Jonathan D. Hauenstein

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Positions

Robert and Sara Lumpkins Collegiate Professor, University of Notre Dame, Notre Dame, IN, Fall 2023 – current.
Chair, Fall 2021 – current.
Professor, Fall 2019 – Spring 2023.
Associate Chair, Fall 2018 – Spring 2021.
Associate Professor (with tenure), Fall 2016 – Spring 2019.
Associate Professor (without tenure), Fall 2015 – Spring 2016.
Assistant Professor, Fall 2014 – Spring 2015.
Department of Applied and Computational Mathematics and Statistics

Organizer, Institute for Computational and Experimental Research in Mathematics, Brown University, Providence, RI, Fall 2018.
Semester Program on *Nonlinear Algebra*

Visiting Scientist, Simons Institute for the Theory of Computing, Berkeley, CA, Fall 2014.
Program on *Algorithms and Complexity in Algebraic Geometry*

Assistant Professor, North Carolina State University, Raleigh, NC, Fall 2012 – Summer 2014.
Department of Mathematics

Postdoctoral Fellow, Institut Mittag–Leffler, Djursholm, Sweden, January 2011 – June 2011.
Scientific Program on *Algebraic Geometry with a view towards applications*

Visiting Assistant Professor, Texas A&M University, College Station, TX, January 2010 – August 2012.
On leave January 2011 – June 2011.
Mentor: Frank Sottile

Fields Postdoctoral Fellow, Fields Institute, Toronto, Ontario, Canada, July 2009 – December 2009.
Thematic Program on the *Foundations of Computational Mathematics*

Visiting Scholar, University of Notre Dame, Notre Dame, IN, July 2009 – June 2014.
Department of Applied and Computational Mathematics and Statistics

Postdoctoral Research Associate, University of Notre Dame, Notre Dame, IN, May 2009 – June 2009.

Education

Ph.D. in Mathematics, University of Notre Dame, Notre Dame, IN, May 2009.
Thesis advisor: Andrew J. Sommese
Thesis title: *Regeneration, local dimension, and applications in numerical algebraic geometry*

M.S. in Mathematics, Miami University, Oxford, OH, August 2005.

B.S. *summa cum laude* in Mathematics and Math–Pre-Engineering Emphasis (Computer Science minor), University of Findlay, Findlay, OH, May 2003.

Research Grants

National Science Foundation CCF 2331440: *Collaborative Research: AF: Small: Real Solutions of Polynomial Systems*, 2024–2026, $300,000 (single PI on this award – part of a collaborative project: $600,000).

National Football League (NFL) Charities/University of Wisconsin, *Hamstring Injury (HAMIR) Index: A Framework For Injury Mitigations Strategies Through Innovative Imaging, Biomechanics, and Data Analytics*, 2023–2024, $215,705 (site PI with co-I John Wagle).

National Science Foundation CMMI 2041789: *Discovery of Dynamic Mechanical Structures through Modeling and Analysis of Closed Chains using Homotopy-Based Optimization*, 2021–2024, $540,148 (co-PI with PI Mark Plecnik).

Army Research Office W911NF-20-2-0218: *Multi-Objective Meta-Learning for Integrating Machine Learning and Domain Knowledge*, 2020–2024, $1,045,182 (co-PI with PI Walter Scheirer).

National Science Foundation DMS 1918692: *Robust Diagnosis in Electronic Health Records Integrating Physics-based Missing Data Multiple Imputation, Fast Inference for Hemodynamic Models, and Differential Privacy*, 2019–2023, $880,203 (co-PI with PI Daniele Schiavazzi and co-PIs Alison Marsden, Fang Liu, and Andrew Kahn).

National Science Foundation CCF 1812746: *AF: Small: Collaborative Research: Certification for Semi-Algebraic Sets with Applications*, 2018–2023, $250,000 (single PI on this award – part of a collaborative project: $499,994).

National Science Foundation DMS 1819006: *International Congress on Mathematical Software (ICMS 2018)*, 2018–2019, $20,000 (single PI).

Oak Ridge Associated Universities: *The International Congress on Mathematical Software (ICMS 2018)*, 2018, $4,000 (single PI).

Oak Ridge Associated Universities: *Polynomials, Kinematics, and Robotics*, 2017, $4,000 (single PI).

Institute for Mathematics and its Applications: *Polynomials, Kinematics, and Robotics*, 2017, $1,000 (PI with co-PIs D. Brake and A. Sommese).

National Science Foundation DMS 1636087: *Quivers and Bipartite Graphs: Physics and Mathematics*, 2016–2017, $16,000 (co-PI with PI Michael Gekhtman).

Office of Naval Research Young Investigator Award: *Harnessing the Complex Numbers for Efficiently Solving Real Problems*, 2016–2020, $509,918 (single PI).

Institute for Mathematics and its Applications: *Workshop on Software and Applications of Numerical Algebraic Geometry*, 2016, $1,500 (PI with co-PIs D. Brake, A. Sommese, and C. Wampler).

National Science Foundation DMS 1547743: *Workshop on Software and Applications of Numerical Algebraic Geometry*, 2015–2017, $19,020 (PI with co-PIs D. Brake, A. Sommese, and C. Wampler).

Army Research Office Young Investigator Program (YIP) Award: *The Geometry of Multiscale Models: Identifiability, Reparameterization, Comparisons, and Parameter Space Exploration*, 2015–2018, $181,715 (single PI).

National Science Foundation ACI 1440583 & ACI 1460032: *Symbolic-Numeric Approaches to Polynomials*, 2014–2018, $149,995 (single PI on this award – part of a collaborative project: $499,188).

Sloan Research Fellowship, 2014–2018, $50,000 (single PI).

DARPA Young Faculty Award (YFA): *Numerical Algebraic Geometric Methods for Data Analysis*, 2013–2015, $492,613 (single PI).

NCSU Faculty Research and Professional Development Fund: *Numerical Algebraic Geometry and Matrix Multiplication*, 2013–2014, $4,000 (single PI).

Air Force Office of Scientific Research FA8650-13-1-7317: *Real Numerical Algebraic Geometry: Finding all Real Solutions of a Polynomial System*, 2012–2013, $394,583 (co-PI with PI Daniel Bates and co-PI Andrew Sommese). NCSU subcontract: $103,192.

National Science Foundation DMS 1114336 & DMS 1262428: *Computational Methods in Numerical Algebraic Geometry*, 2011–2014, $94,000 (single PI).

Publications

Books

(1) D.J. Bates, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. *Numerically Solving Polynomial Systems with Bertini*. Volume 25 of *Software, Environments, and Tools*, SIAM, Philadelphia, 2013.

(2) D.A Cox with contributions by C. D'Andrea, A. Dickenstein, J.D. Hauenstein, H. Schenck, and J. Sidman. *Applications of Polynomial Systems*. Volume 134 of *CBMS Regional Conference Series in Mathematics*, AMS, Providence, RI, 2020.

Published Articles

(3) D.J. Bates, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Adaptive multiprecision path tracking. *SIAM J. Numer. Anal.*, 46(2), 722–746, 2008.

(4) D.J. Bates, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Software for numerical algebraic geometry: a paradigm and progress towards its implementation. *Software for Algebraic Geometry*, edited by M.E. Stillman, N. Takayama, and J. Verschelde, Volume 148 of *IMA Volume in Mathematics and its Applications*, Springer Verlag, 2008, pp. 1–14.

(5) A.N. Al-Khateeb, J.M. Powers, S. Paolucci, A.J. Sommese, J.A. Diller, J.D. Hauenstein, and J.D. Mengers. One-dimensional slow invariant manifolds for spatially homogeneous reactive systems. *J. Chem. Phys.*, 131(2), 024118, 2009.

(6) D.J. Bates, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Stepsize control for path tracking. *Contemp. Math.*, 496, 21–31, 2009.

(7) J.D. Hauenstein, J.C. Migliore, C. Peterson, and A.J. Sommese. Numerical computation of the dimensions of the cohomology of twists of ideal sheaves. *Contemp. Math.*, 496, 235–242, 2009.

(8) D.J. Bates, J.D. Hauenstein, C. Peterson, and A.J. Sommese. A numerical local dimension test for points on the solution set of a system of polynomial equations. *SIAM J. Numer. Anal.*, 47(5), 3608–3623, 2009.

(9) D.J. Bates, J.D. Hauenstein, C. Peterson, and A.J. Sommese. Numerical decomposition of the rank-deficiency set of a matrix of multivariate polynomials. *Approximate Commutative Algebra*, edited by L. Robbiano and J. Abbott, *Texts and Monographs in Symbolic Computation*, Springer Verlag, 2010, pp. 55–77.

(10) J.D. Hauenstein. A counter example to an ideal membership. *Adv. Geom.*, 10(3), 557–559, 2010.

(11) J.D. Hauenstein and A.J. Sommese. Witness sets of projections. *Appl. Math. Comput.*, 217(7), 3349–3354, 2010.

(12) J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Regeneration homotopies for solving systems of polynomials. *Math. Comp.*, 80, 345–377, 2011.

(13) W. Hao, J.D. Hauenstein, B. Hu, Y. Liu, A.J. Sommese, and Y.-T. Zhang. Multiple stable steady states of a reaction-diffusion model on zebrafish dorsal-ventral patterning. *Discrete Cont. Dyn. S.*, 4(6), 1413–1428, 2011.

(14) C.W. Wampler, J.D. Hauenstein, and A.J. Sommese. Mechanism mobility and a local dimension test. *Mech. Mach. Theory*, 46(9), 1193–1206, 2011.

(15) J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Regenerative cascade homotopies for solving polynomial systems. *Appl. Math. Comput.*, 218(4), 1240–1246, 2011.

