Talk at workshop "Discrepancy and Modern Roundings", Holetown, Barbados
- Apr, 2013** *Diffusion and Node-Weighted Steiner Trees.* Talk at University of Maryland, Maryland, USA
- Apr, 2013** *Diffusion and Node-Weighted Steiner Trees.* Talk at Workshop on Combinatorial Optimization, Bellairs Research Centre, Barbados.

- Apr, 2012** Stabilizing Unstable Instances of Network Bargaining. *Talk at Workshop on Algorithmic Game Theory, Bellairs Research Centre, Barbados.*
- Jan, 2012** Structured Set-Cover via Geometric Sampling. *Talk at Technical University Berlin, Berlin, Germany.*
- Nov, 2011** Structured Set-Cover via Geometric Sampling. *Talk at Workshop on Approximation Algorithms, Banff Research Centre, Banff, Canada.*
- Oct, 2011** LP Relaxations for Steiner Trees. *Talk at McMaster University, Hamilton, Canada.*
- Mar, 2011** LP Relaxations for Steiner Trees. *Talk at University of Miami, Miami, USA.*
- Jul, 2010** LP Relaxations for Steiner Trees. *Talk at ETH, Zurich, Switzerland.*
- Jun, 2010** Approximating Prize-Collecting Steiner Forests. *Talk at EPFL, Lausanne, Switzerland.*
- Feb, 2010** On Column Restricted and Priority Integer Covering Programs. *Talk at University of Alberta, Edmonton, Canada.*

Grant Record

Grants held as a principal investigator

Efficient Algorithms for Comb. Opt. Problems in Networks and Beyond CAD 210000 Discovery Grant, NSERC	2017–26
Flexible and Effective Techniques for the Design of Approximation Algorithms CAD 210000 Discovery Grant + CAD 120000 Accelerator Supplement, NSERC	2012–17
Algorithmic Game Theory and Approximate Network Design CAD 140000, Early Researcher Award, Province of Ontario	2007–12
Algorithmic Game Theory and Approximate Network Design CAD 125000, Discovery Grant, NSERC	2007–11
Gambrinus Fellowship EUR 5000, Universität Dortmund, Germany	2007
Approximation Algorithms and Algorithmic Game Theory USD 20000, IBM Corporation Faculty Award, IBM Corp	2005
Approximation Algorithms for Constrained Network Design Problems CAD 60000, Discovery Grant, NSERC	2004–06

Other grants

Infrastructure Grant for Mathematical Excellence CAD 630000, New Opportunities Award, held as one of eleven principal researchers, CFI	2004-08
Infrastructure Grant for Mathematical Excellence CAD 630000, matching funds for above grant, Ontario Research Fund	2004-08

Teaching Activities

Courses taught

Introduction to Combinatorics (Math 239) Number of students: 64	S12
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Introduction to Optimization (CO 250)	F11,S12,W13,S14,W15,F24
Number of students: 97 (F11), 184 (S12), 104 (W13), 111 (S14), 77 (W15), 116 (F24)	
Introduction to Optimization Online (CO 250 Online)	W15
Number of students: 68	
Network Flows (CO 351)	W07,S08
Number of students: 55 (W07), 33 (S08)	
Deterministic OR Models (CO 370)	W07,F12,W20
Number of students: 21 (W07), 70 (F12), 110 (W20)	
Game Theory (CO 456)	F09,F14
Number of students: 42 (F09), 56 (F14)	
Combinatorial Optimization (CO 450/650)	F08,F09,F10
Number of students: 18 (F08), 27 (F09), 8 (F10)	
Algorithmic Game Theory (CO 759)	F12, F16, F18
Number of students: 14 (F12), 56 (F14), 80 (F18)	
Sel. Topics in CO: Modern Roundings in Approximation Algorithms (University of Bonn, Germany) Number of students: 10	S16

