Curriculum Vitae

Frank Sottile

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Education

University of Chicago, Ph.D. in Mathematics, August 1994.
Real enumerative geometry for the Grassmannian of lines in projective space
Ph.D. Supervisor: William Fulton
M.S. in Mathematics. 1989.
Cambridge University, CPGS, Mathematical Tripos, Part III (with distinction). 1986.
Michigan State University, Honors B.S., Physics, summa cum laude. 1985.

Employment

September 2006—, Professor of Mathematics, Texas A&M University
August 2004–August 2006, Associate Professor of Mathematics, Texas A&M University
November–December 2005, Professeur invité, Institute Henri Poincaré, Paris.
January 1–June 15, 2004, Clay Mathematical Institute Research Scholar
September 1999–July 2004, Assistant Professor of Mathematics, University of Massachusetts, Amherst. (On leave August 1999–August 2000 and January–July 2004.)
June 2001, maître de conférence invité, IRMAR, Université de Rennes I, France.
June/July 1999. Visitor, Université de Genève, Switzerland.
May/June 1999, maître de conférence invité, IRMA, Université de Louis Pasteur, Strasbourg, France.
January 1999–June 2000, Van Vleck visiting assistant professor, University of Wisconsin, Madison.
August–December 1998, Postdoctoral Fellow, Program in Symbolic Computation, Mathematical Sciences Research Institute, Berkeley, California.
August 1996–June 1997, Postdoctoral Fellow, Program in Algebraic Combinatorics, Mathematical Sciences Research Institute, Berkeley, California.
July 1994–June 1998, Assistant Professor of Mathematics, University of Toronto. (Leave of absence August 1996–July 1997)

Awards and Fellowships

Kavli Fellow, National Academy of Sciences' Japanese-American Frontiers of Science Symposium, 1–3 December 2007, Kanagawa, Japan.
Clay Mathematical Institute Research Scholar January 1–June 15, 2004.
NSF CAREER Award, "Computation, Combinatorics, and Reality in Algebraic Geometry, with Applications" 1 August 2002 - 31 July 2007.
National Science Foundation Graduate Fellow. 1986–1989.

Winston Churchill Foundation Graduate Fellow, Churchill College, Cambridge University, 1985–1986.

Research Grants and Fellowships

Kavli Fellow of the US National Academy of Sciences, Japanese-American Frontiers of Science Symposium, 1–3 December 2007, Kanagawa, Japan.

IRTAG travel grant, "Bounds for real solutions to polynomial equations", to visit coauthor Frédéric Bihan and the Centre Interfacultaire Bernoulli. April 14–May 9 2008. $2,000.

NSF Individual Research grant, "Applicable Algebraic Geometry: Real Solutions, Applications, and Combinatorics", 1 September 2007 – 31 August 2010. $202,895. DMS-0701050

NSF CAREER grant: Computation, Combinatorics, and Reality in Algebraic Geometry, 1 August 2002–31 July 2007. DMS-0134860.

Co-Principal Investigator, Scientific Computing Research Initiative in the Mathematical Sciences grant, 1 September 2000–31 August 2003. DMS-0079536.

NSF Individual Research Grant, 1 June 2000–31 July 2002. DMS-0070494.

NSERC Individual Research Grant. April 1995–June 1998. OGP0170279.

Grants and Fellowships

NSF conference grant, "Enumeration and bounds in real algebraic geometry", April 21–25 2008, Bernoulli centre, EPFL, Lausanne, Switzerland. DMS-0800253. $12,000.

Proposal for Semester on "Real Algebraic Geometry and Tropical Geometry" at the Bernoulli Centre, EPFL Lausanne, Switzerland. Joint with S. Kharlamov, I. Itenburg, and B. Shapiro. Part of the request for continuing funding of the Bernoulli Centre to the Swiss Government.

Grant: "Summer School on Applicable Algebraic Geometry", 22 July – 11 August 2007. DMS-0704355.

National Security Agency conference grant to fund US participation at the Coloquio Latinamericano di Álgebra in Colonia, Uruguay, 1–12 August, 2005. Co-PIs: Prof. S. Montgomery, University of Southern California, and J. Wolf, University of California at Berkeley. DOD - National Security Agency #0501153.

Texas A&M University internal grant for "Year of the International Student", to help fund participantion of three graduate students at the Coloquio Latinamericano di Álgebra in Colonia, Uruguay, 1–12 August, 2005. Co-PIs: Professors M. Aguiar, H. Schenck, and S. Witherspoon.

National Security Agency conference grant for workshop on "Algorithmic, Combinatorial, and Applicable Real Algebraic Geometry", MSRI, 16–21 April 2004.

National Science Foundation Conference Grant for workshop on "Real Algebraic Geometry and Geometric Modelling", MSRI, 3–4 April 2004.

National Security Agency conference grant for Discrete Mathematics in New England Conferences, 1 September 2002–31 August 2004. MDA 904-02-1-0125.

Five Colleges Lecture Fund for Valley Discrete Math Day, 12 October 2001.

University of Toronto Connaught Fund Committee for International Symposia Grant (for Formal Power Series and Algebraic Combinatorics 1998). March 1997.

Refereed Publications

[1] *Intersection theory on spherical varieties*, with W. Fulton, R. MacPherson, and B. Sturmfels, J. Alg. Geom., **4** (1995), 181–193.

[2] *Pieri's formula for flag manifolds and Schubert polynomials*, Annales de l'Institut Fourier, **46** (1996), 89–110.

[3] *Tableau switching: algorithms and applications*, with G. Benkart and J. Stroomer, J. Combin. Th. Ser. A, **76** (1996), 11–43.