(16) W. Hao, J.D. Hauenstein, B. Hu, and A.J. Sommese. A three-dimensional steady-state tumor system. *Appl. Math. Comput.*, 218(6), 2661–2669, 2011.

(17) D.J. Bates, J.D. Hauenstein, and A.J. Sommese. A parallel endgame. *Contemp. Math.*, 556, 25–35, 2011.

(18) D.J. Bates, J.D. Hauenstein, and A.J. Sommese. Efficient path tracking methods. *Num. Algorithms*,

58(4), 451–459, 2011.

(19)W. Hao, J.D. Hauenstein, B. Hu, Y. Liu, A.J. Sommese, and Y.-T. Zhang. Bifurcation for a free boundary problem modeling the growth of a tumor with a necrotic core. *Nonlinear Anal. – Real World Appl.*, 13(2), 694–709, 2012.

(20)H. Tari, H.-J. Su, and J.D. Hauenstein. Classification and complete solution of the kinetostatics of a compliant Stewart-Gough platform. *Mech. Mach. Theory*, 49, 177–186, 2012.

(21)J.D. Hauenstein and F. Sottile. Algorithm 921: alphaCertified: Certifying solutions to polynomial systems. *ACM Trans. Math. Softw.*, 38(4), 28, 2012.

(22)W. Hao, J.D. Hauenstein, B. Hu, Y. Liu, A.J. Sommese, and Y.-T. Zhang. Continuation along bifurcation branches for a tumor model with a necrotic core. *J. Sci. Comput.*, 53(2), 395–413, 2012.

(23)D. Mehta, J.D. Hauenstein, and M. Kastner. Energy landscape analysis of the two-dimensional nearest-neighbor ϕ^4 model. *Phys. Rev. E*, 85, 061103, 2012.

(24)D. Mehta, Y.-H. He, and J.D. Hauenstein. Numerical algebraic geometry: a new perspective on string and gauge theories. *J. High Energy Phys.*, 2012(7), 18, 2012.

(25)G. Blekherman, J.D. Hauenstein, J.C. Ottem, K. Ranestand, and B. Sturmfels. Algebraic boundaries of Hilbert's SOS cones. *Compos. Math.*, 148(6), 1717–1735, 2012.

(26)W. Hao, J.D. Hauenstein, B. Hu, T. McCoy, and A.J. Sommese. Computing steady-state solutions for a free boundary problem modeling tumor growth by Stokes equation. *J. Comput. Appl. Math.*, 237(1), 326–334, 2013.

(27)J.D. Hauenstein and C.W. Wampler. Numerically intersecting algebraic varieties via witness sets. *Appl. Math. Comput.*, 219(10), 5730–5742, 2013.

(28)G.M Besana, S. DiRocco, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Cell decomposition of almost smooth real algebraic surfaces. *Num. Algorithms*, 63(4), 645–678, 2013.

(29)J.D. Hauenstein. Numerically computing real points on algebraic sets. *Acta Appl. Math.*, 125(1), 105–119, 2013.

(30)J.D. Hauenstein and A.J. Sommese. Membership tests for images of algebraic sets by linear projections. *Appl. Math. Comput.*, 219(12), 6809–6818, 2013.

(31)D.J. Bates, J.D. Hauenstein, T.M. McCoy, C. Peterson, and A.J. Sommese. Recovering exact results from inexact numerical data in algebraic geometry. *Exp. Math.*, 22(1), 38–50, 2013.

(32)J.D. Hauenstein and C.W. Wampler. Isosingular sets and deflation. *Found. Comput. Math.*, 13(3), 371–403, 2013.

(33)D. Mehta, J.D. Hauenstein, and D.J. Wales. Certifying the potential energy landscape. *J. Chem. Phys.*, 138(17), 171101, 2013.

(34)W. Hao, J.D. Hauenstein, C.-W. Shu, A.J. Sommese, Z. Xu, and Y.-T. Zhang. A homotopy method based on WENO schemes for solving steady state problems of hyperbolic conservation laws. *J. Comput. Phys.*, 250, 332–346, 2013.

(35)J.D. Hauenstein, Y.-H. He, and D. Mehta. Numerical elimination and moduli space of vacua. *J. High Energy Phys.*, 2013(9), 83, 2013.

(36)J.D. Hauenstein, C. Ikenmeyer, and J.M. Landsberg. Equations for lower bounds on border rank. *Exp. Math.*, 22(4), 372–383, 2013.

(37)W. Hao, J.D. Hauenstein, B. Hu, and A.J. Sommese. A bootstrapping approach for computing multiple solutions of differential equations. *J. Comput. Appl. Math.*, 258, 181–190, 2014.

(38)D.J. Bates, W. Decker, J.D. Hauenstein, C. Peterson, G. Pfister, F.-O. Schreyer, A.J. Sommese, and C.W. Wampler. Comparison of probabilistic algorithms for analyzing the components of an affine algebraic variety. *Appl. Math. Comput.*, 231, 619–633, 2014.

(39)Z.A. Griffin, J.D. Hauenstein, C. Peterson, and A.J. Sommese. Numerical computation of the Hilbert function of a zero-scheme. *Connections Between Algebra, Combinatorics, and Geometry* (S.M. Cooper and S. Sather-Wagstaff, eds.), *Springer Proceedings in Mathematics & Statistics*, vol. 76, Springer New York, 235–250, 2014.

(40)J.D. Hauenstein and F. Sottile. Newton polytopes and witness sets. *Math. Comp. Sci.*, 8(2), 235–251, 2014.

(41)D. Mehta, J.D. Hauenstein, and D.J. Wales. Certification and the potential energy landscape. *J. Chem. Phys.*, 140, 224114, 2014.

(42)J.D. Hauenstein, I. Haywood, and A.C. Liddell, Jr. An *a posteriori* certification algorithm for Newton homotopies. In *Proceedings of the 39th International Symposium on Symbolic and Algebraic Computation*, ACM, New York, 2014, pp. 248–255.

(43)J.D. Hauenstein, J. Rodriguez, and B. Sturmfels. Maximum likelihood for matrices with rank constraints. *J. Alg. Stat.*, 5(1), 18–38, 2014.

(44)J.D. Hauenstein, V. Pan, and A. Szanto. A note on global Newton iteration over Archimedian and non-Archimedian fields. *LNCS*, 8660, 202–217, 2014.

(45)D. Mehta, N.S. Daleo, J.D. Hauenstein, and C. Seaton. Gauge-fixing on the lattice via orbifolding. *Phys. Rev. D*, 90, 054504, 2014.

(46)D. Mehta, T. Chen, J.D. Hauenstein, and D.J. Wales. Newton homotopies for sampling stationary points of potential energy landscapes. *J. Chem. Phys.*, 141, 121104, 2014.

(47)D. Mehta, J.D. Hauenstein, M. Niemerg, N.J. Simm, and D.A. Stariolo. Energy landscape of the finite-size mean-field 2-spin spherical model and topology trivialization. *Phys. Rev. E*, 91, 022133, 2015.

(48)J.D. Hauenstein, R. Huang, D. Mehta, and Y. Zhang. Global structure of curves from generalized unitarity cut of three-loop diagrams. *J. High Energy Phys.*, 2015(2), 136, 2015.

(49)Z.A. Griffin and J.D. Hauenstein. Real solutions to systems of polynomial equations and parameter continuation. *Adv. Geom.*, 15(2), 173–187, 2015.

(50)J.D. Hauenstein, A. Lerario, E. Lundberg, and D. Mehta. Experiments on the zeros of harmonic polynomials using certified counting. *Exp. Math.*, 24(2), 133–141, 2015.

(51)D. Mehta, N.S. Daleo, F. Dörfler, and J.D. Hauenstein. Algebraic geometrization of the Kuramoto model: equilibria and stability analysis. *Chaos*, 25, 053103, 2015.

(52)J.D. Hauenstein, B. Mourrain, and A. Szanto. Certifying isolated singular points and their multiplicity structure. In *Proceedings of the* 40^{th} *International Symposium on Symbolic and Algebraic Computation*, ACM, New York, 2015, pp. 213–220.

(53)J.D. Hauenstein and A.C. Liddell, Jr. A hybrid symbolic-numeric approach to exceptional sets of generically zero-dimensional systems. In *Proceedings of the 2015 International Workshop on Parallel Symbolic Computation*, ACM, New York, 2015, pp. 53–60.

(54)N.S. Daleo and J.D. Hauenstein. Numerically deciding the arithmetically Cohen-Macaulayness of a projective scheme. *J. Symb. Comput.*, 72, 128–146, 2016.

(55)J.D. Hauenstein and A.C. Liddell, Jr. Certified predictor-corrector tracking for Newton homotopies. *J. Symb. Comput.*, 74, 239–254, 2016.

(56)N.S. Daleo, J.D. Hauenstein, and L. Oeding. Computations and equations for Segre-Grassmann hypersurfaces. *Port. Math.*, 73(1), 71–90, 2016.

(57)D.A. Brake, J.D. Hauenstein, A.P. Murray, D.H. Myszka, and C.W. Wampler. The complete solution of Alt-Burmester synthesis problems for four-bar linkages. *J. Mech. Robot.*, 8(4), 041018, 2016.

(58)F. Gesmundo, J.D. Hauenstein, C. Ikenmeyer, and J.M. Landsberg. Complexity of linear circuits

and geometry. *Found. Comp. Math.*, 16(3), 599–635, 2016.

(59)D.A. Brake, J.D. Hauenstein, and A.C. Liddell, Jr. Validating the completeness of the real solution set of a system of polynomial equations. In *Proceedings of the ACM on International Symposium on Symbolic and Algebraic Computation*, ACM, New York, 2016, pp. 143–150.

