Konstantin Makarychev

Department of Computer Science
Northwestern University
Mudd Hall, Room 3009
2233 Tech Drive, Third Floor
Evanston, IL 60208

Email: konstantin@northwestern.edu
Web: konstantin.makarychev.net

Employment

02/2017 – present	**Northwestern University, Evanston, IL** Associate Professor of Computer Science (with tenure)
01/2017 – present	**Microsoft Research, Redmond, WA** Consultant on the DNA Storage Project
04/2012 – 01/2017	**Microsoft Research, Redmond, WA** Researcher, Theory Group
07/2007 – 04/2012	**IBM Research, Yorktown Heights, NY** Research Staff Member, Algorithms Group
06/2006 – 09/2006	**IBM Research, Yorktown Heights, NY** Intern, Algorithms Group Mentor: Maxim Sviridenko
06/2005 – 09/2005	**Microsoft Research, Redmond, WA** Intern, Theory Group Mentor: Assaf Naor
01/2002 – 08/2003	**Siebel Systems, San Mateo, CA** Software Engineer, Core Engineering

Education

2003 – 2007	**Department of Computer Science, Princeton University** Ph.D. in Computer Science Advisor: Moses Charikar
1996 – 2001	**Department of Mathematics, Moscow University** M.S. in Pure and Applied Mathematics Diploma with Honors; GPA 5.0/5.0 Advisors: Alexander Shen and Nikolai Vereshchagin
1992 – 1996	**Moscow Math High School #57**

Teaching

Northwestern University

- Design and Analysis of Algorithms: *Spring 2021, Winter 2020, Winter 2019, Spring 2018, and Winter 2018*
- Graduate Algorithms: *Fall 2020, Spring 2020*
- Approximation Algorithms: *Winter 2021, Spring 2019, and Spring 2017*
- Math Toolkit for Theoretical Computer Scientists: *Spring 2019*
- Advanced Topics in Approximation Algorithms: *Spring 2020*

University of Washington

- Linear and Semi-Definite Programming in Approximation Algorithms (with Mohit Singh): *Fall 2014*

Summer Schools

- Metric Geometry and Its Applications in Computer Science (CS Club, Saint Petersburg, Russia): Fall 2017
- Approximation Algorithms (CSR Conference): *Summer 2013*

Teaching Assistant at Princeton University

- The Efficient Universe (taught by Avi Wigderson): *Spring 2006*
- Discrete Mathematics (taught by Moses Charikar): *Fall 2004*

Math Instructor

- Math circle classes for high school students at Moscow High School #57, Moscow University, and Moscow Center for Continuous Mathematical Education: *1996 – 1998, 2000 – 2001*

PhD Students

- Sanchit Kalhan (co-advised with Aravindan Vijayaraghavan)
- Aravind Reddy (co-advised with Aravindan Vijayaraghavan)
- Liren Shan

Summer Interns

Microsoft Research

- Euiwoong Lee
- Anand Louis
- Ilya Razenshteyn
- Tselil Schramm
- Grigory Yaroslavtsev

IBM Research

- Rajsekar Manokaran
- Roy Schwartz
- Aravindan Vijayaraghavan

Undergraduate Research Advisees

- Timothy Zhou

Professional Service

- Editorial Board Member: SICOMP (2019 – present)
- Program Committee Member: ICALP 2021, SODA 2020, ESA 2018, STOC 2016, APPROX 2014, CSR 2014, ICALP 2013, CSR 2013, SODA 2013, APPROX 2012, STOC 2008
- General co-chair for STOC 2020
- PhD Dissertation Committees: Abhratanu Dutta (Northwestern University), Tarik Kaced (Montpellier University), Aravindan Vijayaraghavan (Princeton University)
- Grant reviewing for the National Science Foundation (NSF) and Israel Science Foundation (ISF)
- Refereeing for APPROX, COLT, CSR, ESA, FOCS, ICALP, ICML, PODC, SODA, STACS, STOC, WINE (conferences); and Algorithmica, Combinatorica, Discrete Optimization, Information Processing Letters, Journal of ACM, Journal of Global Optimization, Mathematics of Operations Research, SIAM Journal on Computing, SIAM Journal on Discrete Mathematics, Theoretical Computer Science (journals)

Research Funding

2020 – 2024	NSF Award CCF-1955351 for Collaborative Medium Research Project "Design and Analysis of Models and Algorithms for Real-life Problems." This is a joint project with Yury Makarychev.
2019 – 2022	Team member of the Institute for Data, Econometrics, Algorithms, and Learning (IDEAL). The institute is supported by NSF Award CCF-1934931.