[4] *Enumerative geometry for the real Grassmannian of lines in projective space*, Duke Math. J., **87** (1997), 59–85.

[5] *Real enumerative geometry and effective algebraic equivalence*, J. Pure and Appl. Algebra, **117** & **118** (1997), 601–615.

[6] *Enumerative geometry for real varieties*, in Algebraic Geometry, Santa Cruz 1995, ed. by J. Kollár, R. Lazarsfeld, and D. Morrison, PSPUM 61, No. 1, AMS 1997. 435–447.

[7] *Pieri's formula via explicit rational equivalence*, Canad. J. Math., **46** (1997), 1281–1298.

[8] *Some remarks on real and complex output feedback*, with J. Rosenthal, Sys. & Control Lett., **33** (1998), 73–80.

[9] *Schubert polynomials, the Bruhat order, and the geometry of flag manifolds*, with Nantel Bergeron, Duke Math. J., **94** (1998), 273–423.

[10] *Numerical Schubert calculus*, with B. Huber and B. Sturmfels, J. Symb. Comp., **26** (1998), 767–788.

[11] *The special Schubert calculus is real*, ERA of the AMS, **5** (1999), 35–39.

[12] *A monoid for the Grassmannian Bruhat order*, with N. Bergeron. Europ. J. Combin., **20** (1999), 197–211.

[13] *Hopf algebras and edge-labeled posets*, with N. Bergeron, J. Algebra, **216** (1999) 641–651.

[14] *Pieri-type formulas for maximal isotropic Grassmannians via triple intersections*, Colloq. Math., **82** (1999), 49–63.

[15] *Real rational curves in Grassmannians*, J. Amer. Math. Soc., **13** (2000), 333–341.

[16] *Real Schubert calculus: Polynomial systems and a conjecture of Shapiro and Shapiro*, Exper. Math., **9** (2000), 161–182.

[17] *Non-commutative Pieri operators on posets*, with N. Bergeron, S. Mykytiuk, and S. van Willigenburg, J. Combin. Th. Ser. A, **91** (2000), 84–100.

[18] *Some real and unreal enumerative geometry for flag manifolds*, Mich. Math. J. **48** (2000), 573–592.

[19] *A sagbi basis for the quantum Grassmannian*, with B. Sturmfels, J. Pure and Appl. Algebra, **158** (2001), 347–366.

[20] *Rational curves on Grassmannians: systems theory, reality, and transversality*, in "Advances in algebraic geometry motivated by physics (Lowell, MA, 2000)", E. Previato, Ed., Contemp. Math., **276**, Amer. Math. Soc., Providence, RI, 2001, 9–42.

[21] *Complementary algorithms for tableaux*, with with T. Roby, J. Stroomer, and J. West, J. Combin. Th. Ser. A, **96** (2001), 127–161.

[22] *From enumerative geometry to solving systems of polynomial equations with Macaulay 2*, in "Computations in algebraic geometry with Macaulay 2", D. Eisenbud, D. Grayson, M. Stillman, and B. Sturmfels, eds. Algorithms and Computation in Mathematics **8**, Springer-Verlag 2001, 101–129.

[23] *Skew Schubert functions and the Pieri formula for flag manifolds*, with N. Bergeron, Trans. Amer. Math. Soc., **354** (2002), 651–673.

[24] *Shifted quasi-symmetric functions and the Hopf algebra of peak functions*, with Nantel Bergeron, S. Mykytiuk, and S. van Willigenburg, Discrete Math., **256** (2002), 57–66.

[25] *A Pieri-type formula for isotropic flag manifolds*, with N. Bergeron, Trans. Amer. Math. Soc., **354** (2002), 2659–2705.

[26] *Lines tangent to $2n-2$ spheres in $\mathbb{R}^n$*, with T. Theobald, Trans. Amer. Math. Soc., **354**, (2002), 4815–4829.

[27] *Skew Schubert polynomials*, with C. Lenart. Proc. Amer. Math. Soc., **131** (2003), 3319–3328.

[28] *Enumerative real algebraic geometry*, in Algorithmic and Quantitative Real Algebraic Geometry, L. Gonzalez-Vega and S. Basu, eds., DIMACS series volume 60, AMS, 2003. 139–180.

[29] *Toric ideals, real toric varieties, and the moment map*, in "Topics in Algebraic Geometry and Geometric Modeling", ed. by R. Goldman and R. Krasuaskas, Contemp. Math. 334, 2003. 225–240. (Proceedings of AGGM, Vilnius, Lithuania.)

[30] *Elementary transversality in the Schubert calculus in any characteristic*, Michigan Math Journal, 51 (2003), 651–666.

[31] *Common transversals and tangents to two lines and two quadrics in $\mathbb{P}^3$*, with G. Megyesi and T. Theobald. Discrete and Computational Geometry, 30, (2003), 543–571.

[32] *Maximally inflected real rational curves*, with V. Kharlamov. Moscow Mathematics Journal, 3 (2003), Number 3, 947–987.

[33] *A new approach to Hilbert's theorem on ternary quartics*, with V. Powers, B. Reznick, and C. Scheiderer, C. R. Math. Acad. Sci. Paris 339 (2004), no. 9, 617–620.

[34] *Structure of the Malvenuto-Reutenauer Hopf algebra of permutations*, with M. Aguiar. Advances in Mathematics, 191 (2005), 225–275.

[35] *The envelope of lines meeting a fixed line that are tangent to two spheres*, with G. Megyesi. Discr. Comput. Geom, **33**, Number 4, (2005) 617–644.

[36] *Real lines tangent to $2n-2$ quadrics in $\mathbb{R}^n$*, with T. Theobald. Proc. Amer. Math. Soc., 133 (2005), 2835–2844.