(60)J.D. Hauenstein, N. Hein, and F. Sottile. A primal-dual formulation for certifiable computations in Schubert calculus. *Found. Comp. Math.*, 16(4), 941–963, 2016.

(61)D.J. Bates, J.D. Hauenstein, M.E. Niemerg, and F. Sottile. Software for the Gale transform of fewnomial systems and a Descartes rule for fewnomials. *Num. Algorithms*, 73(1), 281–304, 2016.

(62)H. Sidky, A.C. Liddell, Jr., D. Mehta, J.D. Hauenstein, and J. Whitmer. An algebraic geometric method for calculating phase equilibria from fundamental equations of state. *Ind. Eng. Chem. Res.* 55(43), 11363–11370, 2016.

(63)J.D. Hauenstein and C.W. Wampler. Unification and extension of intersection algorithms in numerical algebraic geometry. *Appl. Math. Comput.*, 293, 226–243, 2017.

(64)J.D. Hauenstein and A.J. Sommese. What is numerical algebraic geometry? *J. Symb. Comput.*, 79(3), 499–507, 2017

(65)J.D. Hauenstein and V. Levandovskyy. Certifying solutions to square systems of polynomial-exponential equations. *J. Symb. Comput.*, 79(3), 575–593, 2017.

(66)J.D. Hauenstein, C.W. Wampler, and M. Pfurner. Synthesis of three-revolute spatial chains for body guidance. *Mech. Mach. Theory*, 110, 61–72, 2017.

(67)A. Mahdi, C. Pessoa, and J.D. Hauenstein. A symbolic-numerical approach to the center-focus problem. *J. Symb. Comput*, 82, 57–73, 2017.

(68)J.D. Hauenstein, B. Mourrain, and A. Szanto. On deflation and multiplicity structure. *J. Symb. Comput.*, 83, 228–253, 2017.

(69)D.A. Brake, D.J. Bates, W. Hao, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Algorithm 976: Bertini_real: Numerical decomposition of real algebraic curves and surfaces. *ACM Trans. Math. Softw.*, 44(1), 10, 2017.

(70)A. Bernardi, N.S. Daleo, J.D. Hauenstein, and B. Mourrain. Tensor decomposition and homotopy continuation. *Differ. Geom. Appl.*, 55, 78–105, 2017.

(71)J.D. Hauenstein. Certification using Newton-invariant subspaces. *LNCS*, 10693, 34-–50, 2017.

(72)D.J. Bates, D.A. Brake, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Homotopies for connected components of algebraic sets with application to computing critical sets. *LNCS*, 10693, 107–120, 2017.

(73)T.A. Akoglu, J.D. Hauenstein, and A. Szanto. Certifying solutions to overdetermined and singular polynomial systems over $\mathbb{Q}$. *J. Symb. Comput.*, 84, 147–171, 2018.

(74)O. Coss, J.D. Hauenstein, H. Hong, and D.K. Molzahn. Locating and counting equilibria of the Kuramoto model with rank one coupling. *SIAM J. Appl. Algebra Geometry*, 2(1), 45–71, 2018.

(75)J.D. Hauenstein, S.N. Sherman, and C.W. Wampler. Exceptional Stewart-Gough platforms, Segre embeddings, and the special Euclidean group. *SIAM J. Appl. Algebra Geometry*, 2(1), 179–205, 2018.

(76)J.D. Hauenstein and M.H. Regan. Adaptive strategies for solving parameterized systems using homotopy continuation. *Appl. Math. Comput.*, 332, 19–34, 2018.

(77)L. Chiantini, J.D. Hauenstein, C. Ikenmeyer, G. Ottaviani, and J.M. Landsberg. Polynomials and the exponent of matrix multiplication. *Bull. London Math. Soc.*, 50(3), 369–389, 2018.

(78)J.D. Hauenstein, J.I. Rodriguez, and F. Sottile. Numerical computation of Galois groups. *Found. Comput. Math.*, 18(4), 867–890, 2018.

(79)S.D. Bopardikar, D. Mehta, and J.D. Hauenstein. Optimal configurations in coverage control with polynomial costs. *IFAC-PapersOnLine*, 51(12), 106–111, 2018.

(80)D.A. Brake, J.D. Hauenstein, and C. Vinzant. Computing complex and real tropical curves using monodromy. *J. Pure Appl. Algebra*, 223(12), 5232–5250, 2019.

(81)J.D. Hauenstein, L. Oeding, G. Ottaviani, and A.J. Sommese. Homotopy techniques for tensor decomposition and perfect identifiability. *J. Reine Angew. Math.*, 2019(753), 1–22, 2019.

(82)D.A. Brake, J.D. Hauenstein, F.-O., Schreyer, A.J. Sommese, and M.E. Stillman. Singular value decomposition of complexes. *SIAM J. Appl. Algebra Geometry*, 3(3), 507–522, 2019.

(83)D.J. Bates, J.D. Hauenstein, and N. Meshkat. Identifiability and numerical algebraic geometry. *PLOS ONE*, 14(12), 0226299, 2019.

(84)E. Dufresne, P.B. Edwards, H.A. Harrington, and J.D. Hauenstein. Sampling real varieties for topological data analysis. In *2019 18th IEEE International Conference on Machine Learning and Applications (ICMLA)*, Boca Raton, FL, 2019, pp. 1531–1536.

(85)D.A. Brake, N.S. Daleo, J.D. Hauenstein, and S.N. Sherman. Solving critical point conditions for the Hamming and taxicab distances to solution sets of polynomial equations. In *2019 21st International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, Timisoara, Romania, 2019, pp. 51–58.

(86)J.D. Hauenstein and M.H. Regan. Real monodromy action. *Appl. Math. Comput.*, 373, 124983, 2020.

(87)H.A. Harrington, D. Mehta, H.M. Byrne, and J.D. Hauenstein. Decomposing the parameter space of biological networks via a numerical discriminant approach. *Commun. Comput. Inf. Sci.*, 1125, 114–131, 2020.

(88)R. Fabbri, T. Duff, H. Fan, M.H. Regan, D. da Costa de Pinho, E. Tsigaridas, C.W. Wampler, J.D. Hauenstein, P.J. Giblin, B. Kimia, A. Leykin, and T. Pajdla. TRPLP - Trifocal relative pose from lines at points. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2020, pp. 12073–12083.

(89)J.D. Hauenstein and J.I. Rodriguez. Numerical irreducible decomposition of multiprojective varieties. *Adv. Geom.*, 20(3), 297–318, 2020.

(90)S.N. Sherman, J.D. Hauenstein, and C.W. Wampler. Curve cognate construction made easy. In *Proceedings of the ASME 2020 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. Volume 10: 44th Mechanisms and Robotics Conference*, DETC2020-22409, V010T10A024, 2020.

(91)J.D. Hauenstein, A. Leykin, J.I. Rodriguez, and F. Sottile. A numerical toolkit for multiprojective varieties. *Math. Comp.*, 90, 413–440, 2021.

(92)J.B. Collins and J.D. Hauenstein. A singular value homotopy for finding critical parameter values. *Appl. Numer. Math.*, 161, 233–243, 2021.

(93)J.D. Hauenstein, M. Safey El Din, E. Schost, and T.X. Vu. Solving determinantal systems using homotopy techniques. *J. Symb. Comput.*, 104, 754–804, 2021.

(94)E. Dufresne, H.A. Harrington, J.D. Hauenstein, P.G. Kevrekidis, and P. Tripoli. On some configurations of oppositely charged trapped vortices in the plane. *Adv. Appl. Math.*, 124, 102099, 2021.

(95)S.N. Sherman, J.D. Hauenstein, and C.W. Wampler. A general method for constructing planar cognate mechanisms. *J. Mech. Robot.*, 13(3), 031107, 2021.

(96)J.D. Hauenstein, A.C. Liddell, Jr., S. McPherson, and Y. Zhang. Numerical algebraic geometry and semidefinite programming. *Results Appl. Math.*, 11, 100166, 2021.

(97)P.B. Edwards, J.D. Hauenstein, and C.D. Smyth. Certified evaluations of Hölder continuous functions at roots of polynomials. In *Maple in Mathematics Education and Research (MC2020)*, vol. 1414

of *Commun. Comput. Inf. Sci.*, Springer, Cham, 2021, pp. 185–203.

(98)A. Baskar, C. Liu, M. Plecnik, and J.D. Hauenstein. Designing rotary linkages for polar motions. In *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2021, pp. 1384-1391.

(99)D.J. Bates, D. Eklund, J.D. Hauenstein, and C. Peterson. Excess intersection and numerical irreducible decompositions. In *2021 23rd International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, Timisoara, Romania, 2021, pp. 52–60.

(100)S.N. Sherman, J.D. Hauenstein, and C.W. Wampler. Advances in the theory of planar curve cognates. *J. Mech. Robot.*, 14(3), 031005, 2022.

(101)J.D. Hauenstein and S.N. Sherman. Using monodromy to statistically estimate the number of solutions. In *2nd IMA Conference on Mathematics of Robotics*, vol. 21 of *Springer Proc. Adv. Robot.*, Springer, Cham, 2022, pp. 37–46.

(102)J.D. Hauenstein, L. Manivel, and B. Szendrői. On the equations defining some Hilbert schemes. *Vietnam J. Math.*, 50(2), 487–500, 2022.

(103)A. Baskar, M. Plecnik, and J.D. Hauenstein. Computing saddle graphs via homotopy continuation for the approximate synthesis of mechanisms. *Mech. Mach. Theory*, 176, 104932, 2022.

