

UCSD Mathematics Department  
9500 Gilman Drive, La Jolla, CA 92093  
<http://www.math.ucsd.edu/~njw>

Tel: (858)534-6015  
Fax: (858)534-5273  
njw@math.ucsd.edu

# Curriculum Vitae

## Jiawang Nie

### Research Area

- Polynomial and Semidefinite Optimization
- Moment and Tensor Computation
- Convex and Real Algebraic Geometry
- Numerical Analysis and Scientific Computing

### Education

**Ph.D.** University of California at Berkeley, 2006

**M.S.** Chinese Academy of Sciences, 2000

**B.S.** Xi'an Jiao Tong University, 1997

### Academic Appointments

2015– present, Professor, Mathematics, University of California, San Diego

2011– 2015, Associate Professor, Mathematics, University of California, San Diego

2007– 2011, Assistant Professor, Mathematics, University of California, San Diego

### Awards

- *The Kalman Visiting Fellowship*, University of Auckland, 2015.
- *Optimization Prize for Young Researchers*, INFORMS, 2014
- *Tucker Prize Finalist*, Mathematical Optimization Society, 2009
- *CAREER Award*, National Science Foundation, 2009
- *Hellman Foundation Fellowship*, UCSD, 2009
- *President's Excellent Scholarship*, Chinese Academy of Sciences, 2000
- *Wei Hua Science & Technology Scholarship*, Chinese Academy of Sciences, 1999

### Grants

- NSF DMS-1619973: *Computational Methods for Symmetric Tensor Problems*, \$150,000, 2016.
- NSF DMS-1417985: *Semidefinite Programming Methods for Moment and Optimization Problems*, \$209,999, 2014.

- NSF DMS-0844775: *CAREER: Linear Matrix Inequality Representations in Optimization*, \$500,445, 2009.
- *Semidefinite programming and convex sets*, \$21,333, Hellman Foundation, 2009.
- NSF DMS-0757212: *FRG: Collaborative Research: Semidefinite optimization and convex algebraic geometry* (joint with J. William Helton), \$478,980, 2008.
- Academic Senate Research Grant, UCSD, \$10,493, 2008.

## Publications

1. Jiawang Nie. Generating Polynomials and Symmetric Tensor Decompositions, *Foundations of Computational Mathematics*, to appear. DOI:10.1007/s10208-015-9291-7
2. J. Nie and X. Zhang. Positive Maps and Separable Matrices, *SIAM Journal on Optimization*, Vol. 26, No. 2, pp. 1236-1256, 2016
3. J. Nie. Linear Optimization with Cones of Moments and Nonnegative Polynomials, *Mathematical Programming*, Ser. B, Vol. 153, No. 1, pp. 247-274, 2015.
4. J. Nie. The Hierarchy of Local Minimums in Polynomial Optimization, *Mathematical Programming*, Ser. B, Ser. B, Vol. 151, No.2, pp. 555-583, 2015.
5. C. Cui, Y. Dai, and J. Nie. All Real Eigenvalues of Symmetric Tensors. *SIAM Journal on Matrix Analysis and Applications*, Vol. 35, No. 4, pp. 1582-1601, 2014.
6. J. Nie and L. Wang. Semidefinite Relaxations for Best Rank-1 Tensor Approximations. *SIAM Journal on Matrix Analysis and Applications*, Vol. 35, No. 3, pp. 1155-1179, 2014.
7. J. Nie. The  $\mathcal{A}$ -Truncated  $K$ -Moment Problem. *Foundations of Computational Mathematics*, Vol. 14, No. 6, pp. 1243-1276, 2014.
8. J. Nie. Optimality Conditions and Finite Convergence of Lasserre's Hierarchy. *Mathematical Programming*, Ser. A, Vol. 146, No. 1-2, pp. 97-121, 2014.
9. J. Nie. Polynomial Optimization with Real Varieties. *SIAM Journal On Optimization*, Vol. 23, No. 3, pp. 1634-1646, 2013.
10. J. Nie. Certifying Convergence of Lasserre's Hierarchy via Flat Truncation. *Mathematical Programming*, Ser. A, Vol. 142, No. 1-2, pp. 485-510, 2013.
11. J.Nie. An Approximation Bound Analysis for Lasserre's Relaxation in Multivariate Polynomial Optimization. *Journal of the Operations Research Society of China*, Vol. 1, No. 3, pp. 313-332, 2013.
12. L. Fialkow and J. Nie. On the closure of positive flat moment matrices. *Journal of Operator Theory* 69 (2013), no. 1, 257-277.
13. J. Nie. An Exact Jacobian SDP Relaxation for Polynomial Optimization. *Mathematical Programming*, Ser. A, Vol. 137, pp. 225-255, 2013.
14. J. Nie. Chapter 6: Semidefinite Representability *Semidefinite Optimization and Convex Algebraic Geometry*: 251-291, SIAM, 2013.
15. J. W. Helton and J. Nie. A Semidefinite Approach for Truncated  $K$ -Moment Problem. *Foundations of Computational Mathematics*, Vol. 12, No. 6, pp. 851-881, 2012.
16. J. Nie. Convex hulls of quadratically parameterized sets with quadratic constraints. *Mathematical methods in systems, optimization, and control*, 247258, Oper. Theory Adv. Appl., 222, Birkhuser/Springer Basel AG, Basel, 2012.

