

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 of Jiawang Nie

Research Areas

- Polynomial and Semidefinite Optimization
- Matrix and Tensor Computation
- Convex Algebraic Geometry
- Data Science Optimization

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, Full Professor of Mathematics, UCSD.

2011–2015, Associate Professor of Mathematics, UCSD.

2007–2011, Assistant Professor of Mathematics, UCSD.

2006–2007, Postdoctoral Fellow, IMA, University of Minnesota

Awards and Honors

- *Fellow of the AMS*, 2023.
- *Feng Kang Prize*, 2021.
- *SIAG/Linear Algebra Best Paper Prize*, SIAM, 2018.
- *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

Grants

- NSF DMS-2110780: *Lagrange Multiplier Expression Methods for Optimization*, \$350,000, 2021.
- 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. S. Zhong, Y. Cui and J. Nie, Towards global solutions for nonconvex two-stage stochastic programs: a polynomial lower approximation approach, *SIAM J. Optim.* 34(4), 3477–3505, 2024.
2. L. Huang, J. Nie and Y.-X. Yuan, Finite convergence of Moment-SOS relaxations with nonreal radical ideals, *SIAM J. Optim.* 34(4), 3399–3428, 2024.
3. J. Nie and X. Tang, Nash equilibrium problems of polynomials, *Math. Oper. Res.* 49(2), 1065–1090 2024.
4. J. Nie. *Moment and Polynomial Optimization*, SIAM, 2023.
5. J. Nie, L. Yang, S. Zhong, G. Zhou. Distributionally robust optimization with moment ambiguity sets, *Journal of Scientific Computing* 94(1), 12, 2023.
6. J. Nie, S. Zhong. Loss functions for finite sets, *Computational Optimization and Applications* 84(2), 421–447, 2023.
7. L. Huang, J. Nie and Y. Yuan. Generalized truncated moment problems with unbounded sets, *Journal of Scientific Computing* 95(1), 15, 2023.
8. J. Nie, X. Tang, Z. Yang and S. Zhong. Dehomogenization for completely positive tensors, *Numerical Algebra, Control and Optimization* 13(2), 340–363, 2023.
9. J. Nie and X. Tang. Convex generalized Nash equilibrium problems and polynomial optimization, *Mathematical Programming* 198(2), 1485–1518, 2023.
10. J. Nie, L. Wang, and Z. Zheng. Higher Order Correlation Analysis for Multi-View Learning, *Pacific Journal of Optimization* 19(2), 237–255, 2023.
11. L. Huang, J. Nie and Y. Yuan. Homogenization for polynomial optimization with unbounded sets. *Mathematical Programming* 200(1), 105–145, 2023.
12. M. Dressler, J. Nie and Z. Yang. Separability of Hermitian tensors and PSD decompositions, *Linear and Multilinear Algebra* 70(21), 6581–6608, 2022.
13. B. Guo, J. Nie and Z. Yang. Learning diagonal Gaussian mixture models and incomplete tensor decompositions, *Vietnam Journal of Mathematics* 50(2), 421–446, 2022.
14. S. Friedland, J. Lasserre, L.-H. Lim, J. Nie. Preface to the Special Issue: Polynomial and Tensor Optimization, *Mathematical Programming* 193(2), 511–512, 2022.
15. J. Nie, X. Tang and L. Xu. The Gauss–Seidel method for generalized Nash equilibrium problems of polynomials, *Computational Optimization and Applications* 78(2), 529–557, 2021.
16. J. Nie, Z. Yang and G. Zhou. The saddle point problem of polynomials. *Foundations of Computational Mathematics* 22, 1133–1169, 2022.