(104)A. Baskar, M. Plecnik, and J.D. Hauenstein. Finding straight line generators through the approximate synthesis of symmetric four-bar coupler curves. In *Advances in Robot Kinematics 2022*, vol. 24 of *Springer Proc. Adv. Robot.*, Springer, Cham, 2022, pp. 277-285.

(105)J.D. Hauenstein, L. Matusevich, C. Peterson, and S.N. Sherman. Binomiality testing and computing sparse polynomials via witness sets. *Vietnam J. Math.*, 50(3), 653–678, 2022.

(106)D. Mehta, T. Chen, T. Tang, and J.D. Hauenstein. The loss surface of deep linear networks viewed through the algebraic geometry lens. *IEEE Trans. Pattern Anal. Mach. Intell.*, 44(9), 5664–5680, 2022.

(107)J.D. Hauenstein and M. Helmer. Probabilistic saturations and Alt's problem. *Exp. Math.*, 31(3), 975–987, 2022.

(108)J.D. Hauenstein, A. Mohammad-Nezhad, T. Tang, and T. Terlaky. On computing the nonlinearity interval in parametric semidefinite optimization. *Math. Oper. Res.*, 47(4), 2989–3009, 2022.

(109)A. Baskar, C. Hills, M. Plecnik, and J.D. Hauenstein. Estimating the complete solution set of the approximate path synthesis problem for four-bar linkages using random monodromy loops. In *Proceedings of the ASME 2022 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. Volume 7: 46th Mechanisms and Robotics Conference*, DETC2022-90402, V007T07A026, 2022.

(110)E.A. Bernal, J.D. Hauenstein, D. Mehta, M.H. Regan, and T. Tang. Machine learning the real discriminant locus. *J. Symb. Comput.*, 115, 409–426, 2023.

(111)K. Harris, J.D. Hauenstein, and A. Szanto. Smooth points on semi-algebraic sets. *J. Symb. Comput.*, 116, 183–212, 2023.

(112)E.R. Cobian, J.D. Hauenstein, F. Liu, and D.E. Schiavazzi. AdaAnn: adaptive annealing scheduler for probability density approximation. *Int. J. Uncertain. Quantif.*, 13(3), 39–68, 2023.

(113)R. Fabbri, T. Duff, H. Fan, M.H. Regan, D. da Costa de Pinho, E. Tsigaridas, C.W. Wampler, J.D. Hauenstein, P.J. Giblin, B. Kimia, A. Leykin, and T. Pajdla. Trifocal relative pose from lines at points. *IEEE Trans. Pattern Anal. Mach. Intell.*, 45(6), 7870–7884, 2023.

(114)A. Baskar, M. Plecnik, and J.D. Hauenstein. Finding straight line generators through the approximate synthesis of symmetric four-bar coupler curves. *Mech. Mach. Theory*, 188, 105310, 2023.

(115)S. Abraham, J. Kinnison, Z. Miksis, D. Poster, S. You, J.D. Hauenstein, and W. Scheirer. Efficient

hyperparameter optimization for ATR using homotopy parametrization. In *Automatic Target Recognition XXXIII*, vol. 12521 of *SPIE Proceedings*, 2023, 1252107.
Sophia Abraham earned Best Student Paper award at Automatic Target Recognition XXXIII.

(116)P.B. Edwards, A. Baskar, C. Hills, M. Plecnik, and J.D. Hauenstein. Output mode switching for parallel five-bar manipulators using a graph-based path planner. In *2023 IEEE International Conference on Robotics and Automation (ICRA)*, London, United Kingdom, 2023, pp. 9735–9741.

(117)S.J. Abraham, K.D.G. Maduranga, J. Kinnison, J.D. Hauenstein, and W. Scheirer. NCQS: Nonlinear convex quadrature surrogate hyperparameter optimization. In *Proceedings of the IEEE/CVF International Conference on Computer Vision (ICCV) Workshops*, 2023, pp. 1195-1203.

(118)S. Di Rocco, P.B. Edwards, D. Eklund, O. Gafvert, and J.D. Hauenstein. Computing geometric feature sizes for algebraic manifolds. *SIAM J. Appl. Algebra Geometry*, 7(4), 716–741, 2023.

(119)A. Baskar, M. Plecnik, J.D. Hauenstein, and C.W. Wampler, A numerical continuation approach using monodromy to solve the forward kinematics of cable-driven parallel robots with sagging cables. *Mech. Mach. Theory*, 195, 105609, 2024.

(120)J.D. Hauenstein, A. Huebner, J.P. Wagle, E.R. Cobian, J. Cummings, C. Hills, M. McGinty, M. Merritt, S. Rosengarten, K. Skinner, M. Szemborski, L. Wojtkiewicz. Reliability of markerless motion capture systems for assessing movement screenings. *Orthop. J. Sports Med.*, 12(3), 23259671241234339, 2024.

(121)C. Hills, A. Baskar, M. Plecnik, and J.D. Hauenstein. Computing complete solution sets for approximate four-bar path synthesis. *Mech. Mach. Theory*, 196, 105628, 2024.

(122)Y. Wang, E.R. Cobian, J. Lee, F. Liu, J.D. Hauenstein, and D.E. Schiavazzi. LINFA: a Python library for variational inference with normalizing flow and annealing. *J. Open Source Softw.*, 9(96), 6309, 2024.

(123)J.D. Hauenstein and T. Tang. On parameteric semidefinite programming with unknown boundaries. *J. Symb. Comput.*, 125, 102324, 2024.

Accepted Articles

(124)T. Brysiewicz, J.D. Hauenstein, and C. Hills. Max-convolution through numerics and tropical geometry. To appear in *Numer. Algorithms*.

(125)A. Baskar, M. Plecnik, J.D. Hauenstein, and C.W. Wampler. A real-time algorithms for computing the tension force in a suspended elastic sagging cable. To appear in *Proceedings of the MSF-RoManSy Symposium*.

(126)J. Cummings and J.D. Hauenstein. Multi-graded Macaulay dual spaces. To appear in *J. Algebra Appl.*

(127)W. Hao, J.D. Hauenstein, M.H. Regan, and T. Tang, A numerical method for solving elliptic equations on real closed algebraic curves and surfaces. To appear in *J. Sci. Comput.*

Submitted Articles

(128)D.K. Molzahn, M. Niemerg, D. Mehta, and J.D. Hauenstein. Investigating the maximum number of real solutions to the power flow equations: analysis of loseless four-bus systems.

(129)S. Amethyst, J.D. Hauenstein, and C.W. Wampler. Cellular decompositions and Chebyshev interpolants for real algebraic curves.

(130)C. Bisi, J.D. Hauenstein, and T.T. Truong. Some interesting birational morphisms of smooth affine quadric 3-folds.

(131)D.J. Bates, P. Breiding, T. Chen, J.D. Hauenstein, A. Leykin, and F. Sottile. Numerical nonlinear algebra.

(132)S.J. Abraham, K.D.G. Maduranga, J. Kinnison, Z. Carmichael, J.D. Hauenstein, and W.J. Scheirer. HomOpt: a homotopy-based hyperparameter optimization method.

(133)E.R. Cobian, J.D. Hauenstein, and C.W. Wampler. Robust numerical algebraic geometry.

(134)S. Abraham, S. Cruz, S. You, J.D. Hauenstein, and W. Scheirer. Multi-objective optimization with homotopy-based strategies for enhanced multimodal automatic target recognition models.

Extended Abstracts

(135)J.D. Hauenstein, N. Hein, C.J. Hillar, A. Martin Del Campo, F. Sottile, and Z. Teitler. The monotone secant conjecture in the real Schubert calculus. Accepted to MEGA2011 and presented by A. Martin Del Campo.

(136)J.D. Hauenstein, N. Hein, and F. Sottile. Certifiable numerical computations in Schubert calculus. Accepted to MEGA2013 and presented by N. Hein.

(137)D.A. Brake, D.J. Bates, W. Hao, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Bertini_real: software for one- and two-dimensional real algebraic sets. *LNCS*, 8592, 175–182, 2014. Accepted to ICMS 2014 and presented by D. Brake.

(138)D.J. Bates, D.A. Brake, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. On computing a cell decomposition of a real surface containing infinitely many singularities. *LNCS*, 8592, 246–252, 2014. Accepted to ICMS 2014 and presented by J. Hauenstein.

(139)N.S. Daleo and J.D. Hauenstein. Numerically testing generically reduced projective schemes for the arithmetic Gorenstein property. *LNCS*, 9582, 137–142, 2016. Accepted to MACIS 2015 and presented by J. Hauenstein.

(140)D.A. Brake, J.D. Hauenstein, and A.J. Sommese. Numerical local irreducible decomposition. *LNCS*, 9582, 124–129, 2016. Accepted to MACIS 2015 and presented by D. Brake.

(141)D.A. Brake, J.D. Hauenstein, and A.C. Liddell, Jr. Decomposing solution sets of polynomial systems using derivatives. *LNCS*, 9725, 127–135, 2016. Accepted to ICMS 2016 and presented by J. Hauenstein.

(142)D.A. Brake, J.D. Hauenstein, and M.H. Regan. polyTop: Software for computing topology of smooth real surfaces. *LNCS*, 10931, 397–404, 2018. Accepted to ICMS 2018 and presented by M. Regan.

(143)J.D. Hauenstein, A. Kulkarni, E.C. Sertoz, and S.N. Sherman. Certifying reality of projections. *LNCS*, 10931, 200–208, 2018. Accepted to ICMS 2018 and presented by J. Hauenstein.

(144)J.D. Hauenstein and M.H. Regan. Evaluating and differentiating a polynomial using a pseudo-witness set. *LNCS*, 12097, 61–69, 2020. Accepted to ICMS 2020 and presented by M. Regan.