17. L. Fialkow and J. Nie. The truncated moment problem via homogenization and flat extensions. *Journal of Functional Analysis*, 263 (2012), no. 6, 1682-1700.
18. J. Nie and L. Wang. Regularization Methods for SDP Relaxations in Large Scale Polynomial Optimization. *SIAM Journal On Optimization*, Vol. 22, No. 2, pp. 408-428, 2012.
19. J. Nie. First Order Conditions for Semidefinite Representations of Convex Sets Defined by Rational or Singular Polynomials. *Mathematical Programming*, Ser. A, Vol. 131, No. 1, pp. 1-36, 2012.
20. J.W. Helton and J. Nie. Semidefinite representation of convex sets and convex hulls. *Handbook on semidefinite, conic and polynomial optimization*, 77-112, Internat. Ser. Oper. Res. Management Sci., 166, Springer, New York, 2012.
21. J. Nie. Discriminants and Nonnegative Polynomials *Journal of Symbolic Computation*, Vol. 47, No. 2, pp. 167-191, 2012.
22. J. Nie. Sum of squares methods for minimizing polynomial forms over spheres and hypersurfaces. *Frontiers of Mathematics in China*, 7:321-346, 2012.
23. J. Nie. Polynomial Matrix Inequality and Semidefinite Representation. *Mathematics of Operations Research*, Vol. 36, No. 3, pp. 398-415, 2011.
24. L. Fialkow and J. Nie. Positivity of Riesz Functionals and Solutions of Quadratic and Quartic Moment Problems. *Journal of Functional Analysis*, 258 (2010), no. 1, 328-356.
25. J. Nie, K. Ranestad and B. Sturmfels. Algebraic Degree of Semidefinite Programming. *Mathematical Programming*, Series A, Vol. 122, No.2, pp. 379-405, 2010.
26. C. Ling, J. Nie, L. Qi, and Y. Ye. Bi-Quadratic Optimization over Unit Spheres and Semidefinite Programming Relaxations. *SIAM Journal on Optimization*, Vol. 20, No. 3, pp. 1286-1310, 2009.
27. J.W. Helton and J. Nie. Semidefinite representation of convex sets. *Mathematical Programming, Series A*, Vol. 122, No.1, pp. 21-64, 2010.
28. J. Nie and B. Sturmfels. Matrix cubes parametrized by eigenvalues. *SIAM Journal on Matrix Analysis and Applications*, Vol. 31, No. 2, pp. 755-766, 2009.
29. J.W. Helton and J. Nie. Sufficient and Necessary Conditions for Semidefinite Representability of Convex Hulls and Sets. *SIAM Journal on Optimization*, Vol. 20, No.2, pp. 759-791, 2009.
30. J. Nie. Sum of Squares Method for Sensor Network Localization. *Computational Optimization and Applications*, Vol.43, No. 2 (2009), pp. 151-179.
31. J. Nie and K. Ranestad. Algebraic Degree of Polynomial Optimization. *SIAM Journal on Optimization*, Vol. 20, No. 1, pp. 485-502, 2009.
32. J.William Helton and J. Nie. Structured Semidefinite Representation of Some Convex Sets. *Proceeding of 47th IEEE Conference on Decision and Control*, pp. 4797 - 4800, Cancun, Mexico, Dec. 9-11, 2008.
33. B. Li, J. Nie, and L. Zhi. Approximate GCDs of polynomials and sparse SOS relaxations. *Theoretical Computer Science*, 409(2) pp.200-210, 2008.
34. J. Nie and J. Demmel. Sparse SOS relaxations for minimizing functions that are summation of small polynomials. *SIAM Journal on Optimization*, Vol. 19, No. 4, pp. 1534-1558 (2008).