Thesis supervision

Madison Van Dyk	S20–S24
Ph.D., C&O	
Thesis Title: <i>Routing, Scheduling, and Sorting in Consolidated Networks</i>	
Mathieu Rundstrom	F20–S24
M.Math, C&O	
Thesis Title: <i>Two combinatorial problems from craniosynostosis.</i>	
Hao Sun	F16–S22
Ph.D., C&O	
Thesis Title: <i>Hitting Weighted Even Cycles in Planar Graphs</i>	
Marina Drygala	F19–F20
M.Math, C&O	
Thesis Title: <i>Craniosynostosis Surgery: A Study of Rearrangement</i>	
Ishan Bansal	F19–S20
M.Math, C&O	
Thesis Title: <i>The Merge Algorithm for Capacitated Network Design</i>	
Justin Toth	F15–S21
M.Math, C&O	
Thesis Title: <i>Computing the Nucleolus of Matching and b-Matching Games</i>	
Natig Tofiqzadeh	F18–S20
M.Math, C&O	
Thesis Title: <i>An Algorithm for Stable Matching with Approximation up to the Integrality Gap</i>	
Sina Rezazadeh	S16–W17
Ph.D., C&O	
Linda Farczadi	S12–S15
Ph.D., C&O	
Thesis Title: <i>Matchings and Games on Networks</i>	

Isaac Fung Ph.D., C&O	S11–F15
Mohammad Shadravan M.Math, C&O Thesis Title: <i>On the Integrality Gap of Directed Steiner Tree Problem</i>	S12–S14
Sina Sadeghian M.Math, C&O, joint with L. Sanità Thesis Title: <i>Node-Weighted Prize Collecting Steiner Tree and Applications</i>	S12–S13
Devanshu Pandey M.Math, C&O Thesis title: <i>Vehicle Routing: A Survey of Approximation Algorithm Techniques</i>	F11–W13
Malcolm Sharpe M.Math, C&O	W11–S12
Elyot Grant M.Math, C&O, joint with T. Chan Thesis title: <i>Covering Problems via Structural Approaches</i>	F10–S11
David Steiner M.Math (CS), joint with K. Larson Thesis title: <i>Network Bargaining: Creating Stability using Blocking Sets</i>	F09–W12
Marcus Sheah M.Math, C&O Thesis title: <i>Iterative Rounding Approximation Algorithms in Network Design</i>	F08–W10
James Pearson M.Math, C&O Thesis title: <i>Exact, Approximate, and Online Algorithms for Optimization Problems Arising in DVD Assignment</i>	S08–W09
David Pritchard Ph.D., C&O, joint with L. Tuncel Thesis title: <i>Linear Programming Tools and Approximation Algorithms for Combinatorial Optimization</i>	F06–W09
Patrick Roh M.Math, C&O Thesis title: <i>Minimum Crossing Problems on Graphs</i>	F05–F06
Kunlun Tan M.Math, C&O Thesis title: <i>On the Role of Partition Inequalities in Classical Algorithms for Steiner Problems in Graphs</i>	F04–W06
David Wheatley M.Math, C&O Thesis title: <i>Crossmonotonic Cost-Sharing Methods for Network Design Games</i>	S06–S07