(145)K. Harris, J.D. Hauenstein, and A. Szanto. Smooth points on semi-algebraic sets. *ACM Commun. Comput. Algebra*, 54(3), 105–109, 2020. Accepted to ISSAC 2020 and presented by K. Harris.

(146)J.D. Hauenstein. Applications of numerically solving polynomial systems. To appear in *Nankai Symposium on Mathematical Dialogues*.

Other Articles

(147)J.D. Hauenstein and J.M. McCarthy. Biologically-inspired linkage design: computing form from function. *SIAM News*, 48(8), 2015.

(148)J.D. Hauenstein. Numerical algebraic geometry and optimization. *Notices of the American Mathematical Society*, 65(10), 1251–1252, 2018.

(149)J.D. Hauenstein. Using numerical insights to improve symbolic computations. In *2019 21st International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, Timisoara, Romania, 2019, pp. 11–16.

Software

(1) D.J. Bates, J.D. Hauenstein, A.J. Sommese, and C.W. Wampler. Bertini: Software for numerical algebraic geometry. Available at `bertini.nd.edu`.

(2) J.D. Hauenstein and F. Sottile. alphaCertified: Software for certifying numerical solutions to polynomial equations. Available at `math.tamu.edu/~sottile/research/stories/alphaCertified`.

Advising

Steve Cruz Urrea, Postdoctoral Research Associate, University of Notre Dame, September 2023 – current.
Supported by ARO W911NF-20-2-0218.

Zachary Miksis, Postdoctoral Research Associate, University of Notre Dame, August 2022 – June 2023.
Supported by ARO W911NF-20-2-0218.

Joseph Cummings, Postdoctoral Research Associate, University of Notre Dame, June 2022 – current.

Taylor Brysiewicz, Postdoctoral Research Associate, University of Notre Dame, July 2021 – July 2022.

Caroline Hills, Graduate Student, University of Notre Dame, July 2021 – current.
Co-advised by Mark Plecnik.
Supported by NSF CMMI 2041789.

Aravind Baskar, Graduate Student, University of Notre Dame, January 2021 – current.
Supported by NSF CMMI 2041789.
PhD advisor: Mark Plecnik, Department of Aerospace and Mechanical Engineering.

K. Gayan Maduranga, Postdoctoral Research Associate, University of Notre Dame, September 2020 – July 2022.
Supported by ARO W911NF-20-2-0218.

Matthew Howard, Undergraduate Student, University of Notre Dame, August 2020 – May 2022.

Parker Edwards, Robert and Sara Lumpkins Postdoctoral Research Associate, University of Notre Dame, June 2020 – July 2023.

Emma Cobian, Graduate Student, University of Notre Dame, December 2019 – current.
Supported by NSF DMS 1918692.

Sanesha McPherson, Undergraduate Student, North Carolina Central University, May 2019 – July 2019.
Supported by Notre Dame Graduate School Summer Research Opportunities Program.

Papri Dey, Semester Postdoc, Institute for Computational and Experimental Research in Mathematics, September 2018 – December 2018.

Caroline Hills, Undergraduate Student, University of Notre Dame, June 2018 – July 2018.
Supported by Office of Naval Research Young Investigator Award.

Andrew Moccio, Undergraduate Student, University of Notre Dame, January 2018 – May 2018.
Supported by Office of Naval Research Young Investigator Award.

Tingting Tang, Postdoctoral Associate, University of Notre Dame, September 2017 – August 2019.
Supported by Office of Naval Research Young Investigator Award.

Christopher Lembo, Undergraduate Student, University of Notre Dame, June 2017 – July 2017.
Supported by Office of Naval Research Young Investigator Award.

Michael Semanek, Undergraduate Student, University of Notre Dame, August 2016 – July 2017.
Supported by Office of Naval Research Young Investigator Award.

Patrick Tinsley, Undergraduate Student, University of Notre Dame, August 2016 – May 2017.
Mentored by Daniel Brake.

Samantha Sherman, Graduate Student, University of Notre Dame, August 2016 – May 2021.
Supported by Schmitt Leadership Fellowship in Science and Engineering and NSF CCF 1812746.

Yi Zhang, Postdoctoral Associate, University of Notre Dame, August 2016 – July 2017.
Supported by Office of Naval Research Young Investigator Award.

Hythem Sidky, Graduate Student, University of Notre Dame, August 2016 – May 2017.

Supported by NSF Graduate Research Fellowship.
PhD advisor: Jonathan Whitmer, Department of Chemical and Biomolecular Engineering.

Margaret Regan, Graduate Student, University of Notre Dame, April 2016 – August 2020.
Supported by Schmitt Leadership Fellowship in Science and Engineering and NSF ACI 1460032.

Elizabeth Sudkamp, Undergraduate Research, University of Notre Dame, August 2015 – December 2016.
Supported by Sloan Research Fellowship and mentored by Daniel Brake.

Pierce Cunneen, Undergraduate Research, University of Notre Dame, July 2015 – December 2015.
Supported by Sloan Research Fellowship and mentored by Daniel Brake.

Michael Padala, Undergraduate Research, University of Notre Dame, February 2015 – May 2015.
Supported by Sloan Research Fellowship and mentored by Daniel Brake.

Jose Rodriguez, NSF Postdoctoral Fellow, University of Notre Dame, August 2014 – May 2015.
Supported by NSF Mathematical Sciences Postdoctoral Research Fellowship.

Matthew Niemerg, Research Fellow, Simons Institute for Theory of Computing, August – December 2014.

Daniel Brake, Postdoctoral Associate, University of Notre Dame, January 2014 – August 2017.
Supported by DARPA Young Faculty Award.

Dhagash Mehta, Research Assistant Professor, University of Notre Dame, August 2013 – July 2015.
Supported by DARPA Young Faculty Award.

Alan C. Liddell, Jr., Graduate Student, University of Notre Dame, August 2013 – August 2017.
Supported by DARPA Young Faculty Award and NSF ACI 1460032.

Tulay A. Akoglu, Graduate Student, North Carolina State University, August 2013 – December 2016.
Co-advised with Agnes Szanto.

Noah Daleo, Graduate Student, North Carolina State University, January 2013 – August 2015.
Supported by DARPA Young Faculty Award and NSF DMS 1262428.

Jonathan Page, Undergraduate Research, North Carolina State University, September 2012 – May 2013.
Supported by NSF DMS 1262428.

Zachary Griffin, Undergraduate Research, Texas A&M University, September 2011 – May 2012.
Supported by NSF DMS 1114336.

Ph.D. Committees

Sophia Abraham, University of Notre Dame. (Ph.D. Advisor: Walter Scheirer)

Yu Wang, University of Notre Dame. (Ph.D. Advisor: Fang Liu)

Ernie Tsybulnik, University of Notre Dame, graduated 2023. (Ph.D. Advisor: Yongtao Zhang)

Zachary Miksis, University of Notre Dame, graduated 2022. (Ph.D. Advisor: Yongtao Zhang)

Katherine Harris, North Carolina State University, graduated 2021. (Ph.D. Advisor: Agnes Szanto)

Xinyue Zhao, University of Notre Dame, graduated 2021. (Ph.D. Advisor: Bei Hu)

Xiaozhi Zhu, University of Notre Dame, graduated 2021. (Ph.D. Advisor: Yongtao Zhang)

Owen Coss, North Carolina State University, graduated 2020. (Ph.D. Advisor: Hoon Hong)

AmirHosein Sadeghimanesh, University of Copenhagen, graduated 2018. (Ph.D. Advisor: Elisenda Feliu)

Francesco Pancaldi, University of Notre Dame, graduated 2017. (Ph.D. Advisors: Mark Alber & Andrew Sommese)

Tim McCoy, University of Notre Dame, graduated 2014. (Ph.D. Advisor: Andrew Sommese)

James Rohal, North Carolina State University, graduated 2014. (Ph.D. Advisor: Hoon Hong)

Thomas Wentworth, North Carolina State University, graduated 2014. (Ph.D. Advisor: Ilse Ipsen)

Master's Committees

Francisco Huizar, University of Notre Dame, graduated 2022. (Ph.D. Advisor: Jeremiah Zartman)

Ashley White, North Carolina State University, graduated 2014.

Invited Presentations

Geometric feature sizes and numerical algebraic geometry, Geometry of Polynomial System Solving, Optimization and Topology, Institut Henri Poincaré, Paris, France, October 2023.

Introduction to ACMS and numerical algebraic geometry, ND-NHSM-ENSIA Research/Pedagogy Workshop, Algerian Research Hub, Algiers, Algeria, October 2023.

Numbers game: how science aids sports performance, Science Exploration Series, University of Notre Dame, September 2023.

Fixed points, saddle graphs, and numerical algebraic geometry, Dynamical systems and Semi-algebraic geometry: interactions with Optimization and Deep Learning, Dalat, Vietnam/hybrid, July 2023.

Benefits and drawbacks of singularities in applications, "Numerical Methods in Algebraic Geometry," SIAM Conference on Applied Algebraic Geometry, Eindhoven, The Netherlands, July 2023.

Using saddle graphs for the approximate synthesis of mechanisms, "Algebro-Geometric Aspects of Optimization," SIAM Conference on Optimization, Seattle, May – June 2023.

Homotopies of probability distributions for variational inference, "Random Algebraic Geometry," Banff International Research Station, April 2023.

Geometric feature sizes of algebraic manifolds, "Complexity and Topology in Computational Algebraic Geometry," Joint Mathematics Meetings, Boston, January 2023.