[37] *Quiver Coefficients are Schubert Structure Constants*, with A. Buch and A. Yong. Mathematics Research Letters, Volume 12, Issue 4, (2005) 567–574.

[38] *Transversals to line segments in $\mathbb{R}^3$*, with H. Brönnimann, H. Everett, S. Lazard, and S. Whitesides. Discr. Comput. Geometry, **34**, Number 3, (2005), 381–390. August 2005.

[39] *Structure of the Loday-Ronco Hopf algebra of trees*, with M. Aguiar. J. Algebra, **295** (2006), Issue 2, 473–511.

[40] *Combinatorial Hopf algebras and generalized Dehn-Sommerville relations*, with M. Aguiar and N. Bergeron. Compositio Mathematica, Volume 142, (2006), Issue 1, 1–30.

[41] *Commutative Hopf algebras of permutations and trees*, with M. Aguiar. J. Algebraic Combinatorics, Volume 22, Number 4, December 2005. 451 – 470.

[42] *Cremona Convexity, Frame Convexity, and a Theorem of Santaló*, with J. Goodman, A. Holmsen, R. Pollack, and K. Ranestad. Advances in Geometry, **6**, No. 3, (2006), 301–322.

[43] *Lower Bounds for Real Solutions to Sparse Polynomial Systems*, with E. Soprunova. Advances in Mathematics, **204**, (2006), 116–151.

[44] *Polynomial systems with few real zeroes*, with B. Bertrand and F. Bihan. Mathematisches Zeitschrift, **253**, No. 2, (2006), 361–385.

[45] *Experimentation and conjectures in the real Schubert calculus for flag manifolds*, with J. Ruffo, Y. Sivan, and E. Soprunova. Experimental Mathematics, **15**, No. 2, (2006), 199–221.

[46] *Grothendieck polynomials via permutation patterns and chains in the Bruhat order*, with C. Lenart and S. Robinson. Amer. J. Math., **128**, (2006), 805–848.

[47] *Irrational proofs of three theorems of Stanley*, with M. Beck. European Journal of Combinatorics, **28** (2007), 403-409.

[48] *A Pieri-type formula in the K-theory of a flag manifold*, with C. Lenart. Trans. AMS, **359** (2007), 2317-2342.

[49] *Line tangents to four triangles in three-dimensional space*, with H. Brönnimann, O. Devillers, and S. Lazard. Discrete and Computational Geometry, **37**, No. 3, (2007), 369–380.

[50] *Real Hessian curves*, with A. Ortiz-Rodríguez. Boll. Soc. Math. Mexico, **13**, No. 1, 2007.

[51] *New Fewnomial Upper Bounds from Gale dual polynomial systems*, with Frédéric Bihan, Moscow Mathematics Journal, **7** (2007), Number 3, 387–407.

[52] *Sharpness of fewnomial bound and the number of components of a fewnomial hypersurface*, with F. Bihan and M. Rojas, IMA Volume 146: Algorithms in Algebraic Geometry edited by Alicia Dickenstein, Frank-Olaf Schreyer, and Andrew J. Sommese. pp. 15–20, Springer, New York, 2007.

[53] *Bounds on the number of real solutions to polynomial equations*, with Daniel J. Bates, Frédéric Bihan, IMRN, 2007, 2007:rnm114-7.

[54] *Line problems in non-linear computational geometry*, with T. Theobald. Surveys in Discrete and Computational Geometry - Twenty Years Later, Contemporary Mathematics,**453** AMS, pp. 411–432, 2008.

Accepted Manuscripts

[55] *The recursive nature of cominuscule Schubert calculus*, with K. Purbhoo. `math.AG/0607669`, Advances in Math, to appear.

[56] *Gale duality for complete intersections*, with Frédéric Bihan, 10 pages. Annales de l'Institut Fourier, to appear.

Manuscripts in Review

[57] *Equivariant Chow groups of the quot scheme*, with T. Braden and L. Chen.

[58]  (Theorems of Brion, Lawrence, and Varchenko on rational generating functions for cones), with M. Beck and Ch. Haase.

[59] *Linear precision for parametric patches*, with Luis Garcia 20 pages. `arXiv:0706.2116`.

[60] *A Littlewood-Richardson rule for Grassmannian permutations*, with Kevin Purbhoo `ArXiv.org/0708.1582`.

[61] *Galois groups of Schubert problems via numerical homotopy continuation*, with A. Leykin, `ArXiV:0710.4607`.

[62] *Convex Hulls of Orbits and Orientations of a Moving Protein Domain*, with Marco Longinetti and Luca Sgheri, `ArXiV:0712.3777`.

[63] *Betti number bounds for fewnomial hypersurfaces via stratified Morse theory*, with Frédéric Bihan, `arXiv:0801.2554`.

[64] *General isotropic flags are general (for Grassmannian Schubert calculus)*, `arXiV:math.AG/0801.2611`.

Refereed Conference Abstracts

[1] *A geometric approach to the combinatorics of Schubert polynomials*, in Proc. Formal Power Series and Algebraic Combinatorics, May 29–June 2, 1995, Marne-la-Valée, Paris, 501–510. (see [2] above).

[2] *Identities of Littlewood-Richardson coefficients for Schubert polynomials and orders on S_n*, with Nantel Bergeron, in Proc. Formal Power Series and Algebraic Combinatorics, 14–18 July, 1997, Universität Wien, vol. 1, 84–94. (see [9] above).

[3] *Shifted quasi-symmetric functions and the Hopf algebra of peak functions*, with N. Bergeron, S. Mykytiuk, and S. van Willigenburg, in Proc. Formal Power Series and Algebraic Combinatorics, Barcelona, 7–11 June 1999. (see [24] above).