Awards and Honors

2011	IBM A-Level Accomplishment for work on Semidefinite Programming
2010	IBM Research 2009 Pat Goldberg Memorial Best Paper Award
2006 – 2007	IBM Ph.D. Fellowship
2003 – 2007	Gordon Wu Fellowship
2003	Siebel Engineering Outstanding Contributor Award
1996 – 1997	George Soros Fellowship
1996	Russian Mathematical Olympiad – Silver Medal

Surveys and Book Chapters

1. **Perturbation Resilience**
   Konstantin Makarychev and Yury Makarychev
   Beyond the Worst-Case Analysis of Algorithms. Editor: Tim Roughgarden. Cambridge University Press. 2020.

2. **Approximation Algorithms for CSPs (a survey of results)**
   Konstantin Makarychev and Yury Makarychev
   The Constraint Satisfaction Problem: Complexity and Approximability. Editors: Andrei Krokhin and Stanislav Zivny. Dagstuhl Follow-Ups. 2017.

3. **Bilu–Linial Stability (a survey on Bilu–Linial stability and perturbation resilience)**
   Konstantin Makarychev and Yury Makarychev
   Advanced Structured Prediction. Editors: T. Hazan, G. Papandreou, D. Tarlow. MIT Press. 2016.

Publications

4. **Batch Optimization for DNA Synthesis**
   Konstantin Makarychev, Miklos Z. Racz, Cyrus Rashtchian, Sergey Yekhanin
   working paper

5. **Correlation Clustering with Asymmetric Classification Errors**
   Jafar Jafarov, Sanchit Kalhan, Konstantin Makarychev, Yury Makarychev
   ICML 2020

6. **Bisect and Conquer: Hierarchical Clustering via Max-Uncut Bisection**
   Sara Ahmadian, Vaggos Chatziafratis, Alessandro Epasto, Euiwoong Lee, Mohammad Mahdian, Konstantin Makarychev, Grigory Yaroslavtsev
   AISTATS 2020

7. **Certified Algorithms: Worst-Case Analysis and Beyond**
   Konstantin Makarychev and Yury Makarychev
   ITCS 2020

8. **Correlation Clustering with Local Objectives**
   Sanchit Kalhan, Konstantin Makarychev, Timothy Zhou
   NeurIPS 2019

9. **Performance of Johnson-Lindenstrauss Transform for k-Means and k-Medians Clustering**
   Konstantin Makarychev, Yury Makarychev, Ilya Razenshteyn
   STOC 2019

10. **DNA assembly for nanopore data storage readout**
    with Karin Strauss, Luis Ceze, et al.
    Nature Communications 10, Article number: 2933 (2019)

11. **Scaling up DNA data storage and random access retrieval**
    with Karin Strauss, Luis Ceze, et al.
    Nature Biotechnology 36, pp. 242-248, 2018

12. **Nonlinear Dimension Reduction via Outer Bi-Lipschitz Extensions**
    Sepideh Mahabadi, Konstantin Makarychev, Yury Makarychev, Ilya Razenshteyn
    STOC 2018

13. **Clustering Billions of Reads for DNA Data Storage**
    Cyrus Rashtchian, Konstantin Makarychev, Miklos Z. Racz, Siena Dumas Ang, Djordje Jevdjic, Sergey Yekhanin, Luis Ceze, Karin Strauss
    NeurIPS 2017 (spotlight presentation)

14. **Algorithms for Stable and Perturbation-Resilient Problems**
    Haris Angelidakis, Konstantin Makarychev, Yury Makarychev
    STOC 2017

15. **Robust algorithms with polynomial loss for near-unanimity CSPs**
    Victor Dalmau, Marcin Kozik, Andrei Krokhin, Konstantin Makarychev, Yury Makarychev, Jakub Opršal
    SODA 2017

16. **Learning Communities in the Presence of Errors**
    Konstantin Makarychev, Yury Makarychev, Aravindan Vijayaraghavan
    COLT 2016

17. **Union of Euclidean Metric Spaces is Euclidean**
    Konstantin Makarychev and Yury Makarychev
    Discrete Analysis 2016