Other student supervision

Haripriya Pulyassary Undergraduate Research Assistant, C&O Project: <i>Algorithms for generalized multicommodity flows over time</i>	S20
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Madison van Dyk Undergraduate Research Assistant, C&O Project: <i>Improved Approximations for Precedence-Constrained Deadline Scheduling</i>	F18
Simon Huang Undergraduate Research Assistant, C&O Project: <i>Improved Approximation Algorithms for Tree Augmentation in Bounded Compressed Height Instances</i>	S18
Erlang Wiratama Surya Undergraduate Research Assistant, C&O Project: <i>Improved Approximation Algorithms for Tree Augmentation in Bounded Compressed Height Instances</i>	S18
Deon Nicholas Undergrad Research Assistant Project: <i>Optimization in Cranofacial Surgery – Joint with Sick Kids, Toronto</i>	W15
Jason Lin Undergrad Research Assistant Project: <i>Directed Multicuts in Planar Graphs</i>	S14
Alexander Remorov Undergrad Research Assistant, joint with L. Tuncel Project: <i>Combinatorial Algorithms for solving Convex Programs</i>	S11
Elyot Grant Undergrad Research Assistant Project: <i>Approximating Capacitated Covering Problems</i>	S09
James Pearson Undergrad Research Assistant Project: <i>Optimization Problems in the Mail-Order DVD Rental Industry</i>	S08
Jonathan Dietrich Undergraduate Research Assistant Project: <i>On the Integrality Gap of an LP Relaxation for the VPN Problem</i>	S05
Maurice Cheung Undergraduate Research Assistant Project: <i>Efficient Implementation of a Fast Packing LP Solver</i>	S06
Siddharth Rajaram M.Math (essay), C&O Essay title: <i>The Lifted-Cut Relaxation of the Steiner Forest Problem</i>	F06–S07

Thesis examination

Vishnu Narayan M.Math (C&O), University of Waterloo Thesis title: <i>Approximating Minimum-Size 2-Edge-Connected and 2-Vertex-Connected Spanning Subgraphs</i>	W17
Vinayak Pathak Ph.D. (CS), University of Waterloo Thesis title: <i>Reconfiguring Triangulations</i>	W15

Shahin Kamali	F14
Ph.D. (CS), University of Waterloo	
Thesis title: <i>Alternative Measures for Finer Analysis of Bin Packing, List Update, and Other Online Problems</i>	
Bundit Laekhanukit	S14
Ph.D. (CS), McGill University	
Thesis Title: <i>Inapproximability of Combinatorial Problems in Subexponential Time</i>	
Hadi Minnoei	S13
Ph.D. (C&O), University of Waterloo	
Thesis Title: <i>Mechanism Design for Covering Problems</i>	
Nima Mousavi	S13
Ph.D. (ECE), University of Waterloo	
Thesis title: <i>Algorithmic Problems in Access Control</i>	
Narges Simjour	S13
Ph.D. (CS), University of Waterloo	
Thesis title: <i>Parameterized Enumeration of Neighbour Strings and Kemeny Aggregations</i>	
Babak Behsaz	F12
Ph.D. (CS), University of Alberta, Edmonton	
Thesis title: <i>Approximation Algorithms for Clustering Problems</i>	
Beth-Ann Austin	S11
M.Math (C&O), University of Waterloo	
Thesis title: <i>2-Crossing Critical Graphs with a V_8 Minor</i>	
Isabel Urrutia-Schroeder	S11
M.Math (C&O), University of Waterloo	
Thesis title: <i>Finding 3-Connected 2-Crossing-Critical Graphs with V_8 Minors and no V_{10} Minors.</i>	
Shubham Gupta	S11
M.Math (C&O), University of Waterloo	
Thesis title: <i>Building Networks in Uncertainty</i>	
Andy Curtis	F11–W12
Ph.D. (CS), University of Waterloo	
Thesis title: <i>Reducing the Cost of Operating a Datacenter Network</i>	
Nicolas Sonnerat	S10
Ph.D. (Math), McGill University	
Thesis title: <i>Galaxy Cutsets and Graph Connectivity: Variations on a Theme</i>	
Weibei Li	S10
M.Math (Computational Math), University of Waterloo	
Thesis title: <i>The Prize-collecting Steiner Tree Problem and Underground Mine Planning</i>	
Bundit Laekhanukit	S10
M.Math (C&O), University of Waterloo	
Thesis title: <i>Approximation Algorithms for (S, T)-Connectivity Problems</i>	
Peruvemba Ravi	S10
M.Math (Math), University of Waterloo	
Thesis title: <i>A Study of Worst-Case Performance Bounds for Fast and Simple Approximation Algorithms for the Minimization of Makespan of Flowtime-Optimal Schedules in the Basic Parallel Identical Machine Model</i>	