17. J. Nie, L. Wang, J. Ye and S. Zhong. A Lagrange multiplier expression method for bilevel polynomial optimization, *SIAM Journal on Optimization* 31(3), 2368–2395, 2021.
18. J. Nie and Z. Yang. Hermitian tensor decompositions, *SIAM Journal on Matrix Analysis and Applications* 41(3), 1115–1144, 2020.
19. I. Klep and J. Nie. A matrix Positivstellensatz with lifting polynomials, *SIAM Journal on Optimization* 30 (1), 240–261, 2020.
20. J. Nie, L. Yang, and S. Zhong. Stochastic polynomial optimization. *Optimization Methods and Software* 35 (2), 329–347, 2020.
21. J. Nie and K. Ye. Hankel tensor decompositions and ranks. *SIAM Journal on Matrix Analysis and Applications*, 40(2), 486–516, 2019.
22. J. Nie. Tight relaxations for polynomial optimization and Lagrange multiplier expressions, *Mathematical Programming* 178 (1-2), 1-37, 2019.
23. J. Fan, J. Nie, and A. Zhou. Completely Positive Binary Tensors, *Mathematics of Operations Research* 44 (3), 1087-1100, 2019.
24. J. Nie, Z. Yang and X. Zhang. A complete semidefinite algorithm for detecting copositive matrices and tensors, *SIAM Journal on Optimization*, 28(4), 2902–2921, 2018.
25. J. Fan, J. Nie, and A. Zhou. Tensor eigenvalue complementarity problems, *Mathematical Programming*, 170(2), 507–539, 2018.
26. J. Nie and X. Zhang Real eigenvalues of nonsymmetric tensors, *Computational Optimization and Applications*, 70(1), 1–32, 2018.
27. J. Nie. Low rank symmetric tensor approximations. *SIAM Journal on Matrix Analysis and Applications*, 38(4), 1517–1540, 2017.
28. J. Nie. Symmetric tensor nuclear norms, *SIAM Journal on Applied Algebra and Geometry*, 1(1), 599–625, 2017.
29. J. Nie, L. Wang, and J. Ye. Bilevel polynomial programs and semidefinite relaxation methods. *SIAM Journal on Optimization*, 27(3), 1728–1757, 2017.
30. J. Nie. Generating Polynomials and Symmetric Tensor Decompositions, *Foundations of Computational Mathematics*, Vol. 17, No. 2, pp. 423-465, 2017.
31. J. Nie and X. Zhang. Positive Maps and Separable Matrices, *SIAM Journal on Optimization*, Vol. 26, No. 2, pp. 1236-1256, 2016
32. J. Nie. Linear Optimization with Cones of Moments and Nonnegative Polynomials, *Mathematical Programming*, Ser. B, Vol. 153, No. 1, pp. 247–274, 2015.
33. J. Nie. The Hierarchy of Local Minimums in Polynomial Optimization, *Mathematical Programming*, Ser. B, Ser. B, Vol. 151, No.2, pp. 555-583, 2015.
34. 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.
35. 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.

36. J. Nie. The \mathcal{A} -Truncated K -Moment Problem. *Foundations of Computational Mathematics*, Vol. 14, No. 6, pp. 1243-1276, 2014.
37. J. Nie. Optimality Conditions and Finite Convergence of Lasserre's Hierarchy. *Mathematical Programming*, Ser. A, Vol. 146, No. 1-2, pp. 97-121, 2014.
38. J. Nie. Polynomial Optimization with Real Varieties. *SIAM Journal On Optimization*, Vol. 23, No. 3, pp. 1634-1646, 2013.
39. J. Nie. Certifying Convergence of Lasserre's Hierarchy via Flat Truncation. *Mathematical Programming*, Ser. A, Vol. 142, No. 1-2, pp. 485-510, 2013.
40. 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.
41. L. Fialkow and J. Nie. On the closure of positive flat moment matrices. *Journal of Operator Theory* 69 (2013), no. 1, 257-277.
42. J. Nie. An Exact Jacobian SDP Relaxation for Polynomial Optimization. *Mathematical Programming*, Ser. A, Vol. 137, pp. 225-255, 2013.
43. J. Nie. Chapter 6: Semidefinite Representability *Semidefinite Optimization and Convex Algebraic Geometry*: 251-291, SIAM, 2013.
44. 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.
45. J. Nie. Convex hulls of quadratically parameterized sets with quadratic constraints. *Mathematical methods in systems, optimization, and control*, 247-258, Oper. Theory Adv. Appl., 222, Birkhäuser/Springer Basel AG, Basel, 2012.
46. L. Fialkow and J. Nie. The truncated moment problem via homogenization and flat extensions. *Journal of Functional Analysis*, 263 (2012), no. 6, 1682-1700.
47. 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.
48. 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.
49. 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.
50. J. Nie. Discriminants and Nonnegative Polynomials *Journal of Symbolic Computation*, Vol. 47, No. 2, pp. 167-191, 2012.
51. J. Nie. Sum of squares methods for minimizing polynomial forms over spheres and hypersurfaces. *Frontiers of Mathematics in China*, 7:321-346, 2012.
52. J. Nie. Polynomial Matrix Inequality and Semidefinite Representation. *Mathematics of Operations Research*, Vol. 36, No. 3, pp. 398-415, 2011.
53. 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.