35. S. He, Z. Luo, J. Nie and S. Zhang. Semidefinite Relaxation Bounds for Indefinite Homogeneous Quadratic Optimization. *SIAM Journal on Optimization*, Vol. 19, No.2, pp. 503-523, 2008.
36. M. Mevissen, M. Kojima, J. Nie and N. Takayama. Solving partial differential equations via sparse SDP relaxations. *Pacific Journal of Optimization*, Vol. 4 (2) 213 - 241 (2008).
37. J. Nie, P. Parrilo and B. Sturmfels Semidefinite representation of  $k$ -ellipse. *IMA Volume 146: Algorithms in Algebraic Geometry* (Eds. A. Dickenstein, F.-O. Schreyer, and A. Sommese), pp. 117-132, Springer, New York, 2008.
38. J. Nie, J. Demmel and M. Gu. Global minimization of rational functions and the nearest GCDs. *Journal of Global Optimization*, Vol. 40 (2008), no.4, 697-718.
39. C. Hillar and J. Nie. An elementary and constructive proof of Hilbert's 17th Problem for matrices. *Proceedings of the American Mathematical Society*, 136 (2008), 73-76.
40. J. Nie and M. Schweighofer. On the complexity of Putinar's positivstellensatz. *Journal of Complexity* 23(2007) 135-150.
41. J. Demmel, J. Nie and V. Powers Representations of positive polynomials on non-compact semialgebraic sets via KKT ideals. *Journal of Pure and Applied Algebra*, Vol. 209, No. 1, pp. 189-200, 2007.
42. J. Nie, J. Demmel and B. Sturmfels. Minimizing polynomials via sum of squares over the gradient ideal. *Mathematical Programming, Series A*, Vol. 106 (2006), No. 3, 587-606.
43. J. Nie and J. Demmel. Minimum ellipsoid bounds for solutions of polynomial systems via sum of squares. *Journal of Global Optimization* (2005) 33: 511-525.
44. J. Nie and J. Demmel. Shape optimization of transfer functions. *Multilevel optimization methods and applications* (eds. W. Hager, P. Pardalos, S. Huang etc.), pp. 313-326, Springer series on nonconvex optimization and its applications, 2005.
45. J. Nie and Y. Yuan. A predictor-corrector algorithm for QSDP combining Dikin-type and Newton centering steps. *Annals of Operations Research*, 103(2001) 115-133.
46. J. Nie and Y. Yuan. A potential reduction algorithm for a new SDP problem. *Science in China*, Vol.43, No.1, Jan. 2000.

#### **Ph.D. Thesis**

**Title:** Global optimization of polynomial functions and applications

**Co-Chairs:** James Demmel and Bernd Sturmfels

#### **Master Thesis**

**Title:** An extended semidefinite programming problem.

**Chair:** Ya-xiang Yuan.

#### **Invited Lectures**

- *The International Workshop on Operator Theory and its Applications*, Washington University in St. Louis, July 18-22, 2016.
- *The International Symposium on Optimization*, Pittsburgh, PA, July 13-17, 2015.
- *SIAM Conference on Optimization*, San Diego, California, May 19-22, 2014.

- *Optimization and Algebraic Geometry*, National Institute for Mathematical Sciences (NIMS), Daejeon, Korea, June 16-20, 2014.
- *The International Conference on Engineering and Computational Mathematics*, Hong Kong Polytechnic University, Hong Kong, Dec. 16-18, 2013.
- *Western Section Meeting of the American Mathematical Society*, University of Colorado in Boulder, April 13-14, 2013.
- *Thematic programme on Polynomial Optimisation*, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, 2013.
- *Workshop on Large Scale Conic Programming*, Institute for Mathematical Sciences (IMS), Singapore, 2012.
- *West Coast Optimization Meeting*, University of British Columbia, Canada, 2012.
- *SIAM Conference on Applied Algebraic Geometry*, North Carolina State University, 2011.
- *The 5th Sino-Japan Optimization Meeting*, Beijing, China, 2011
- *International Workshop on Certified and Reliable Computation*, Nanning, GuangXi, China, 2011
- *Convex Optimization and Algebraic Geometry*, IPAM, UCLA, 2010.
- *Recent Advances in Optimization Methods and Applications*, SIAM Annual Meeting, Pittsburgh, PA, 2010.
- *Advances in the Theory of Integer Linear Optimization and its Extensions*, Western Section Meeting of the American Mathematical Society, San Francisco, CA, 2009.
- *The 33rd annual meeting of Southeast-Atlantic Section of the Society for the Industrial and Applied Mathematics (SIAM-SEAS)*, April 4-5, University of South Carolina, Columbia, SC, 2009.
- *18th International Symposium on Mathematical Theory of Networks and System (MTNS)*, Blacksburg, Virginia, 2008.
- *The XIXth International Workshop on Operator Theory and its Applications*, Williamsburg, Virginia, 2008.
- *Colloquium Talk*, Operations Research, Univ. of North Carolina, Chapel Hill, 2007.
- *Optimization and Engineering Applications*, Banff International Research Station, Canada, 2006.
- *Positive Polynomials and Optimization*, Banff International Research Station, Canada, 2006.
- *SIAM conference on Discrete Mathematics*, Victoria, Canada, 2006.