Amir Ali Ahmadi

329 Sherrerd Hall, Charlton Street
Princeton University
Princeton, NJ 08544 USA
Tel: (240) 505-3152
aaa@princeton.edu
http://aaa.princeton.edu/

Affiliations while at Princeton University

Professor — July 2019 – Present
Dept. of Operations Research and Financial Engineering (ORFE)

Assistant Professor, ORFE — September 2014 – July 2019

Director — 2019 – Present
Certificate Program in Optimization and Quantitative Decision Science

Volunteer Assistant Coach — 2021
Princeton Men's Tennis Team

Associated Faculty, Dept. of Electrical and Computer Engineering — 2020 – Present
Associated Faculty, Dept. of Computer Science — 2015 – Present
Associated Faculty, Dept. of Mechanical and Aerospace Engineering — 2017 – Present
Associated Faculty, Program in Applied and Computational Mathematics — 2017 – Present
Associated Faculty, Center for Statistics and Machine Learning — 2016 – Present

Visiting Research Scientist — 2020 – 2021
Google Brain (Robotics group)

Visiting Senior Optimization Fellow — 2021– 2022
Citadel, Global Quantitative Strategies

Previous Affiliation

Herman Goldstine Fellow — 2012 – 2014
Department of Business Analytics and Mathematical Sciences, IBM Watson Research Center
(The Goldstine Fellowship is awarded annually to at most two candidates in all areas of mathematical and computer sciences.)

Postdoctoral Associate Computer Science and Artificial Intelligence Laboratory (CSAIL) — 2011 – 2012
Robot Locomotion Group, Laboratory for Information and Decision Systems (LIDS), MIT

Education

Massachusetts Institute of Technology — 2008 – 2011
Ph.D., Electrical Engineering and Computer Science (Minor in Mathematics)

Massachusetts Institute of Technology — 2006 – 2008
S.M., Electrical Engineering and Computer Science (GPA: 5.0/5.0)

University of Maryland — 2002 – 2006
B.S., Electrical Engineering (*Ranked 1st in the Dept., University Honors, Electrical Eng. Honors)*
B.S., Mathematics (*Ranked 1st in the Dept., University Honors)*

Selected Awards and Distinctions

For teaching

1. **The Princeton SEAS Distinguished Teaching Award** 2023
   Awarded annually to one faculty member across the School of Engineering and Applied Sciences
2. **Teaching Award of Princeton University's Engineering Council**
   Four-time recipient: 2015, 2019, 2020, 2024
3. **Phi Beta Kappa Award for Excellence in Undergraduate Teaching** 2017
   Awarded annually to two faculty members across the Princeton campus
4. **Excellence in Teaching of Operations Research Award** 2017
   International award given by the Institute for Industrial and Systems Engineers

For research

1. **Egon Balas Prize** (for contributions to mathematical optimization) 2024
2. **Kavli Fellow – National Academy of Science** 2023
3. **The Presidential Early Career Award for Scientists and Engineers (PECASE)** 2019
   Highest honor bestowed by the U.S. government on early-career scientists and engineers
4. **Sloan Fellowship** (in Computer Science) 2017
5. **INFORMS Optimization Society Young Researchers' Prize** 2018
   For an outstanding paper in optimization whose authors are within 8 years of their PhD
6. **Multidisciplinary University Research Initiative (MURI) Award** 2018-2025
   Jointly received with 6 colleagues. Total award of $7.5M
7. **DARPA Faculty Award** 2017-2019
   Career award of the Defense Advanced Research Projects Agency
8. **NSF CAREER Award** 2016-2021
   Awarded on first attempt and after one year at Princeton
9. **AFOSR YIP** 2014-2017
   Air Force Office of Scientific Research Young Investigator Program Award (AF career award)
   Awarded on first attempt and during the first semester at Princeton
10. **Google Faculty Research Award** 2016
    Aimed to recognize and support world-class, permanent faculty perusing cutting-edge research in areas of mutual interest to Google
11. **Best SICON Paper Prize** 2015
    For one of two most outstanding papers published in the SIAM Journal on Control and Optimization in the years 2013-2015
12. **INFORMS Computing Society Prize** 2012
    For the best series of papers at the interface of Operations Research and Computer Science
13. **IBM Watson Herman Goldstine Fellowship in Mathematical Sciences** 2012, 2013
14. **ICRA Best Paper Award** 2013
    For the best paper at the 30th IEEE International Conference on Robotics and Automation
15. **Princeton SEAS Innovation Award** 2018
16. **Princeton University's Howard B. Wentz, Jr. Junior Faculty Award** 2016
    For excellence in research and teaching
17. **NSF Junior Oberwolfach Fellowship:** Four-time recipient: 2014, 2015, 2016, 2019
18. **Selected for National Academy of Engineering's US Frontiers of Eng. Symposium** 2018
    Attendance opportunity offered to 100 early career engineers from all areas of engineering
19. **Best Student-Paper Award Finalist, IEEE Conference on Decision and Control** 2008

Selected Papers (out of 58; first letter in the title is linked to the paper online)

