Harm Derksen

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Education

Ph.D. Mathematics, Summa Cum Laude, 1997
University of Basel, Switzerland
Advisor: Hanspeter Kraft

M.A. Mathematics, Cum Laude, 1993
University of Nijmegen, the Netherlands
Advisor: Arno van den Essen.

Employment

2020–present, Full Professor, Northeastern University

2009–2020, Full Professor, University of Michigan

2004–2009, Associative Professor, University of Michigan

2000–2004, Assistant Professor, University of Michigan

1998–2000, C.L.E. Moore Instructor, Massachusetts Institute of Technology

1997–1998, Research Scholar, Northeastern University

Funding and Awards

2020–2024, Co-Principal Investigator, NSF grant IIS 2014003, $996,386, *SCH: INT: Improving Care for Heart Failure Patients Using Tropical Geometry and Soft Computing*.

2020–2023, Principal Investigator, NSF grant DMS 2001460, $293,000, *Invariant Theory and Complexity Theory for Quiver Representations and Tensors*.

2018–2021, Principal Investigator, NSF grant IIS 1837985, $1,418,872, *BIG DATA: F: Algorithms for Tensor-Based Modeling of Large Scale Structured Data*.

2016–2019, Principal Investigator, NSF grant DMS 1601229, $285,000, *Invariant Theory, Tensors and Applications*.

2017–2021, Co-Investigator, NSF grant IIS 1722801, $1,299,371, *: SCH: INT: Data in Motion Prediction and Assessment of Acute Respiratory Distress Syndrome*.

2017–2020, Co-Investigator, Toyota Motor Company, grant, $1,573,526, *Development and Assessment of an In-Vehicle Cardiac Monitoring and Severe Event Prediction System*.

2017–2020, Co-Investigator, Department of Defense, grant, $2,202,042, A Multimodal Integrative Platform for Continuous Monitoring and Decision Support during Postoperative Care in Cardiac Patients - BA150235.

2012–2015, Principal Investigator, NSF grant, DMS 1302032, $142,865, *Invariant Theory, Complexity and Quivers*

2009–2012, Principal Investigator, NSF grant DMS 0901298, $379,101, *Invariant Theory and Algebraic Combinatorics*

2004–2009, Principal Investigator, NSF CAREER grant DMS 0349019, *Invariant Theory, Algorithms and Applications* $400,000

2001–2004, Principal Investigator DMS 0102193, NSF grant, $95,494, *Quivers, Invariant Theory and Applications*

1999–2001, Co-Investigator, NSF grant DMS 9970165, $53,931

1997–1998, Scholarship, Swiss National Science Foundation,
Freiwillige Akademische Gesellschaft, Basel, Sfr. 34,000

1994, Scholarship, VSB Bank, the Netherlands,DFL 9,000

1993, Study Prize for Master Thesis, University of Nijmegen, the Netherlands

1993, First prize, Dutch University Mathematics Competition

1988, Bronze Medal, International Mathematical Olympiad

Service

2009–present, Editor, Applicable Algebra in Engineering, Communication and Computing

2009–2016, Editor, Proceedings of the American Mathematical Society

2007–2014, Editor, Journal of Algebra

2015–2018, Member of the Questions Committee, William Lowell Putnam Competition (currently chair)

2005-2014, Organizer of the University of Michigan Undergraduate Mathematics Competition $(\mathrm{UM})^2\mathrm{C}$

2002, 2006, 2014, 2018 NSF panel

Reviewer for Math Reviews

2015-present, Minority Outreach K-12, including the future U program and the Wolverine Express

Graduate Students

current, Zhi Jiang

current, Robert Cochrane

current, Alana Huszar

2019, Francesca Gandini

2016, Visu Makam

2011, Harlan Kadish

2010, Jiarui Fei

2009, Ryan Kinser

2005, Calin Chindris

2002, Jessica Sidman (co-advisor)

Postdoc Mentoring

2018-2020, Cristian Minoccheri

2017-2019, Neriman Tokcan

2015-2018, Jack Jeffries

2015-2017, Rob Eggermont (co-mentor)

2007-2009, Tatyana Chmutova

2006-2009, Sophie Morier-Genoud

Patents

2019,2020, Najarian, Kayvan; Derksen, Harm; Li, Zhi; Gryak, Jonathan; Gunaratne, Pujitha, *Systems and methods for predicting and detecting a cardiac event*, US 10,786,208, patent.

2018, Najarian, Kayvan; Belle, Ashwin; Ward, Kevin; Derksen, Harm, *Early detection of hemodynamic decompensation using taut-string transformation* , US 9,974,488, patent.