Piyashat Sripratak M.Math (C&O), University of Waterloo Thesis title: <i>On the Number of Edges in a Quasi-planar Graph</i>	W10
Aaron Dos Remedios M.Math (C&O), University of Waterloo Thesis title: <i>Approximation Algorithms For Multi-Unit Online Auctions With Unknown Supply</i>	W10
Jane Gao Ph.D. (C&O), University of Waterloo Thesis title: <i>Generation and Properties of Random Graphs and Analysis of Randomized Algorithms</i>	W09
Wai-Shing Fung M.Sc., Chinese University of Hong Kong Thesis title: <i>Degree Bounded Vertex Connectivity Network Design with Metric Cost</i>	S09
Mina Razaghpour M.CS, University of Waterloo Thesis title: <i>The Steiner Ratio for the Obstacle-Avoiding Steiner Tree Problem</i>	F08
Ashkan Aazami Ph.D. (C&O), University of Waterloo Thesis title: <i>Hardness Results and Approximation Algorithms for some Problems on Graphs</i>	F07–F08
Ehsan Chiniforooshan Ph.D. (CS), University of Waterloo Thesis title: <i>Intersperse Coloring</i>	F07
Narges Simjour M.Math. (CS), University of Waterloo Thesis title: <i>A Different Optimality Measure for the d-Domestic Number Problem</i>	S06
Michael J. Spriggs Ph.D. (CS), University of Waterloo Thesis title: <i>Morphing Parallel Graph Drawings</i>	F06

Post-doctoral fellows

Martin Groß Joint with L. Sanità & C. Swamy	F16–F18
Kanstantsin Pashkovich Joint with L. Sanità	F14–F16
Umang Bhaskar Joint with C. Swamy	F14–S15
Andreas Feldmann Joint with C. Swamy & L. Sanità	F12–S15
Ian Post Joint with C. Swamy	F12–W15
Zachary Friggstad Joint with C. Swamy	F11–W14
Konstantinos Georgiou Joint with B. Guenin and C. Swamy	F10–F12

Y. Sharma Joint with C. Swamy	F10–W11
Deeparnab Chakrabarty	F08–W10
Rohit Khandekar Joint with J. Cheriyan and J. Geelen	F05–S06

Service

Committees

Masters for Mathematics Teachers Steering Committee C&O Representative	2017–22
Computational Mathematics Steering Committee C&O Representative	2014–17
Faculty of Math Dean Search Committee C&O Representative	2014–2015
Faculty of Math Research Advisory Committee C&O Representative	2013–14
Computational Mathematics Colloquium C&O Representative	2009–14
Dept. Tenure & Promotions Committee	2009
Computational Mathematics Colloquium Chair	2009
Dept. Advisory Committee on Appointments	2007
Computational Mathematics Colloquium Chair	2006–2007
Computational Mathematics Program Committee	2006
Tutte Seminar Series, C&O Chair	2005–06
Dept. Advisory Committee on Appointments, C&O	2005

Administrative appointments

Dean, Mathematics	07/2025– present
Department Chair, C&O	2010–2011, 09/2016–08/2019, 07/2020–22
Associate Chair for Undergraduate Affairs	2006–2007, 2008–10

Professional Activities

Society memberships and positions

Association for Computing Machinery (ACM)

Member

Mathematical Optimization Society (MOS)

Member

Editorial position

Mathematical Programming, Series A

Co-Editor

2018–20

SIAM Journal on Computing

Guest editor, Best papers of STOC'14

Journal of Computer and System Sciences (Elsevier)

Associate Editor

2015–18

Surveys in Operations Research (Elsevier)

Associate Editor

2014–15

Conference & workshop organization

Workshop on Approximation and Online Algorithms

Program Committee Chair (w. Britta Peis)