[4] *Jeux de tableaux*, with T. Roby, J. Stroomer, and J. West, in Formal Power Series and Algebraic Combinatorics, Moscow. D. Krob, A.A. Mikhaelev, and A.V. Mikhaelev, eds., Springer-Verlag, 2000. 332–343. (see [21] above).

[5] *Structure of the Malvenuto-Reutenauer Hopf algebra of permutations (Extended Abstract)*, with M. Aguiar, in Proc. Formal Power Series and Algebraic Combinatorics, Melbourne, Australia, 8–13 July 2002. (see [34] above).

[6] *Transversals to line segments in $\mathbb{R}^3$*, with H. Brönnimann, H. Everett, S. Lazard, and S. Whitesides. For 15th Canadian Conference on Computational Geometry, Dalhousie University, Halifax, Canada. 11–13 August, 2003. (see [38] above).

[7] *On the number of line tangents to four triangles in three-dimensional space*, with H. Brönnimann, O. Devillers, and S. Lazard. For 16th Canadian Conference on Computational Geometry, Concordia University, 2004. (See [49] above.)

[8] *Experimentation and conjectures in the real Schubert calculus for flag manifolds*, with J. Ruffo, Y. Sivan, and E. Soprounova. for MEGA '05, Alghero, Sardinia, Italy, 26 May–2 June 2005. (See [45] above.)

[9] *The Horn recursion for Schur P- and Q- functions*, with K. Purbhoo. Accepted as a talk at the 18th Conference on Formal Power Series and Algebraic Combinatorics, San Diego, CA, June 2006. (See [55] above.)

[10] *Computing monodromy via parallel homotopy continuation*, With Anton Leykin. Accepted as a talk at Parallel Symbolic Computation'07, 27 - 28 July 2007 University of Western Ontario. (See [61] above.)

Other Mathematical Publications

[1] *A graduate student's view of the international congress of mathematicians*, Mathematical Intelligencer, **9** No. 2 (1987) 33–35.

[2] *Beating the Cost of Meetings, Giving Math Talks*, AMS Special Sessions*, Getting Started in Research: a personal perspective*, four contributions to Starting Our Careers: A Collection of Essays and Advice on Professional Development from the Young Mathematicians' Network. A. Crandel and C. Bennett, eds., AMS 1999. (* written with C. Bennett.)

[3] Proceedings, 10 International Conference on Formal Power Series and Algebraic Combinatorics (10ième conférence, les séries formelles et la combinatoire algebriques) 14–19 June 1998, Fields Institute, Toronto. Ed. by N. Bergeron, I. Goulden, and F. Sottile.

[4] *Schubert Calculus; Schubert Cell; Schubert Cycle; and Schubert Polynomial*, four entries for the Kluwer Encyclopaedia of Mathematics, Supplement III. Kluwer Academic Publishers, 2002, 343–346.

[5] Letter to the editor of the Notices of the AMS concerning the Digital Millenium Copyright Act, (also signed by G. Avrunin, A. Buch, and A. Hwang). Notices of the AMS, **49**, No. 3, (2002), page 310.
[6] *Tropical Interpolation*, for the MSRI newletter in Autumn 2004.
[7] *Gale duality for complete intersections*, With Frédéric Bihan. Abstract for Oberwolfach report on the workshop on tropical geometry, 10–14 December 2007.

WWW pages. See `www.math.tamu.edu/~sottile/pages/index.html`

[1] *A non-trivial real system that cannot be controlled by real output feedback*. Work with J. Rosenthal. September 1997.
[2] *Identities of Littlewood-Richardson coefficients for Schubert polynomials*. Work with N. Bergeron, August 1998.
[3] *The conjectures of Shapiro and Shapiro: an archive of computations*. April 2000.
[4] *Enumerative real algebraic geometry*. Web-based survey. June 2001.
[5] *Lines transversal to* 2 *lines and a quadric*. Work with G. Megyesi and T. Theobald. April 2002.
[6] *Some maximally inflected curves*. Work with V. Kharlamov. July 2002.
[7] *Combinatorial Hopf algebras*. Work with M. Aguiar and N. Bergeron. Computations and examples. September 2002.
[8] *Experimentation and conjectures in the real Schubert calculus*. Work with J. Ruffo, Y. Sivan, and J. Soprounova. August 2003.

Teaching Experience

Michigan State University.
Teaching Assistant, Calculus and Analytic Geometry, 1982–1985.

University of Cambridge
Undergraduate Supervisions (tutorials), 1987–1988.

University of Chicago
Calculus, Autumn 1990–Spring 1992.
Topology and the Infinite, Autumn 1992.
Number Theory, Spring 1993.
Quantitative Analysis (program for entering minority students), Summer 1993.

University of Toronto
Winter 1995: Graduate reading course on Elliptic Curves.
1994-95, 1995-96, and 1997-98: Math 137Y, Proof-based Calculus. Large lecture.
Winter 1995, 1996, and 1998: Math 344S, Introduction to Combinatorics.
Autumn 1994 and 1995: Math 267F, Advanced Ordinary Differential Equations.
Autumn 1997: Math 280F, Multivariate Engineering Calculus. Large Lecture.