Professional Memberships

American Mathematical Society (AMS)

Mathematical Association of America (MAA)

Society for Industrial and Applied Mathematics (SIAM)

Institute of Electrical and Electronics Engineers (IEEE)

Selected Presentations

November 2020, *The G-Stable Rank for Tensors*, Texas A&M University, College Station, TX.

October 2020, *Algorithms for Tensors and Applications*, University of Michigan, Ann Arbor, MI.

August 2020, *Algebraic Methods for Tensor Data*, Workshop: Symmetry, Randomness, and Computations in Real Algebraic Geometry, ICERM, Providence, RI.

March 2020, *The G-stable Rank for Tensors and the Cap Set Problem*, AMS Meeting, University of Virginia, Charlottesville, VA.

January 2020, *Applications of Tensor Rank*, Colloquium, University of Iowa, Iowa City, IA.

November 2019, *Invariant Theory and Wheeled PROPs*, Conference on Geometric Methods in Representation Theory, Columbia, MO.

August 2019, *The Canonical Decomposition* , Conference on Homological Methods and Tilting Theory of Finite Dimensional Algebras, University of Iowa, Iowa City, IA.

July 2019, *Algorithms for the separation of orbits of matrices*, SIAM conference on Applied Algebraic Geometry, Bern, Switzerland.

February 2019, *Singular Values of Tensors*, Courant-CUNY symbolic-numeric computing seminar, New York, NY.

November 2018, *Upper and Lower Degree Bounds for Generating Invariants*, 6th Conference on Geometric Methods in Representation Theory, University of Iowa.

October 2018, *An Algebraic Approach to Tensor Analysis*, special session, AMS Meeting, University of Michigan.

October 2018, *Constructive Invariant Theory*, Colloquium, Rutgers University, New Brunswick, NJ.

July 2018, *The Graph Isomorphism Problem and the Module Isomorphism Problem*, Symmetry vs. Regularity (WL2018), Pilsen, Czech Republic.

July 2018, *Polynomial and Tensor Optimization*, International Symposium on Mathematical Programming (ISMP 2018), Bordeaux, France.

June 2018, *An Introduction to Invariant Theory*, Optimization, Workshop Complexity and Invariant Theory, Istitute of Advanced Study, Princeton, NJ.

April 2018, *Constructive Invariant Theory and Non-Commutative Rank*, Colloquium, University of Illinois, Chicago, IL.

February 2018, *Matrix Invariants and Complexity*, North Carolina State University, Raleigh, NC.

January 2018, *Constructive Invariant Theory and Non-Commutative Rank*, Colloquium, Purdue University, West Lafayette, IN.

January 2018, *Constructive Invariant Theory and Non-Commutative Rank*, Colloquium, University of California, San Diego, CA.

January 2018, *Singular Values for Tensors*, special SIAM session on "Tensors! Mathematical Challenges and Opportunities", Joint Mathematics Meeting, San Diego, CA.

November 2017, *Stability of Quiver Representations*, Conference on Geometric Methods in Representation Theory, Iowa City, Iowa.

July 2017, *Learning with Privileged Information and its Application in Medical Informatics*, Boosting and Learning in Mathematical Imaging Algorithms, SIAM annual meeting.

April, 2017, *Invariant Theory for Quivers*, Maurice Auslander Distinguished Lectures and International Conference, Falmouth, MA.

February 2017, *Matrix Invariants*, Radboud University, Nijmegen, the Netherlands.

November 2016, *Invariant Theory for Quivers*, conference, Geometric Methods in Representation Theory, Columbia, MO.

October 2016, *Matrix Invariants and Algebraic Complexity Theory*, Institute of Advanced Study, Princeton, NJ.

October 2016, *Invariant Theory and Quiver Representations* (2 lectures), Simons Institute, New York, NY.

January 2016, *Tensor Decompositions and the Nuclear Norm*, conference, Tensor Decompositions and Applications (TDA 2016), Leuven, Belgium.

April 2015, *General Representations of Quivers*, International Conference on Representation Theory and Commutative Algebra, University of Connecticut.

March 2015, *Sparsity in Big Data*, Frontiers in Science Public Lecture, Florida Atlantic University, Boca Raton, FL.

July 2014, *Locally Nilpotent Derivations* (3 lectures), International Conference/Short-School on Affine Algebraic Geometry and the Jacobian Conjecture, Chern Institute, Tianjin, China.

November 2014, *Generalized Singular Values*, conference, Tensors in Computer Science and Geometry, Simons Institute, Berkeley, CA.

May 2014, *Recurrence Sequences in Positive Characteristic*, conference, Heights, Modularity, Transcendence, CIRM, Luminy, France.

May 2014, *Tensor Decompositions, Matrix Completion and Singular Values*, conference, Computational Nonlinear, Algebra, Institute for Computational and Experimental Research in Mathematics (CERM), Brown University, Providence, RI.