Algebraic techniques in optimization

1. A. A. Ahmadi, A. Chaudhry, and J. Zhang. **Higher-order Newton methods with polynomial work per iteration.** *Advances in Mathematics*, 2024.
2. A. A. Ahmadi, O. Gunluk. **Robust-to-dynamics optimization.** *Mathematics of Operations Research,* 2024.
3. A. A. Ahmadi, A. Majumdar. **DSOS and SDSOS optimization: more tractable alternatives to sum of squares and semidefinite optimization.** *SIAM Journal on Applied Algebra and Geometry*, 2019. (Subject of feature article in Quanta Magazine (Simons Foundation): "A classical math problem gets pulled into the modern world")
4. A. A. Ahmadi, C. Dibek. **A sum of squares characterization of perfect graphs.** *SIAM Journal on Applied Algebra and Geometry*, 2023.
5. A. A. Ahmadi, G. Hall. **On the construction of converging hierarchies for polynomial optimization based on certificates of global positivity.** *Mathematics of Operations Research*, 2019. (INFORMS Optimization Society Young Researchers' Prize)
6. A. A. Ahmadi, B. El Khadir. **Time-varying semidefinite programs.** *Mathematics of Operations Research*, 2021.
7. A. A. Ahmadi, G. Hall. **DC Decomposition of nonconvex polynomials with algebraic techniques.** *Mathematical Programming,* 2017. (INFORMS Computing Society Best Student Paper Award)

Computational complexity in numerical optimization

8. A. A. Ahmadi, J. Zhang. **Complexity aspects of local minima and related notions.** *Advances in Mathematics*, 2022. (Subject of feature article in Quanta Magazine (Simons Foundation): "Surprising limits discovered in quest for optimal solutions")
9. A. A. Ahmadi, J. Zhang. **On the complexity of finding a local minimizer of a quadratic function over a polytope.** *Mathematical Programming*, 2022. (Answers an open problem in the optimization community from 1992)
10. A. A. Ahmadi, A. Olshevsky, P. A. Parrilo, and J. N. Tsitsiklis. **NP-hardness of deciding convexity of quartic polynomials and related problems**. *Mathematical Programming*, 2013. (INFORMS Computing Society Prize, MIT News) (Answers an open problem in the optimization community from 1992)
11. A. A. Ahmadi, J. Zhang. **On the complexity of testing attainment of the optimal value in nonlinear optimization.** *Mathematical Programming*, 2019.

Optimization in dynamical systems

12. A. A. Ahmadi, A. Chaudhry, V. Sindhwani, S. Tu. **Safely learning dynamical systems**. *To appear in Foundations of Computational Mathematics*, 2024.
13. A. A. Ahmadi, B. El Khadir. **Learning dynamical systems with side information.** *SIAM Review*, 2023.
14. A. A. Ahmadi, B. El Khadir. **A globally asymptotically stable polynomial vector field with rational coefficients and no local polynomial Lyapunov function.** *Systems & Control Letters*, 2018.
15. A. A. Ahmadi, R. Jungers, P. A. Parrilo, and M. Roozbehani. **Joint spectral radius and path-complete graph Lyapunov functions**. *SIAM Journal on Control and Optimization,* 2014. (Best SICON Paper Prize, 2013-2015)

Selected Invited Talks (out of >150)

1. SIAM Conference on Optimization (Plenary Speaker), 2021
2. National Applied Mathematics Conference of Colombia (Plenary Speaker), Medellin, 6/22
3. Centrum Wiskunde & Informatica (CWI) Lecture, Amsterdam, 10/22
4. Workshop on Design and Analysis of Robust Systems (Keynote Speech), Porto 4/18
5. The Belgian inter-university conference on Dynamical Systems, Control and Optimization (Plenary Speaker), Liege 5/15
6. Oberwolfach meeting on Polynomial Optimization for Nonlinear Dynamics, 7/24
7. Oberwolfach meeting on Mixed Integer Nonlinear Optimization, 8/23
8. Oberwolfach meeting on Mixed Integer Nonlinear Optimization, 6/19
9. Oberwolfach meeting on Applied Koopmanism, 2/16
10. Oberwolfach meeting on Mixed Integer Nonlinear Optimization, 10/15
11. Oberwolfach meeting on Real Algebraic Geometry with a View Towards Systems Control, 4/14
12. Distinguished Seminar on Optimization and Data, University of Washington, Spring '24
13. UPenn Optimization Seminar (Inaugural talk), Wharton, Fall '23
14. LIDS Colloquium, MIT Laboratory for Information and Decision Systems, Fall '23
15. University of British Columbia, Sauder School of Business, Spring '23
16. ETH, Department of Mathematics, DACO seminar, Spring '23
17. Stanford University, Management Science and Engineering, 11/17
18. Future Trends in Polynomial Optimization, LAAS-CNRS, Toulouse, 11/23
19. CWI Workshop on Polynomial Optimization in Control and Energy, 11/22
20. Jon-Shmuel Halfway to Twelfty, Marne-la-Vallee, 7/23
21. Workshop on Mixed Integer Programming, Univ. of Miami, 5/16
22. Mixed Integer Nonlinear Programming, Institut Henri Poincare, Paris, 9/13

Selected Service and Professional Activities

- Initiator and organizer of the first **Princeton Day of Optimization**
    - ~350 participants from over 50 academic and industrial institutions
    - Website: https://orfe.princeton.edu/pdo/
- Initiator and current co-organizer of the **Princeton Optimization Seminar**
    - >120 seminars held since inception
    - Past talks: https://orfe.princeton.edu/events/optimization-seminar/past
- Co-organizer of workshop on **Positivity**
    - Theme: the interface between the bootstrap program for conformal field theory and semidefinite optimization/convex algebraic geometry
    - Website: https://pcts.princeton.edu/events/2022/positivity
- Associate Editor of *Mathematics of Operations Research* (2019 – 2023)
- On the Selection Committee of the Best Student Paper Prize and the Balas Prize of the INFORMS Optimization Society
- Co-organizer of workshop on ``Solving large-scale semidefinite programs in control, machine learning, and robotics'' at the IEEE Conference on Decision and Control (11 coordinated lectures)
    - Website: http://aaa.princeton.edu/largesdps