University of Wisconsin-Madison

Winter 1999:	Math 320: Differential Equations and Linear Algebra
	Math 213: Calculus and Introduction to Differential Equations.
Autumn 1999:	Math 763: Introduction to Algebraic Geometry
	Math 130: Arithmetical Problem Solving
Winter 2000:	Math 841: Geometry of Linear Algebraic Groups
	Math 130: Arithmetical Problem Solving

University of Massachusetts

Autumn 2000: Math 697R: Applicable Algebraic Geometry
Winter 2001: Math 131: Calculus I, Sections 9 and 11.
Autumn 2001: Reading Course: Algebraic Geometry w/ Jim Ruffo
Winter 2002: Math 411: Introduction to Abstract Algebra
Reading Course: Schubert Calculus w/ Jim Ruffo
Autumn 2002: Math 127: Calculus I
Math 411: Introduction to Abstract Algebra
Reading Course/Senior Honors Thesis: w/ Chris Strader.
Spring 2003: Math 131: Course Chair, Calculus I
Math 412: Introduction to Abstract Algebra
Reading Course/Senior Honors Thesis: w/ Chris Strader.
Autumn 2003: Math 127H: Honors calculus for the life sciences
Math 697W: Symmetric Functions

Texas A&M University

Autumn 2004: Math 662: Young Tableaux
Spring 2005: Math 171: Calculus, early vectors

Institut Henri Poincaré

November 2005: Real solutions to equations from geometry.

Texas A&M University

Autumn 2006: Math 151H: Honors Introductoryy Calculus
Math 311: Advanced Engineering Mathematics.
Spring 2007: Math 689: Introduction to Applicable Algebraic Geometry
Summer 2007: Math 689: Applicable Algebraic Geometry
Autumn 2007: Math 221: Multivariate Calculus
Math 648: Computational Algebraic Geometry.

Supervision of Students and Thesis Committees

Postdoctoral advisor, Greg Warrington, September 2001 – June 2003.
Postdoctoral advisor, Eugenia Soprounova, September 2002 – July 2004.
Postdoctoral advisor, Luis Garcia, January 2005 – July 2007.
NSF Postdoctoral advisor, Chris Hillar, Since August 2005.

Thesis advisor, Mariana Pereira, Spring 2003–Autumn 2004. (She changed advisors).
Thesis advisor, Jim Ruffo, August 2001–August 2007. Ph.D. 2007.
Thesis advisor, Corey Irving, since August 2006.
Thesis advisor, Abraham Martin Del Campo Sanchez, since September 2006.
Thesis advisor, Nikolas Hein, since August 2007.

Thesis committees, external.

External examiner for Kuimars Kaveh, Ph.D. 2002, University of Toronto.
External examiner for Stefan Mykytiuk, Ph.D. 2002, York University.
Thesis committee, Seongchun Kwon, Ph.D. 2003, Michigan State University.

Thesis committees, Texas A& M.

(Chair) James Ruffo, Ph.D. 2007.
Mariana Pereira, Ph.D. 2006.

Waqar Malik, Mechanical Engineering, Ph.D. 2006.

Walter Moreira, 2006–
Luke Oeding, 2005–
Svetlana Poznanovik, 2006–
Xiaolong Tang, Mechanical Engineering, 2007–
Phong Sy Nguyen, Electrical And Computer Engineering, 2007–

Academic advisor, Sarah Croog, Autumn 2002.
Advisor for senior honor's thesis, Chris Strader, 2002–2003.
Supervisor for Undergraduate Research, Yuval Sivan, Summer/Autumn 2003.

Departmental Service

1995-1996 Organized the Algebraic Geometry Seminar at the University of Toronto.
1997-1998 Colloquium Committee for the Department of Mathematics at the University of Toronto.
Co-organizer of the Valley Geometry Seminar Winter 2001–Autumn 2003.
Chair, Colloquium Committee, Department of Mathematics, U. Mass., 2002-2003.
Organizer, Algebraic Geometry Seminar, Texas A&M University, Autumn 2004.
Graduate Affairs Committee, Department of Mathematics, Texas A&M University, 2004-2005.
Co-organizer of the Algebra and Combinatorics Seminar, Autumn 2006 and Winter 2007.
Executive Committee, Texas A&M University, 2006-2008.

Professional Service

Conference organization

Member, Scientific Committee for "Métodos Efectivos en Geometría Algebraica" (MEGA09) in Barcelona, Spain, 2009.
Member, Organizing Committee for CombinaTexas 2008 in El Paso, Texas, April 2008.
Co-organizer (with B. Shapiro), Workshop on "Enumeration and bounds in real algebraic geometry", Bernoulli Center of the EPFL, 21–26 April 2008.
Semester on "Real Algebraic Geometry and Tropical Geometry" at the Bernoulli Centre, EPFL Lausanne, Switzerland. Co-organizer with S. Kharlamov, I. Itenburg, and B. Shapiro. January—June 2008.
Member, Scientific Committee for "Mathematics of Computer and Information Sciences" (MACIS07) in Paris, France, December 2007.
Lead Organizer (With L. Matusevich and T. Theobald), IMA 2007 Summer PI Graduate Program, "Applicable Algebraic Geometry", July–August 2007.
Lead Organizer for Workshop on "Non-linear Computational Geometry" at the IMA, May-June 2007.
Co-organizer (with J. Carrell) Workshop on "Contemporary Schubert Calculus and Schubert Geometry" at the Banff Institute Research Station, 18-23 March 2007.
Co-organizer (with A. Ram) AMS special session on "Combinatorial Representation Theory" at the Fall AMS resional meeting in Fayetteville, Arkansas, 3-4 November 2006.
Co-organizer (with S. Lall, V. Powers, and S. Kuhlmann) Workshop on "Positive Polynomials and Optimization" at the Banff Institute Research Station, 7-12 October 2006.
Member, program committee, SIAM Conference on Discrete Mathematics, University of Victoria, Victoria BC, Canada. June 25-28, 2006.

Co-organizer (with J.M. Landsberg, H. Schenck, and P. Lima-Filho) Texas Algebraic Geometry Seminar, May 2006.