Introduction to Homotopy Continuation, "AMS Short Course on Polynomial Systems, Homotopy Continuation, and Applications," Joint Mathematics Meetings, Boston, January 2023.

Creating an atlas of approximate straight-line linkages using homotopy continuation and machine learning, "Algebraic Geometry and Machine Learning," SIAM Conference on Mathematics of Data Science, September 2022.

Numerical computations in algebraic geometry, Combinatorial, Computational, and Applied Algebraic Geometry (CCAAGS-22), University of Washington, June – July, 2022.

Analyzing energy landscapes using numerical algebraic geometry, Dynamical Systems and Systems of Equations, Centro di Ricerca Matematica Ennio De Giorgi/hybrid, June 2022.

Investigating the maximum number of real solutions for the Kuramoto model, "Algebraic, Combinatorial, and Optimization Methods for Kuramoto and Power-flow Equations," AMS Spring Western Sectional Meeting/virtual, University of Denver, May 2022.

Structured polynomial systems arising in energy landscapes, "Structured Polynomial Systems in Mathematics and its Applications," Joint Mathematics Meetings/virtual, April 2022.

Homotopy continuation in variational inference, "Nonlinear Algebra with Applications to Statistics," AMS Spring Central Sectional Meeting/virtual, Purdue, March 2022.

Homotopy continuation for kinematic synthesis and variational inference, Applied Algebra and Analysis Online Seminar, TU Braunschweig and Universität Osnabrück, February 2022.

Homotopy continuation and applications, Colloquium, Boise State University/virtual, November 2021.

Some applications of homotopy continuation in science and engineering, SIAM SAGA – Seminar on Applied Geometry and Algebra, virtual, November 2021.

Using monodromy to statistically estimate the number of solutions, 2$^{\text{nd}}$ IMA Conference on Mathematics of Robotics/virtual, Manchester, UK, September 2021.

Solving overdetermined kinematic problems using homotopy continuation, "New Trends in Polynomial System Solving," SIAM Conference on Applied Algebraic Geometry/virtual, Texas A&M, August 2021.

Applications of numerically solving polynomial systems, Nankai Symposium on Mathematical Dialogues, Chern Institute of Mathematics/virtual, Nankai University, August 2021.

Energy landscapes and algebraic geometry, Symbolic Computation Seminar/virtual, North Carolina State University, May 2021.

Computing critical points for differential equations using numerical algebraic geometry, Applied Mathematics and Computation Seminar/virtual, University of Massachusetts Amherst, April 2021.

Some hybrid symbolic-numeric methods in algebraic geometry, Sage/Oscar Days for Combinatorial Algebraic Geometry, ICERM/virtual, Brown University, February 2021.

Numerically testing binomiality via a witness set, Joint Mathematics Meetings/virtual, January 2021.

Certified evaluations of Hölder continuous functions at roots of polynomials, Maple Conference 2020, Waterloo, Canada/virtual, November 2020.

Certification in numerical algebraic geometry, Applied Math Seminar, University of North Carolina at Greensboro/virtual, October 2020.

Computing sparse polynomials via witness sets, "Algebraic geometry via numerical computation," ICMS 2020, TU Braunschweig/virtual, July 2020.

Synchronization: pendulum clocks, GPS navigation, and the power grid, Michigan Society of Professional Engineers Western Chapter, Grand Rapids, Michigan, March 2020.

Numerical real algebraic geometry and applications, Computational Mathematics and Applications Seminar, University of Oxford, February 2020.

Numerical methods for solving polynomial equations, Helen Barton Lecture Series in Computational Mathematics, University of North Carolina at Greensboro, February 2020.

Decomposing the parameter space of biological networks via a numerical discriminant approach, Maple Conference 2019, University of Waterloo, October 2019.

Using numerical insights to improve symbolic computations, SYNASC 2019, West University of Timisoara, September 2019.

Tutorial: Homotopy continuation and numerical algebraic geometry using Bertini, SYNASC 2019, West University of Timisoara, September 2019.

Critical points of the Hamming and taxicab distance functions, "Euclidean Distance Geometry and Its Applications," SIAM Conference on Applied Algebraic Geometry, University of Bern, July 2019.

Singular value decomposition of chain complexes, AMS Spring Southeastern Sectional Meeting, Auburn University, March 2019.

Nonlinearity in everyday life, College of Science Collegiate Workshop, Junior Parents Weekend, University of Notre Dame, February 2019.

Parameters homotopies for minimal problems, Algebraic Vision Research Cluster, ICERM, Brown University, February 2019.

Numerically solving elliptic PDEs on curves and surfaces, Applied Algebra Day, Massachusetts Institute of Technology, November 2018.

Numerical algebraic geometry and optimization, AMS Fall Southeastern Sectional Meeting, University of Arkansas, November 2018.

Algebraic properties from numerical data, Valley Geometry Seminar, University of Massachusetts Amherst, October 2018.

Foundations of numerical algebraic geometry, "Nonlinear Algebra Bootcamp," ICERM, Brown University,

September 2018.

Numerically solving systems of polynomial equations, Summer School on Numerical Computing in Algebraic Geometry, MPI MIS, Leipzig, Germany, August 2018.

Certifying reality of projections, "Computational Algebraic Geometry," ICMS 2018, University of Notre Dame, July 2018.

Numerical algebraic geometry and semidefinite programming, "Optimization and Algebraic Geometry," 2018 SIAM Annual Meeting, Portland, OR, July 2018.

Applications of sampling in numerical algebraic geometry, Applications of Polynomial Systems, NSF/CBMS Regional Conference in the Mathematical Sciences, Texas Christian University, June 2018.

Semidefinite programming and numerical algebraic geometry, 2018 Meeting on Applied Algebraic Geometry, Georgia Tech, April 2018.

The secret of staying in sync: it's not magic, it's math, College of Science Collegiate Workshop, Junior Parents Weekend, University of Notre Dame, February 2018.

Applications of Solving Nonlinear Equations, Talk Science seminar by *Scientia*, University of Notre Dame, February 2018.

Interplay of semidefinite programming, numerical algebraic geometry, and PDEs, Computational and Applied Mathematics Colloquium, Penn State, January 2018.

Certification using Newton-invariant subspaces, MACIS, Vienna, Austria, November 2017.

Homotopies for connected components of algebraic sets with application to computing critical sets, MACIS, Vienna, Austria, November 2017.

The secret of staying in sync: it's not magic, it's math, Science Exploration Series, University of Notre Dame, October 2017.

Real solutions to polynomial equations, Colloquium, University of Wisconsin, October 2017.

Polynomials and the exponent of matrix multiplication, "Applicable and Computational Algebraic Geometry," AMS Fall Central Sectional Meeting, University of North Texas, September 2017.

Semidefinite programming and numerical algebraic geometry, "New Trends in Polynomial System Solving and Applications," SIAM Conference on Applied Algebraic Geometry, Georgia Tech, July 2017.

Equilibria of the Kuramoto model, "Applied and Computational Algebraic Geometry," Mathematical Congress of the Americas, July 2017.

Symmetrizing the matrix multiplication tensor, "Computational Algebraic Geometry," Foundations of Computational Mathematics, University of Barcelona, July 2017.

Robotics, kinematics, and polynomials, "Math Day," University of Findlay, March 2017.

Mathematics of synchronization, "Math Day," University of Findlay, March 2017.

Computing the real equilibrium points of the Kuramoto model, "Theory and Applications of Numerical Algebraic Geometry," Joint Mathematics Meetings, Atlanta, January 2017.

Decomposing the parameter space, "Applied Algebraic Geometry," AMS Fall Southeastern Sectional Meeting, North Carolina State University, November 2016.

Decomposing solution sets via derivatives, "Foundations of Numerical Algebraic Geometry," AMS Fall Western Sectional Meeting, University of Denver, October 2016.

Validating the completeness of the real solution set of a system of polynomial equations, ISSAC, Wilfred Laurier University, Waterloo, Ontario, Canada, July 2016.

Decomposing solutions sets of polynomial systems using derivatives, "Algebraic Geometry in Applications," ICMS, Zuse Institute Berlin, July 2016.

What is numerical algebraic geometry?, "Algebraic Vision," American Institute Mathematics, San Jose, California, May 2016.

Numerical computations in geometry, Texas Geometry and Topology Conference, Texas Christian University, February 2016.

Computing real solutions to systems of polynomial equations using numerical algebraic geometry, "Symbolic-Numeric Computing Seminar," CUNY Graduate Center, February 2016.

Tensor decomposition via numerical algebraic geometry, "Nonlinear Algebra," Joint Mathematics Meetings, Seattle, January 2016.

A variety of witness sets and applications, Algorithms and Complexity in Algebraic Geometry Reunion Workshop, Simons Institute, December 2015.

Local decomposition and local methods for analyzing real solutions, Workshop on Algebra, Geometry, and Proofs in Symbolic Computation, Fields Institute, December 2015.

Numerically testing generically reduced projective schemes for the arithmetic Gorenstein property, MACIS, Zuse Institute Berlin, November 2015.

A hybrid approach to the center-focus problem, Third Workshop on Hybrid Methodologies for Symbolic-Numeric Computation, ICIAM 2015, Beijing, China, August 2015.

Applications of numerical algebraic geometry, Plenary Talk, SIAM Conference on Applied Algebraic Geometry, Daejeon, Korea, August 2015.

Numerical algebraic geometry and physics, Applications of Computational Algebraic Geometry to Theoretical Physics, SIAM Conference on Applied Algebraic Geometry, Daejeon, Korea, August 2015.

A hybrid symbolic-numeric approach to exceptional sets of generically zero-dimensional systems, PASCO, University of Bath, July 2015.