July 2013, *Isomorphism Problems*, Syracuse University, NY.

May 2013, *Invariant Theory and Complexity*, conference, Michigan Computational Algebraic Geometry, Western Michigan University, Kalamazoo, MI.

April 2013, *Minimal Presentations of Modules*, conference, Algebra, Combinatorics and Representation Theory,

May 2012, East Coast Computer Algebra Day, Oakland University, Rochester, MI.

January 2012,*(Poly)Matroid Invariants*, colloquium, Northeastern University, Boston, MA.

November 2011, *Polymatroids*, Temple University, Philadelphia, PA.

October 2011, *Constructive Invariant Theory*, Oakland University, MI.

October 2011, *Kruskal's Uniqueness Inequality is not Sharp*, SIAM conference on Applied Algebraic Geometry, North Carolina State University, Raleigh, NC.

March, 2011, colloquium, University of Kent, Canterbury, United Kingdom.

February 2011, Berkeley-Davis-Stanford Algebraic Geometry Colloquium, Berkeley, CA.

February 2011, *Counting Subrepresentations of Quivers*, Queen's University, Kingston, ON, Canada.

December 2010, Mini-Workshop on Polynomial Vector Fields, Oberwolfach, Germany.

October 2010, colloquium, Western Michigan University, Kalamazoo, MI.

February 2010, *Matroid Polytopes*, Convex Algebraic Geometry, Banff Institute, Banff, Canada.

February 2010, *(Poly)Matroid Invariants*, Katholieke Universiteit Nijmegen, Nijmegen, the Netherlands.

December 2008, *Quivers with Potentials* (3 lectures), International Conference on Cluster Algebras and Related Topics, Morelia, Mexico.

November 2008, *Subspace Arrangements*, colloquium, University of Illinois, Urbana-Champaign, IL.

July 2008, *G-invariant Tensors*, European Mathematical Congress, Amsterdam, the Netherlands.

April 2008, *Symmetric and Quasi-Symmetric Functions Associated to Polymatroids*, University of Washington, Seattle, WA.

March 2008, *Quivers with Potentials*, Workshop Combinatorial Representation Theory, MSRI, Berkeley, CA.

December 2007, *Generators of Invariant Rings*, colloquium, University of California, San Diego, CA.

October 2007, *Generators of Invariant Rings*, colloquium, Wayne State University, Detroit, MI.

September 2007, *A Counterexample to Okounkov's Log-Concavity Conjecture*, Texas A& M, College Station, TX.

September 2007, *Mutations of Quivers*, colloquium, Texas A& M, College Station, TX.

August 2007, *A Counterexample to Okounkov's Log-Concavity Conjecture*, ICRA XII, Torun, Poland.

March 2007, *Quivers with Potentials*, workshop, Topics in Combinatorial Representation Theory, MSRI, Berkeley, CA.

February 2007, *Generators of Invariant Rings*, Valley Geometry Seminar, University of Massachusetts, Amherst, MA.

January 2007, *Segmentation of Multivariate Mixed Data via Lossy Coding and Compression*, SPIE conference on VCIP, San Jose, CA.

September 2006, *Algorithms for Invariant Rings of Algebraic Groups*, IMA Workshop on Algorithms in Algebraic Geometry, Minneapolis, MN.

May 2006, *Hilbert Series of Subspace Arrangements*, conference, Castelnuovo-Mumford Regularity and Related Topics, CIRM, Luminy, France

May 2006, *LR Coefficients which are equal to 1*, Lie Days in Martina Franca, Italy.

March 2006, *Subspace Arrangements*, Colloquium, University of Western Ontario, London, ON, Canada.q

March 2006, *A Skolem-Mahler-Lech Theorem in Positive Characteristic*, conference, Heights in Diophantine Geometry, Erwin Schrödinger Institute, Vienna, Austria.

November 2005, *Rational Invariant Theory*, Diamant/Eidma Symposium, Mierlo, the Netherlands.

August 2005, *Quivers and Combinatorics*, 2005 AMS Summer Institute on Algebraic Geometry, Seattle.

May 2005, *Rational Invariant Theory*, Vrije Universiteit Amsterdam, the Netherlands.

April 2005, *Rational Invariant Theory*, University of Zürich, Switzerland.

June 2004, *Universal Denominators of Hilbert Series*, Conference on Algebraic Geometry and Algebraic Groups, Aarhus, Denmark.

May 2004, Conference on Transformation Groups, Basel, Switzerland.

March 2004, *Rational Invariant Theory*, 2nd Latin American School and Workshop on Polynomial Systems, Angra dos Reis, Brazil.