18. **A bi-criteria approximation algorithm for k-Means**
    Konstantin Makarychev, Yury Makarychev, Maxim Sviridenko, Justin Ward
    APPROX 2016

19. **Satisfiability of Ordering CSPs Above Average**
    Konstantin Makarychev, Yury Makarychev, Yuan Zhou
    FOCS 2015

20. **Correlation Clustering with Noisy Partial Information**
    Konstantin Makarychev, Yury Makarychev, Aravindan Vijayaraghavan
    COLT 2015

21. **Near Optimal LP Rounding Algorithm for Correlation Clustering on Complete Graphs**
    Shuchi Chawla, Konstantin Makarychev, Tselil Schramm, Grigory Yaroslavtsev
    STOC 2015

22. **Network-Aware Scheduling for Data-Parallel Jobs: Plan When You Can**
    Virajith Jalaparti, Peter Bodik, Ishai Menache, Sriram Rao, Konstantin Makarychev, Matthew Caesar
    SIGCOMM 2015

23. **Solving Optimization Problems with Diseconomies of Scale**
    Konstantin Makarychev and Maxim Sviridenko
    FOCS 2014
    Journal of the ACM, Volume 65, Issue 6, November 2018, Article No. 42.

24. **Nonuniform Graph Partitioning with Unrelated Weights**
    Konstantin Makarychev and Yury Makarychev
    ICALP 2014
    Sbornik: Mathematics (Russian Academy of Sciences), vol. 208

25. **Precedence-constrained Scheduling of Malleable Jobs with Preemption**
    Konstantin Makarychev and Debmalya Panigrahi
    ICALP 2014

26. **Constant Factor Approximation for Balanced Cut in the PIE Model**
    Konstantin Makarychev, Yury Makarychev, Aravindan Vijayaraghavan
    STOC 2014

27. **Bilu-Linial Stable Instances of Max Cut**
    Konstantin Makarychev, Yury Makarychev, Aravindan Vijayaraghavan
    SODA 2014

28. **Approximation Algorithm for Sparsest k-Partitioning**
    Anand Louis and Konstantin Makarychev
    SODA 2014

29. **Speed Regularization and Optimality in Word Classing**
    Geoffrey Zweig and Konstantin Makarychev
    ICASSP 2013

30. **Local Search is Better than Random Assignment for Bounded Occurrence Ordering k-CSPs**
    Konstantin Makarychev
    STACS 2013

31. **Sorting Noisy Data with Partial Information**
    Konstantin Makarychev, Yury Makarychev, Aravindan Vijayaraghavan
    ITCS 2013 – Innovations in Theoretical Computer Science

32. **Approximation Algorithm for Non-Boolean MAX k-CSP**
    Konstantin Makarychev and Yury Makarychev
    APPROX 2012

33. **Approximation Algorithms for Semi-random Graph Partitioning Problems**
    Konstantin Makarychev, Yury Makarychev, Aravindan Vijayaraghavan
    STOC 2012

34. **Concentration Inequalities for Nonlinear Matroid Intersection**
    Konstantin Makarychev, Warren Schudy, Maxim Sviridenko
    SODA 2012
    Random Structures & Algorithms, vol. 46, no. 3, 2015

35. **The Grothendieck Constant is Strictly Smaller than Krivine's Bound**
    Mark Braverman, Konstantin Makarychev, Yury Makarychev, Assaf Naor
    FOCS 2011; preprint arXiv:1103.6161 [math.FA]
    Forum of Mathematics, Π, Volume 1, 2013

36. **How to Play Unique Games Against a Semi-random Adversary**
    Alexandra Kolla, Konstantin Makarychev, Yury Makarychev
    FOCS 2011

37. **Min-Max Graph Partitioning and Small Set Expansion**
Nikhil Bansal, Uriel Feige, Robert Krauthgamer, Konstantin Makarychev, Viswanath Nagarajan, Joseph (Seffi) Naor, Roy Schwartz
FOCS 2011
Special Issue of SIAM Journal of Computing (SICOMP), vol. 43, no. 2, 2014

38. **Improved Approximation for the Directed Spanner Problem**
Piotr Berman, Arnab Bhattacharyya, Konstantin Makarychev, Sofya Raskhodnikova, Grigory Yaroslavtsev
ICALP 2011
Special Issue of Information and Computation, vol. 222, pp. 93-107, 2013.