Center-focus problem and algebraic geometry, "Numerical Algebraic Geometry," 2015 Meeting of the MAA Rocky Mountain Section, April 2015.

Nonlinear algebra, Colloquium, University of Findlay, April 2015.

Parameters and polynomials, Applied Interdisciplinary Mathematics Seminar, University of Michigan, April 2015.

The center-focus problem, "Homotopy continuation methods and their applications to science and engineering," AMS Spring Central Sectional Meeting, Michigan State University, March 2015.

Newton homotopies and certification, "Computational Algebraic Geometry," Foundations of Computational Mathematics, University of the Republic, December 2014.

Optimization and numerical algebraic geometry, "Trends in Optimization Seminar," University of Washington, October 2014.

Newton homotopies and applications, "Computational Algebraic Geometry and Applications to Science and Engineering," AMS Fall Western Sectional Meeting, San Francisco State University, October 2014.

Computing sparse solutions to polynomial systems using optimization, "Optimization," 42$^{\text{nd}}$ Annual Mathematics Conference, Miami University, September 2014.

Solving Polynomials, "Algebraic Geometry Boot Camp," Simons Institute, September 2014.

An introduction to software in numerical algebraic geometry, "Numerical Algebraic Geometry," ICMS, Hanyang University, August 2014.

Numerical algebraic geometric techniques for real curves and surfaces, "Curves and Surfaces," ICMS, Hanyang University, August 2014.

An a posteriori *certification algorithm for Newton homotopies*, ISSAC, Kobe University, July 2014.

Numerical real algebraic geometry, "Computational Nonlinear Algebra," ICERM, Brown University, June 2014.

Algorithms of numerical algebraic geometry, "Computational Nonlinear Algebra," ICERM, Brown University, June 2014.

Applications of numerical real algebraic geometry, "Applied Geometry, Topology, and Networks," IMSE Hot TIME Symposium, University of Illinois, February 2014.

The geometry of structural identifiability and inverse problems, Colloquium, University of Notre Dame, February 2014.

Numerical algebraic geometry, Colloquium, University of Tennessee, February 2014.

The mobility of mechanisms, Junior Colloquium, University of Tennessee, February 2014.

Homotopy continuation and decomposition, "Nonlinear Systems: Polynomial Equations, Nonlinear PDEs, and Applications," 2014 Joint Mathematics Meetings, Baltimore, January 2014.

Recovering exact results from approximate numerical computations, PolSys Seminar, University of Pierre and Marie Curie, November 2013.

Certifying solutions of an overdetermined system of equations, Numerical Methods and Efficient Computations, Centre International de Rencontres Mathematiques, October 2013.

Applications of Real Numerical Algebraic Geometry, SIAM Conference on Applied Algebraic Geometry, Colorado State University, August 2013.

Numerical Elimination Theory and Matrix Multiplication, SIAM Conference on Applied Algebraic Geometry, Colorado State University, August 2013.

Computing multiple solutions to discretizations of differential equations, MEGA2013: Effective Methods in Algebraic Geometry, Goethe University Frankfurt am Main, June 2013.

Polynomials, nonlinear algebraic differential equations, and applications, ACMS Colloquium, University of Notre Dame, February 2013.

A homotopy method based on WENO scheme for solving steady-state problems, Numerical Analysis Seminar, North Carolina State University, November 2012.

Gradient descent homotopies and real solving, MAA Mathfest 2012, Madison, August 2012.

Real solutions to parameterized polynomial systems, 2012 SIAM Annual Meeting, Minneapolis, July 2012.

Dietmaier's algorithm and numerical algebraic geometry, Seminar on Computational Algebraic Geometry, University of California, Berkeley, May 2012.

Software for numerical algebraic geometry, Simons Foundation Roundtable on Software for Research, New York City, May 2012.

Parameterized system of equations, Midwest Numerical Analysis Days 2012, University of Notre Dame, May 2012.

Certification and applications of solutions to polynomial-exponential systems, From Dynamics to Complexity: A Conference Celebrating the Work of Mike Shub, Fields Institute, May 2012.

Real solving and certification, Algebra Seminar, Georgia Tech, April 2012.

Symbolic–numeric methods for systems of polynomial equations, North Carolina State University, January 2012.

Numerical solving of polynomial equations and applications, Mathematics Colloquium, University of Wisconsin, December 2011.

Numerical solving of polynomial equations: from 3264 and 1442 to 83200 and 38475, University of California, Berkeley, December 2011.

Certifying solutions to systems of polynomial-exponential equations, "Computational and Algorithmic Algebraic Geometry," AMS Fall Western Sectional Meeting, University of Utah, October 2011.

Real solving and numerical algebraic geometry, "Advances in numerical algebraic geometry," SIAM Conference on Applied Algebraic Geometry, North Carolina State University, October 2011.

Real solving and certification, "Real-number complexity," Foundations of Computational Mathematics Conference, Budapest University of Technology and Economics, July 2011.

Computing real solutions using numerical algebraic geometry, RWTH Aachen University, June 2011.

Numerical algebraic geometry, Miami University, March 2011.

Multiplicity and a local dimension test, "Algebraic geometry: computations and applications," Royal Institute of Technology (KTH), February 2011.

Solving polynomial systems using regeneration, "Solving polynomial equations," CIAM Workshop, Royal Institute of Technology (KTH), February 2011.

Deflation and isosingular sets, Hybrid Methodologies for Symbolic-Numeric Computation, Mathematical Sciences Research Institute, November 2010.

Witness sets of projections, "Numerical Algebraic Geometry," AMS Fall Central Sectional Meeting, University of Notre Dame, November 2010.

Regeneration and differential equations, "Geometric and numeric tools for differential equations," Banff International Research Station, August 2010.

Regeneration and numerical algebraic geometry, "Kinematics and Numerical Algebraic Geometry," SIAM Annual Meeting, Pittsburgh, July 2010.

Multiplicity, local dimension, and mechanism mobility, FRAGMENT Seminar, Colorado State University, March 2010.

Regeneration and applications of numerical algebraic geometry, FRAGMENT Seminar, Colorado State University, March 2010.

Numerical algebraic geometry, "Convex Algebraic Geometry," Banff International Research Station, February 2010.

Applying numerical algebraic geometry to zebrafish patterning and tumor growth models, Numerical Analysis Seminar, Texas A&M University, February 2010.

Computing Hilbert functions using dual bases, "Applications of Algebraic Geometry," AMS National Meeting, San Francisco, January 2010.

Algebraic computations using numerical dual bases, "Oberwolfach Seminar: New Trends in Algorithms for Real Algebraic Geometry," Mathematisches Forschungsinstitut Oberwolfach, November 2009.

Finite games, homotopy continuation, and numerical algebraic geometry, Combinatorics and Probability Seminar, University of Pennsylvania, October 2009.

Homotopy continuation and numerical algebraic geometry, Postdoctoral Seminar Series, Fields Institute, October 2009.

Numerical algebraic geometry and its applications, University of Central Oklahoma, January 2009.

Algorithms of numerical algebraic geometry and Bertini, CIAM Tutorial, Royal Institute of Technology (KTH), June 2008.

Homotopy continuation and intersecting algebraic sets without defining equations, Graduate Student Seminar, University of Notre Dame, October 2007.

Regeneration, adaptive multiprecision, and Bertini, "Numerical and Symbolic Techniques in Algebraic Geometry and Its Applications," AMS Fall Central Sectional Meeting, DePaul University, October 2007.

Parallel solving of polynomial systems, Center for Research Computing Workshop on Scientific Computing, University of Notre Dame, May 2007.

An introduction to multiobjective optimization and its application to finite games, "Optimization Theory and Applications," AMS Spring Central Sectional Meeting, Miami University, March 2007.

Editorial Boards

SIAM Journal on Applied Algebra and Geometry, 2022 – current.

Maple Transactions, 2021 – current.

Guest editor (with Y.-H. He, I. Kotsireas, D. Mehta, and T. Tang) of *Algebraic Geometry and Machine Learning*, a virtual special issue of *Journal of Symbolic Computation*, 2022.

Journal of Symbolic Computation (JSC), 2020 – current.

Guest editor (with A. Sommese) of *Numerical Algebraic Geometry*, a special issue of *Journal of Symbolic Computation* (Volume 79, Part 3), 2017.

Journal of Algebra and Its Applications (JAA), 2015 – 2022.

Conferences, Seminars, and Sessions Organized

Member of the *CASC 2024* Program Committee, Rennes, France, September 2024.

General Chair, *ISSAC 2024*, Raleigh, NC, July 2024.

Organizer of *Bayesian Statistics and Statistical Learning*, IMSI, University of Chicago (with M. Drton, L.-H. Lim, and D. Pati), December 2023.

Member of the *MEGA* Advisory Board, July 2022 – current.

Member of the *MEGA 2022* Executive Committee, Cracow, Poland, June 2022.

Member of the *Maple Conference 2021* Program Committee, Waterloo, Ontario, Canada, November 2021.

Minisymposium on *Algebraic Geometry and Machine Learning* (with T. Tang, D. Mehta, and Y.-H. He), SIAM Conference on Applied Algebraic Geometry, Texas A&M/virtual, August 2021.

Member of the *ISSAC 2021* Program Committee, Saint Petersburg, Russia, July 2021.

Organizer of *Workshop on Algebraic Geometry and Machine Learning*, Tsinghua Sanya International Mathematics Forum/virtual (with Y.-H. He, A. Kasprzyk, D. Mehta, and S.-T. Yau), January 2021.

Member of the *Maple Conference 2020* Program Committee, Waterloo, Ontario, Canada, November 2020.