February 2004, *Castelnuovo-Mumford Regularity of Subspace Arrangements and Invariant Theory*, Berkeley-Stanford joint Algebraic Geometry Seminar.

December 2003, International Conference on Commutative Algebra and Combinatorics, Allahabad, India.

November 2003, University of Toronto, Toronto, ON, Canada.

October 2003, Northeastern University, Boston, MA.

September 2003, *Hilbert Series of Invariant Rings*, Midwest Lie Theory Conference, Eau Claire, WI.

September 2003, University of Wisconsin, Madison, WI.

April 2003, *Semi-Invariants for Quivers* (lecture series), Oberwolfach, Germany.

February 2003, *Applications of Quiver Representations II*, workshop, MSRI, Berkeley, CA.

July 2002, *Invariant Theory for Quivers* (lecture series), ICRA X, Toronto, ON, Canada.

April 2002, *Invariant Theory* (lecture series), Workshop on Invariant Theory, Kingston, ON, Canada.

August 2001, *Quiver Representations and LR-Coefficients*, Workshop Integrable Models, Combinatorics and Representation Theory, RIMS, Kyoto, Japan.

May 2001, *Record Breaking Codes / Quivers and LR-Coefficients*, Northeastern University, Boston, MA.

March 2001, Conference Algebraic Groups, Oberwolfach, Germany.

February 2001, *Semi-Invariants of Quivers and Klyachko's Saturation Problem*, Queens University, Kingston, ON, Canada.

September 2000, *On the σ-Stable Decomposition*, summer school, Geometry of Quiver Representations, England.

August 2000, *On the σ-Stable Decomposition of Dimension Vectors*, ICRA IX, Beijing, China.

January 2000, *Semi-Invariants of Quivers and Klyachko's Saturation Problem*, Rutgers University, Piscataway, NJ.

January 2000, *Semi-Invariants of Quivers and Klyachko's Saturation Problem*, University of Michigan, Ann Arbor, MI.

November 1999, *Semi-Invariants of Quivers and Klyachko's Saturation Problem*, Yale University, New Haven, CT.

November 1999, Conference Representations de Groupes Algébriques.

July 1999, *The Automorphism Group of $\mathbf{C}^n$ is Small*, conference, Poly '99, Krakow, Poland.

February 1999, *Constructive Invariant Theory*, conference, Groupes de Galois différentiels, CIRM, Luminy, France.

October 1998, *Constructive Invariant Theory*, MSRI, Berkeley, CA.

June 1998, *Constructive Invariant Theory*, conference, MEGA 98, Saint Malo, France.

April 1999, *Semi-Invariants of Quivers and Klyachko's Saturation Problem*, Princeton University, Princeton, NJ.

April 1998, *Semi-Invariants of Quivers and Klyachko's Saturation Problem*, Northeastern University, Boston, MA.

April 1998, *Constructive Invariant Theory*, Massachusetts Institute of Technology, Cambridge, MA.

March 1998, *Constructive Invariant Theory*, AIDA Workshop, Nunspeet, the Netherlands.

February 1998, *Computation of Reductive Group Invariants / Polynomial Bounds for Invariant Rings*, Florida State University, Tallahassee, FL.

October 1997, *The Holomorphic Linearization Problem*, Brandeis University, Waltham, MA.

October 1997, *Computation of Reductive Group Invariants*, McGill University, Montreal, Canada.

June 1997, conference, *The Holomorphic Linearization Problem*, Algebra Tagen, Berne, Switzerland.

April 1997, conference, *Computation of Reductive Group Invariants*, Invariants and Representations of Algebras, Essen, Germany.

October 1996, conference, *The Holomorphic Linearization Problem*, Groupes Algébriques de Transformations, CIRM, Luminy, France.

October 1996, *The Linearization Problem*, University of Innsbruck, Austria.

July 1996, summer school, *Constructive Invariant Theory* (2 lectures), Monastir, Tunisia.

July 1996, *Computation of Reductive Group Invariants*, Heidelberg University, Germany.

May 1996, *Computation of Reductive Group Invariants*, Computational Invariant Theory, Dagstuhl, Germany.

September 1995, *Computation of Reductive Group Invariants*, University of Nijmegen, the Netherlands.

June 1995, conference, *Computation of Reductive Group Invariants*, Contact Franco-Belge, Reims, France.

July 1994, conference, *Quotients of Reductive Group Actions*, Automorphisms of Affine Spaces, Curaçao, the Netherlands Antilles.

December 1993, *The Kernel of a Derivation*, Institute Henri Poincaré, Paris, France.

October 1993, *The Kernel of a Derivation / Inverse Degrees and the Jacobian Conjecture*, Krakow, Poland.