39. **Maximizing Polynomials Subject to Assignment Constraints**
Konstantin Makarychev and Maxim Sviridenko
ICALP 2011

40. **On Parsimonious Explanations For 2-D Tree- and Linearly-Ordered Data**
Howard Karloff, Flip Korn, Konstantin Makarychev, Yuval Rabani
STACS 2011

41. **Assembly of Circular Genomes**
Konstantin Makarychev and Alantha Newman
ITCS 2011

42. **Metric Extension Operators, Vertex Sparsifiers and Lipschitz Extendability**
Konstantin Makarychev and Yury Makarychev
FOCS 2010;
Israel Journal of Mathematics, vol. 212 (2), May 2016

43. **Maximum Quadratic Assignment Problem**
Konstantin Makarychev, Rajsekar Manokaran, Maxim Sviridenko
ICALP 2010
ACM Transactions on Algorithms, vol. 10, no. 4, article 18, August 2014

44. **How to Play Unique Games on Expanders**
Konstantin Makarychev and Yury Makarychev
WAOA 2010

45. **On Hardness of Pricing Items for Single-Minded Bidders**
Rohit Khandekar, Tracy Kimbrel, Konstantin Makarychev, Maxim Sviridenko
APPROX 2009 (see a nice entry on the problem at Richard Lipton's blog).

46. **Integrality Gaps for Sherali-Adams Relaxations**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
STOC 2009

47. **Indexing Genomic Sequences on the IBM Blue Gene**
Amol Ghoting and Konstantin Makarychev
SC 2009
ACM Gordon Bell Prize Finalist

48. **Serial and Parallel Methods for I/O Efficient Suffix Tree Construction**
Amol Ghoting and Konstantin Makarychev
SIGMOD 2009
ACM Transactions on Database Systems (TODS), vol. 35(4), pp. 25:1-25:37
IBM Pat Goldberg Best Paper Award

49. **Online Make-to-Order Joint Replenishment Model: Primal Dual Competitive Algorithms**
Niv Buchbinder, Tracy Kimbrel, Retsef Levi, Konstantin Makarychev, Maxim Sviridenko
SODA 2008

50. **Local Global Tradeoffs in Metric Embeddings**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
FOCS 2007
Special issue of SIAM Journal of Computing (SICOMP), vol. 39, no. 6, pp. 2487-2512, 2010

51. **On the Advantage over Random for Maximum Acyclic Subgraph**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
FOCS 2007

52. **Near-Optimal Algorithms for Maximum Constraint Satisfaction Problems**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
SODA 2007;
Special issue of ACM Transactions on Algorithms, vol. 5, no. 3, article 32, July 2009a

53. **A Divide and Conquer Algorithm for d-Dimensional Linear Arrangement**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
SODA 2007

54. **How to Play Unique Games Using Embeddings**
Eden Chlamtac, Konstantin Makarychev, Yury Makarychev
FOCS 2006

55. **Near-Optimal Algorithms for Unique Games**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
STOC 2006

56. **Directed Metrics and Directed Graph Partitioning Problems**
Moses Charikar, Konstantin Makarychev, Yury Makarychev
SODA 2006

57. **Square root log n approximation algorithms for Min UnCut, Min 2CNF Deletion, and directed cut problems**
    Amit Agarwal, Moses Charikar, Konstantin Makarychev, Yury Makarychev
    STOC 2005

58. **Quadratic Forms on Graphs**
    Noga Alon, Konstantin Makarychev, Yury Makarychev, Assaf Naor
    STOC 2005
    Inventiones Mathematicae, vol. 163, no. 3, pp. 499-522, March 2006

59. **Chain Independence and Common Information**
    Konstantin Makarychev and Yury Makarychev
    IEEE Transactions on Information Theory, 58(8), pp. 5279-5286, 2012

60. **A new class of non Shannon type inequalities for entropies**
    Konstantin Makarychev, Yury Makarychev, Andrei Romashchenko, Nikolai Vereshchagin
    Communications in Information and Systems, vol. 2, no. 2, pp. 147-166, December 2002

61. **The Importance of Being Formal**
    Konstantin Makarychev and Yury Makarychev
    The Mathematical Intelligencer, vol. 23 no. 1, 2001

62. **Proof of Pak's conjecture on tilings by T-tetrominoes (in Russian)**
    Konstantin Makarychev and Yury Makarychev
    manuscript

PhD Thesis

63. **Quadratic Forms on Graphs and Their Applications**
    Konstantin Makarychev