Steering Committee, Effective Methods in Algebraic Geometry, 26 May - 2 June 2005, Porto Conte, Alghero, Sardinia, Italy.

Co-organizer (with Ezra Miller) Special Session on The Modern Schubert Calculus, 2004 Fall Central Section Meeting of the AMS, October 23-24, 2004 Evanston, IL.

Co-organizer (N. Bergeron, L. Billera, and S. van Willigenburg) Workshop on "Combinatorial Hopf Algebras" at the Banff Institute Research Station, 28 August – 2 September 2004.

Member of Program Committee for "Formal Power Series and Algebraic Combinatorics", June 28–July 2, 2004, University of British Columbia, Vancouver, Canada.

Co-organizer (with Pedro Luis Del Angel R., Isidro Nieto, and Emma Previato) Special Session on Algebraic Geometry at the Joint AMS-SMM International Meeting, Houston, TX, 13-15 May 2004.

Co-organizer (with V. Powers and L. Gonzalez-Vega), Algorithmic, Combinatorial and Applicable Real Algebraic Geometry, MSRI, April 12–16, 2004.

Organizer, "Geometric Modeling and Real Algebraic Geometry", MSRI, 3–4 April, 2004.

Organizing Committee, Introductory Workshop in Topological Aspects of Real Algebraic Geometry, MSRI, January 12–16, 2004.

Chair of Organizing Committee "Topological methods in Real Algebraic Geometry", a semester-long program at MSRI Berkeley, January–June 2004.

Co-organizer (with Prof. Dr. F.-O. Schreyer and C. Lossen) of DMV Oberwolfach-Seminar on Computational Algebraic Geometry. MFI Oberwolfach, 16–22 November 2003.

Co-organizer (with C. Andradas, A. Diaz-Campo, and V. Powers) Special Session on Real Algebraic Geometry, AMS-RMSE Joint International meeting in Seville, Spain, 18-21 June 2003.

Member of Conference Committee for "Effective Methods in Algebraic Geometry", 10–14 June 2003, Kaiserslautern, Germany.

Member of Steering Committee for "Discrete Mathematics in the Northeast" conference series. October 2001 – December 2003.

Member of Program Committee for "Formal Power Series and Algebraic Combinatorics", 8–12 July 2002, University of Melbourne, Australia.

Co-organizer (with C. Woodward) Special Session on The Modern Schubert Calculus, 2002 Fall Eastern Section Meeting of the AMS, Boston, MA, 5–6 October 2002.

Organizer, "Valley Discrete Math Day", 12 October 2001, University of Massachusetts, Amherst.

Co-organizer (with S. Hoşten) Special Session on Computational Algebraic Geometry and its Applications, Spring Eastern Section Meeting of the AMS Hoboken, NJ, 28–29 April 2001.

Co-organizer (with J. de Loera) Special Session on Algebraic and Geometric Combinatorics, Fall Western Section Meeting of the AMS San Francisco, CA, October 21–22, 2000.

Co-organizer (with N. Bergeron) Special Session on the Modern Schubert Calculus, Fall Central Section Meeting of the AMS, Toronto, Ontario, CANADA, September 22–24, 2000.

Co-organizer (with R. Lazarsfeld) of A Workshop in Algebraic Geometry in Honor of William Fulton, University of Michigan, Ann Arbor, Michigan, 14–16 April 2000.

Organizing and Programme Committees, 10th International Conference on Formal Power Series and Algebraic Combinatorics, 15–19 June 1998, Toronto.

Editing, Refereeing, and Reviewing

Editor (with I. Emiris and T. Theobald) Proceedings of IMA Workshop on Nonlinear Computational Geometry. (in progress)

Member of Editorial Board, SIAM Journal on Discrete Mathematics, since January 2004.

Guest editor (with J. de Loera and B. Sturmfels), Special issue of Discrete and Computational Geometry on Geometric Combinatorics. **27**, No. 1, (2002).

Guest editor (with N. Bergeron and I. Goulden), Discrete Mathematics Special Issue, "Formal Power Series and Algebraic Combinatorics, Toronto, 1998", **225** Nos. 1–3, (2000).

Editorial Board of the Young Mathematicians Network. August 1994–August 1999.

Referee for the following journals/conferences. Numbers in parentheses represent how often served in this capacity.

Advances in Geometry	Advances in Math. (7)
American J. Math.	Annals of Math. (2)
Annales d'l'Institut Fourier	Arabian J. Sci. Engr.
Asian J. Math. (2)	Boletin Soc. Math. Mexico
Bulletin of the AMS	Bulletin of Canadian Math. Soc.
Canadian Journal of Mathematics	Combinatorica
Computational Geom. Th. & Appl.	Computer Aided Geometric Design (2)
Comp. Alg. in Sci. Comput.	Comunications in Algebra (2)
Constructive Approximation	Discrete & Comput. Geometry (11)
Discrete Mathematics (4)	Documenta Mathematica
Duke Mathematical Journal (3)	Electronic J. Combinatorics (4)
Experimental Math. (3)	European J. Combin. (3)
FPSAC conferences (21)	Foundations Comput. Math. (2)
Illinois J. Math. (2)	IJM (Allahabad)
Int. Math. Res. Notes	Int. J. Math.
Int. J. Math. and Math. Sci.	Inventiones Math.
ISSAC Conference	Journal of the AMS (4)
J. Algebra (4)	J. Algebraic Combinatorics (7)
J. Algebraic Geometry	J. Combinatorial Th. Series A (5)
J. Math. Phys.	J. Pure and Appl. Algebra
J. Symbolic Computation (8)	Linear Alg. and Applications (5)
London Math. Society (2)	MAA Monthly (2)
Mathematics of Computation (2)	MEGA conferences (6)
Michigan Math. J.	Pacific J. Math.
Proceedings of the AMS (7)	Quarterly J. Math.
Revista Matematica	Selecta Math.
Sem. Lotharingien Combin. (2)	SIAM J. Control & Optimization (4)
SIAM J. Discrete Math (5)	Special Publications (8)
Theoretical Computer Science	Topology
Transactions of the AMS (5)	ACM Transactions on Graphics
Turkish J. Math.	