2021

Hausdorff Workshopl on Combinatorial Optimization

Co-Organizer

2018

Hausdorff Summer School on Combinatorial Optimization

Co-Organizer

2018

European Symposium on Algorithms (ESA)

Member of Program Committee

2017

International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX)

Member of Program Committee

2017

Integer Programming and Combinatorial Optimization (IPCO)

Local arrangements chair

2017

Symposium on Discrete Algorithms (SODA)

Member of program committee

2017

Workshop on Approximation and Online Algorithms (WAOA)

Member of Program Committee

2016

Integer Programming and Combinatorial Optimization (IPCO)

Member of Program Committee

2016

Hausdorff Trimester on Combinatorial Optimization

Co-Organizer

2015

International Symposium on Algorithmic Game Theory (SAGT)

Member of Program Committee

2015

International Symposium on Mathematical Programming (ISMP) Session Organizer	2015
ACM EC Member of program committee	2014
International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX) Member of Program Committee	2014
Symposium on Theory of Computing (STOC) Member of program committee	2014
Symposium on Discrete Algorithms (SODA) Member of program committee	2014
Workshop on Flexible Network Design Co-Organizer	2013
Conference on Web and Internet Economics (WINE) Member of program committee	2013
International Symposium on Algorithmic Game Theory (SAGT) Member of program committee	2013
International Symposium on Mathematical Programming (ISMP) Cluster Chair (Combinatorial Optimization)	2012
International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX) Member of Program Committee	2012
International Symposium on Combinatorial Optimization (ISCO) Member of Program Committee	2012
European Symposium on Algorithms (ESA) Member of Program Committee	2012
Workshop on Approximation and Online Algorithms (WAOA) Member of Program Committee	2011
Workshop on Approximation and Online Algorithms (WAOA) Member of Program Committee	2010
CORS-INFORMS Annual Meeting Session Chair	2010
Workshop on Approximation and Online Algorithms, Zurich, Switzerland Member of program committee	2006
European Symposium on Algorithms, Mallorca, Spain Member of program committee	2005
Workshop on Comb. & Alg. Aspects of Networking, Waterloo, Canada Member of program committee	2005

Refereeing and reviewing

Journals

Since 2003, I have on average reviewed 5 papers per year for ACM Transactions on Algorithms, Algorithmica, Discrete and Applied Mathematics, Information Processing Letters, Journal of Discrete

Algorithms, Journal of Graph Algorithms and Applications, Journal of the ACM, Mathematical Programming, SIAM Journal on Computing, SIAM Journal on Discrete Mathematics, Operations Research, Operations Research Letters, and Theoretical Computer Science.

Conferences

Since 2003, I have on average reviewed 5–10 papers per year for ACM Symposium on the Theory of Computing (STOC), ACM-SIAM Symposium on Discrete Algorithms (SODA), ACM Symposium on Principles of Distributed Computing (PODC), Conference on Integer Programming and Combinatorial Optimization (IPCO), European Symposium on Algorithms (ESA), IEEE Symposium on Foundations of Computer Science (FOCS), International Colloquium on Automata, Languages and Programming (ICALP), Workshop on Comb. & Alg. Aspects of Networking (ISAAC), International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX), Foundations of Software Technology and Theoretical Computer Science (FSTTCS), Latin American Theoretical Informatics (LATIN), Workshop on Approximation and Online Algorithms (WAOA), Workshop on Comb. & Alg. Aspects of Networking (CAAN), Symposium on Theoretical Aspects of Computer Science (STACS), Scandinavian Workshop on Algorithm Theory (SWAT). This count does not include papers refereed during program committee memberships.

Consulting

<i>Correcting Cranofacial Deformations</i> SickKids Hospital, Toronto, Canada	2011–2015, 2018–22
<i>Optimization Issues in the DVD Rental Industry</i> Zip.Ca, Ottawa, Canada	2009–10
<i>Scheduling automated stacker cranes</i> Hutchinson, Hong Kong, China	2006