Member of the *2nd IMA Conference on Mathematics of Robotics* Organizing Committee, Manchester, UK, September 2020 (postponed to September 2021).

Software Presentations Chair of *ISSAC 2020*, Kalamata, Greece, July 2020.

Member of the *Maple Conference 2019* Program Committee, Waterloo, Ontario, Canada, October 2019.

Member of the *ISSAC 2019* Program Committee, Beijing, China, July 2019.

Member of the *2019 SIAM Conference on Applied Algebraic Geometry (AG19)* Program Committee, Bern, Switzerland, July 2019.

Organizer of *Nonlinear Algebra in Applications*, ICERM, Brown University (with A. Dickenstein, E. Gorla, Y.-H. He, and C. Uhler), November 2018.

Member of the semester program on *Nonlinear Algebra* Organizing Committee, ICERM, Brown University (with D. Bates, S. Di Rocco, A. Leykin, F. Sottile, M. Stillman, and C. Vinzant), Fall 2018.

Local organizer of the *International Congress on Mathematical Software (ICMS 2018)*, University of Notre Dame (with A. Sommese), July 2018.

Member of the *2018 SIAM Annual Meeting (AN18)* Organizing Committee, Portland, OR, July 2018.

Member of the *MACIS 2017* Program Committee and co-chair of the *Track on Foundations of Algorithms in Mathematics, Engineering, and Scientific Computation*, Vienna, Austria, November 2017.

Organizer of *Polynomials, Kinematics, and Robotics*, University of Notre Dame (with D. Bates, D. Brake, and A. Sommese), June 2017.

Member of the *ECCAD 2017* Poster Committee, Wolfram Research, Champaign, IL, April 2017.

Member of the *ISSAC 2016* Program Committee, Waterloo, Ontario, Canada, July 2016.

Special session on *Software for numerically solving polynomial systems* (with D. Bates and D. Brake), 5^{th} *International Congress on Mathematical Software*, Zuse Institute Berlin, July 2016.

Minisymposium on *Applications of Algebraic Geometry* (with D. Bates and D. Brake), SIAM Annual Meeting, Boston, July 2016.

Organizer of *Workshop on Quivers and Bipartite Graphs*, University of Notre Dame (London, UK), (with M. Gekhtman, A. Hanany, Y.-H. He, and M. Probst), May 2016.

Organizer of *Workshop on Software and Applications of Numerical Algebraic Geometry*, University of Notre Dame (with D. Brake, A. Sommese, and C. Wampler), May 2016.

Member of the *MACIS 2015* Program Committee and organizer of the special session on *Applied Algebraic Geometry*, Berlin, Germany, November 2015.

Member of the *PASCO 2015* Program Committee, Bath, UK, July 2015.

Solving Polynomial Equations, Simons Institute for the Theory of Computing (with P. Koiran and F. Sottile), October 2014.

Polynomial Solving Seminar, Simons Institute (with G. Malajovich), Fall 2014.

Member of the 4^{th} *International Congress on Mathematical Software* Program Committee and organizer of the special session on *Software for Numerical Algebraic Geometry* (with A.J. Sommese), Hanyang University, August 2014.

Member of the *ISSAC 2014* Program Committee, Kobe, Japan, July 2014.

Member of the *ECCAD 2014* Organizing Committee, Duke University, April 2014.

Minisymposium on *Algorithms in Numerical Algebraic Geometry*, SIAM Conference on Applied Algebraic Geometry, Colorado State University, August 2013.

Symbolic Computation Seminar, North Carolina State University, Fall 2012 – Spring 2014.

Minisymposium on *Numerical algebraic geometric algorithms for kinematics and PDE applications*, 2012 SIAM Annual Meeting, Minneapolis, July 2012.

Minisymposium on *Advances in Numerical Algebraic Geometry*, SIAM Conference on Applied Algebraic Geometry, North Carolina State University, October 2011.

Algebraic Geometry Seminar, Texas A&M University, Spring 2012, Fall 2011, and Fall 2010.

Special session on *Numerical Algebraic Geometry* (with D.J. Bates, A.J. Sommese, and C.W. Wampler), AMS Fall Central Sectional Meeting, University of Notre Dame, November 2010.

Other Conferences and Workshops Attended

Algebraic Geometry in Spectral Theory, ICERM, Brown University, February 2023.

Texas Algebraic Geometry Symposium, Texas A&M University, April 2012.

MEGA2011: Effective Methods in Algebraic Geometry, Stockholm University, May 2011 – June 2011.

Texas Algebraic Geometry Symposium, University of Texas, April 2010.

Mathematical Developments Arising from Biology, Mathematical Biosciences Institute, November 2009.

Workshop on Complexity of Numerical Computation, Fields Institute, October 2009.

International Workshop on Model Reduction in Reacting Flows, University of Notre Dame, March 2009 – April 2009.

Joint Mathematics Meetings, Washington, D.C., January 2009.

International Conference on Scientific Computing, Las Vegas, Nevada, July 2008.

Foundations of Computational Mathematics Conference, City University of Hong Kong, June 2008.

Interactions of Classical and Numerical Algebraic Geometry, University of Notre Dame, May 2008.

SIAM Conference on Parallel Processing for Scientific Computing, Atlanta, Georgia, March 2008.

Spring Center for Applied Mathematics Workshop, University of Notre Dame, February 2008 – March 2008.

Symbolic-Numeric Computation International Workshop, University of Western Ontario, July 2007.

International Conference on Applications of Computer Algebra, Oakland University, July 2007.

Spring Center for Applied Mathematics Workshop, University of Notre Dame, March 2007.

Software for Algebraic Geometry Workshop, Institute for Mathematics and its Applications, October 2006.

Spring AMS Central Sectional Meeting, University of Notre Dame, April 2006.

Spring Center for Applied Mathematics Workshop, University of Notre Dame, March 2006.

Teaching Experience

Seminar on Mathematics and Statistics in Sports Performance, University of Notre Dame, Spring 2023 co-taught with Sam Rosengarten.

Introduction to Probability, University of Notre Dame, Spring 2021, Fall 2020, Spring 2020, Fall 2017, Spring 2017, Fall 2016, and Spring 2016.

Numerical Analysis I, University of Notre Dame, Fall 2019, Fall 2017, Fall 2016, and Fall 2015.

Topics in Applied Mathematics: Nonlinear Equations, University of Notre Dame, Spring 2016 and Spring 2015.

Topics in Num. Analysis: Numerical Algebraic Geometry, North Carolina State University, Spring 2014.

Algebraic Geometry, North Carolina State University, Fall 2013.

Numerical Algebraic Geometry, Tutorials in the Mountains, Pingree Park mountain campus of Colorado State University, July 2013.

Engineering Mathematics I, Texas A&M University, Spring 2012 and Fall 2011.

Methods of Applied Mathematics I, Texas A&M University, Fall 2010.

Differential Equations, Texas A&M University, Spring 2010.

Principles of Finite Mathematics, University of Notre Dame, Spring 2008.

Calculus I, Miami University, Spring 2005 and Fall 2004.

Precalculus, Miami University, Spring 2004 and Fall 2003.

Pedagogical Training

University of Notre Dame Mathematics Teaching Seminar, 2006.

Miami University Seminar in the Teaching of First-Year Mathematics and Statistics, 2003.

Honors, Awards, Scholarships, and Fellowships

Member, American Mathematical Society Short Course Committee, 2024.

Fellow of the American Mathematical Society, 2022.

Michiana Forty under 40, South Bend Regional Chamber, 2021.

College Research Award, College of Science, University of Notre Dame, 2020.

Rev. Edmund P. Joyce, C.S.C., Award for Excellence in Undergraduate Teaching ($1500 award),

University of Notre Dame, 2020.

Chair, SIAM Activity Group in Algebraic Geometry, January 2018 – December 2019.

Secretary, International Congress on Mathematical Software, 2016 – current.

Office of Naval Research Young Investigator Award, 2016.

Secretary, SIAM Activity Group in Algebraic Geometry, January 2016 – December 2017.

Faculty Advisor, University of Notre Dame du Lac Chapter of SIAM, 2016 – current.

The Honor Society of Phi Kappa Phi, The University of Findlay Chapter, 2016.

Distinguished Alumni Award, University of Findlay, 2015.

Army Young Investigator Program (YIP) Award, 2015.

2014 SIAM Bestseller list (#23).

The Journal of Chemical Physics: 2014 Editors' Choice.

Sloan Research Fellowship, 2014.

DARPA Young Faculty Award (YFA), 2013.

Student Led Award for Teaching Excellence ($5000 award), Texas A&M University, Spring 2010.

Outstanding Graduate Student Teacher Award for Excellence in Teaching, Kaneb Center for Teaching and Learning, University of Notre Dame, 2009.

Graduate Fellow of the Center for Applied Mathematics, University of Notre Dame, 2007 – 2008.

University of Notre Dame University Fellowship, 2005 – 2006.

Graduate Assistant Effective Teacher Award in Mathematics and Statistics, Miami University, 2005.

Graduate Faculty Prize in Mathematics and Statistics, Miami University, 2005.

Miami University Graduate Summer Scholarship, 2005 and 2004.

Miami University Graduate Assistantship, 2003 – 2005.

Miami University Graduate School Academic Achievement Assistantship, 2003.

Ohio Board of Regents Graduate/Professional Fellowship, 2003 – 2004.

Outstanding Senior Majoring in Mathematics, University of Findlay, 2003.

Mathematics and Computer Science Horizons Award, University of Findlay, 2002 and 2001.

Professional Memberships

American Association for the Advancement of Science (AAAS)

American Mathematical Society (AMS)

Association for Computing Machinery (ACM)

Society for Industrial and Applied Mathematics (SIAM)