NSF Panels, 2002, 2004, 2006.

Ad hoc reviewer for NSF (6), NSA (4), NSERC Canada (3), ISF Israel (1), and FONDECYT Chile (1) in 1999-01, 2004-08.

Reviewer for Math Reviews since April 2000. Have written 32 reviews.

Reviewer for Zentralblatt since August 2002. Have written 15 reviews.

Other Professional Service

Invited to be a panelist at NeXT workshop on "The path to tenure while starting a family" at the Alberqueque Mathfest in August 2005.

Invited to be a panelist at NeXT workshop on "Jump Starting your Research" at the Atlanta Mathfest in August 1997.

Moderator for YMN/MAA panel on the 2-body problem at the Joint Mathematical meetings in San Antonio, 13 January 1999.

Panelist at MSRI sponsor's day panel on "U.S. Mathematics Ph.D. production and the job market", 5 March 1999.

Nominated for position of member-at-large on the AMS council for the 2001 elections.

Member of the American Mathematical Society since 1988,
Society for Industrial and Applied Mathematics since 1998,
ACM SIG on Symbolic and Algebraic Manipulation since 2002.

Promotion, tenure, and reappointment letters for KTH Stockholm, Chalmers University, University of Illinois at Chicago, Texas A&M University (2), Stanford University, University of Connecticut, University of Waterloo, Michigan State University, Dartmouth College, Rutgers University, Nanyang Technological University, Singapore, Rutgers University Newark, and University of Washington.

Letter of Nomination for the Jenks Prize in Excellence in Symbolic-Computation Software Development for SINGULAR, 2004.

Letters of recommendation for academic jobs.

2000/1: Shawn Robinson, Marcelo Aguiar.
2001/2: Linda Chen, Mike Reid, Gregory Warrington, Stephanie van Willigenburg, Wayne Zandbergen.
2002/3: Linda Chen, Johann Huismann, Victor Kreiman, Seongchun Kwon, Mike Reid, Shawn Robinson, Eugenia Soprounova, Thorsten Theobald, Gregory Warrington, Alexander Yong.
2003/4: Nantel Bergeron, Seongchun Kwon, Alexander Yong, Kevin Purbhoo, Frédéric Bihan, Severine Fiedler.
2004/5: Frédéric Bihan, Benoît Bertrand, Greg Blekherman, Chris Hillar, Tara Holm, Seongchun Kwon, Jeremy Martin, Evgenia Soprunova.
2005/6: Luis Garcia, Ivan Soprunov, and Benoît Bertrand.
2006/7: Kevin Purbhoo, Luis Garcia, James Ruffo, Benoît Bertrand, and Evgenia Soprunova.
2007/8 Benoît Bertrand, Seth Sullivant, Chris Hillar, Sonja Petrovic, and Ezra Miller.

2003: Letter in support of sabbatical grant from Texas Tech University for David Weinberg.

2006: Letter in support of sabbatical grant from UNAM Mexico city for Javier Elizondo.

Letters of recommendation for graduate school.

1995/6: Gordon Goldthorpe.
1996/7: Matt Szczesny.
2000/1: Sarah Croog.
2002/3: Peter Gallagher, So Okada, Chris Strader, Sarah Croog.

2003/4: Chris Barrieau, Yuval Sivan.
2004/5: Don LaBonte.

Research Talks

Major Invited Talks

Bounds for real solutions to polynomial systems, (4 lectures) Introductory workshop, Semester on Real and Tropical Algebraic Geometry, CIB, EPFL, Lausanne, 21–25 Janauary 2008.

Real solutions to equations from geometry, graduate course, Institute Henri Poincaré, Paris, November-December 2005.

The Horn recursion in the cominuscule Schubert calculus, 6 August 2005, Plenary talk, XVI Coloquio Latinoamericano de Álgebra, 1 - 9 August 2005, Colonia, Uruguay.

Real Solutions to Polynomial Systems and Enumerative Real Algebraic Geometry I, II, III, 7-9 January 2004. Introductory workshop, Topological Aspects of Real Algebraic Geometry, MSRI.

Examples and Applications of Computational Algebraic Geometry, 17-21 November 2003, Oberwolfach-Seminar on Computational Algebraic Geometry, Mathematisches Forschunginstitute Oberwolfach.

The topology of real algebraic curves, and
$\mathbb{R}$*eal solutions to systems of equations*, Joint Howard University/MSRI Berkeley Workshop. September 21-22, 2002, Howard University, Washington DC.

A Gromov-Witten invariant in the real world, 28 April 2001, Invited Address, AMS Regional Meeting in Hoboken, NJ.

Quantum cohomology in the real world, 27 October 2000, Connecticut Valley Colloquium, Mt. Holyoke College.

Real enumerative geometry and solving systems of equations, A short course of 4 lectures, 26 May, and 2, 9, 16 June 1999, IRMA Strasbourg, France.

Invited 1-hour talks at conferences

Frontiers of reality in the Schubert calculus, Workshop on Real, tropical, and complex enumerative geometry. Centre de recherches mathematiques. 21 June 2007.

New Fewnomial Upper Bounds from Gale Dual Polynomial Systems, IMA workshop on Algorithms in Algebraic Geometry. 18–22 September 2006.