54. J. Nie, K. Ranestad and B. Sturmfels. Algebraic Degree of Semidefinite Programming. *Mathematical Programming*, Series A, Vol. 122, No.2, pp. 379-405, 2010.
55. 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.
56. J.W. Helton and J. Nie. Semidefinite representation of convex sets. *Mathematical Programming, Series A*, Vol. 122, No.1, pp. 21-64, 2010.
57. 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.
58. 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.
59. J. Nie. Sum of Squares Method for Sensor Network Localization. *Computational Optimization and Applications*, Vol.43, No. 2 (2009), pp. 151-179.
60. J. Nie and K. Ranestad. Algebraic Degree of Polynomial Optimization. *SIAM Journal on Optimization*, Vol. 20, No. 1, pp. 485-502, 2009.
61. 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.
62. B. Li, J. Nie, and L. Zhi. Approximate GCDs of polynomials and sparse SOS relaxations. *Theoretical Computer Science*, 409(2) pp.200-210, 2008.
63. 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).
64. 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.
65. 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).
66. 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.
67. 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.
68. 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.
69. J. Nie and M. Schweighofer. On the complexity of Putinar's positivstellensatz. *Journal of Complexity* 23(2007) 135-150.
70. 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.

71. 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.
72. 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.
73. 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.
74. 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.
75. 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.

Institute: University of California, Berkeley.

Co-Chairs: James Demmel and Bernd Sturmfels.

Ph. D. Students

Chris Nelson (2012), Li Wang (2014), John Rehbeck (2017), Xindong Tang (2021), Zi Yang (2021), Suhan Zhong (2022), Zequn Zheng (2023).

Postdoctoral supervisees

Feng Guo (2012-2013), Marieke Dressler (2018-2021), Kisun Lee (2020-2023), Aliabadi Mohsen (2022-2025), Lei Huang (2023-2026).

Editorial Board Services

- Numerical Algebra, Control and Optimization, co-Editor-in-Chief, 2021-present.
- Science in China Mathematics, Associate Editor, 2023-present.
- Journal of the Operations Research Society of China, Associate Editor, 2012-present.
- Computational Optimization and Applications, Associate Editor, 2014-present.
- SIAM Journal On Matrix Analysis and Applications, Associate Editor, 2018-present.
- Mathematics of Operations Research, Associate Editor, 2019-present.

Invited/Plenary/Prize Lectures

- Plenary Lecture, The International Workshop on Modern Optimization and Applications, June 23-25, 2024.
- Plenary Lecture, The 9th International Conference on Statistical Optimization and Learning, July, 15-17, 2024.

- Feng Kang Prize speaker, Annal meeting of Computational Mathematics in China, July 15-19, 2023.
- Plenary Lecture, The Workshop on Tensor Optimization and Application, July 24, 2022.
- Colloquium speaker, Department of Mathematics, University of Hong Kong, February 24, 2022.
- Plenary Lecture, The 9th CAM (Computational and Applied Mathematics) and ICCM (International Congress of Chinese Mathematician) Workshop, August 19-22, Nanjing, 2021.
- Plenary Lecture, The workshop on Tensor and Polynomial Optimization, April 16, 2021.
- Invited Lecture, Department of Mathematics, Shanghai University, September 19, 2020.
- CAM colloquium speaker, Penn State University, September 8, 2020.
- Plenary Lecture, The OR Forum, The Operations Research Society of China, August 30, 2020.
- Invited Lecture, *Geometry of Real Polynomials, Convexity and Optimization*, Banff International Research Station, Canada, May 26-31, 2019.
- Invited Lecture, *Hyperbolic Polynomials and Hyperbolic Programming*, Simons Institute for the Theory of Computing, Berkeley, CA, April 30 – May 3, 2019.
- Plenary Lecture, “*Optimization: Fundamentals and Algorithms for Structured Problems*”, University of Toulouse, France, June 28-29, 2018.
- Plenary (Prize) Lecture, *The SIAM Conference on Applied Linear Algebra (SIAM-ALA18)*, Hong Kong, May 4-8, 2018.
- Plenary Lecture, *The 11th International Conference on Numerical Optimization and Numerical Linear Algebra*, China, August 8-11, 2017.
- Invited Lecture, *The 7th International Congress of Chinese Mathematicians*, Beijing, China, August 6-11, 2016.
- Plenary Lecture, *Optimization and Algebraic Geometry*, National Institute for Mathematical Sciences (NIMS), Daejeon, Korea, June 16-20, 2014.
- Prize Lecture, INFORMS Annual Meeting, San Francisco, November 9-12, 2014.
- Plenary Lecture, *Thematic programme on Polynomial Optimisation*, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, 2013.
- Invited Lecture, *Workshop on Large Scale Conic Programming*, Institute for Mathematical Sciences (IMS), Singapore, 2012.
- Plenary Lecture, *The 5th Sino-Japan Optimization Meeting*, Beijing, China, 2011
- Invited Lecture, *Convex Optimization and Algebraic Geometry*, IPAM, UCLA, 2010.