Line problems in nonlinear computational geometry, Discrete and Computational Geometry: Twenty Years Later. Snowbird, Utah, 18-23 June 2006.

The Shapiro Conjecture, 9 November 2005, workshop on Real Algebra, Quadratic Forms and Model Theory; Algorithms and Applications, Institute Henri Poincaré, Paris.

Bounds for real solutions to sparse polynomial systems, 9 September 2005, Annual Network Meeting - RAAG2005.

The Horn recursion in the Schubert calculus, 26 February 2005. CombinaTexas, San Marcos, Texas.

The Horn recursion in the cominuscule Schubert calculus, 15 February 2005. Trends in Topological Combinatorics, KTH Stockholm.

Real Solutions to Structured Equations, 1 April 2003. Commutative Algebra and Geometry, Banff International Research Station.

Tutorial on projective toric varieties, 30 July 2002, Algebraic Geometry and Geometric Modeling, Vilnius Lithuania.

Common transversals and tangents, 19 July 2002, Symbolic Computational Algebra, University of Western Ontario, London Ontario.

Topological lower bounds on the number of real solutions, 23 May 2002, Solving Systems of Polynomial Equations, Texas A&M University.

Enumerative real algebraic geometry, 14 June 2001, Real Algebraic and Analytic Geometry, Rennes, France.

Enumerative real algebraic geometry, 13 March 2001, Workshop on Algorithmic and Quantitative Aspects of Real Algebraic Geometry in Mathematics and Computer Science. DIMACS, Rutgers, New Jersey.

Polytopes and isotropic Schubert calculus, 14 October 2000, Combinatorialists of New England, Smith College.

Reality in the Schubert calculus, 11 September 2000, RiP-Workshop "Perspectives in Topology of Real Algebraic Varieties", MFI Oberwolfach, Germany.

Some real and unreal enumerative geometry, 21 June 2000, Effective Methods in Algebraic Geometry '00, Bath, England.

Some real and unreal conjectures in enumerative geometry, 12 June 2000, Symbolic Computation: Solving Equations in Algebra, Geometry, and Engineering, AMS-IMS-SIAM Joint Research Conference, Mt. Holyoke College.

Some real and unreal enumerative geometry for flag manifolds, 15 April 2000, Workshop in Algebraic Geometry in honor of William Fulton, University of Michigan, Ann Arbor.

A sagbi basis for the quantum Grassmannian, 4 June 1999, COCOA VI, Villa Gualino, Torino, Italy.

Feedback control of linear systems and the real Schubert calculus, 18 September 1998, Solving Systems of Equations Workshop, MSRI, Berkeley.

Pieri-type formulas for the classical groups, 4 April 1997, Schubert Varieties, MFI Oberwolfach, Germany.

Real enumerative geometry for Grassmannians, 29 July 1995, Computational Geometry Seminar, AMS Summer Research Institute in Algebraic Geometry, Santa Cruz.

Refereed talks

Identities of structure constants for Schubert polynomials and orders on the symmetric group, 16 July 1997, Formal Power Series and Algebraic Combinatorics, Vienna, Austria.

Identities of Littlewood-Richardson coefficients for Schubert polynomials, 15 April 1997, Symmetric Functions and Representation Theory Workshop, MSRI, Berkeley.

Real enumerative geometry and effective algebraic equivalence, 6 June 1996, Effective Methods in Algebraic Geometry, Eindhoven, The Netherlands.

Real enumerative geometry for the Grassmannian of lines in projective space, 2 July 1995, Real Algebraic and Analytic Geometry, Segovia, Spain.

A geometric approach to the combinatorics of Schubert polynomials, 29 May 1995, Formal Power Series and Algebraic Combinatorics, Marne-la-Valée, Paris.

Other conferences

Gale Duality for Complete Intersections, Tropical Geometry, Oberwolfach, 9–15 December 2007.

Real Solutions to Polynomial Equations, Japanese-American Frontiers of Science, Japan, 1-3 December 2007. Poster.

Linear precision for toric patches, COMPASS 07, Computational Methods for Algebraic Spline Surfaces, September 12, 2007, Strobl, Austria.

New fewnomial upper bounds, IMA workshop on Complexity, coding, and communications, 16–20 April 2007. Poster.

Optimal fewnomial bounds from Gale dual polynomial systems, Speedmath talk, AMS Session on Algebra and Number Theory, AMS national meeting, New Orleans. 6 January 2007.

Simple counting of integer points via irrationality, Special session on Extremal and Probabilistic Combinatorics, AMS Sectional Meeting in Fayetteville, Ar 3-4 November 2006.

Lower bounds for real polynomial systems from sign-imbalanced posets, Saturday on Discrete Mathematics in Darmstadt, 26 November 2005.

The convexity behind Santaló's Helley-type Theorem, 9 October 2005. Special session on geometric transversal theory, AMS Eastern Sectional Meeting in Annandale-on-Hudson, NY. 8-9 October 2005.

The Horn recursions for Schur P- and Q- functions, 9 October 2005. Special session on Algebraic and Geometric Combinatorics, AMS Eastern Sectional Meeting in Annandale-on-Hudson, NY. 8-9 October 2005.

Bounds for real solutions to sparse polynomial systems, 7 August 2005, in Commutative Algebra and Algebraic Geometry session in the XVI Coloquio Latinoamericano de Álgebra, 1 - 9 August 2005, Colonia, Uruguay.

Lower bounds in enumerative real algebraic geometry from sign-imbalanced posets, 7-10 January, 2004, Special Session on Geometry and Combinatorics, AMS National Meeting in Pheonix, AZ.

Structure of the Malvenuto-Reutenauer Hopf algebra of permutations, 4 May 2002, Special Session on Combinatorial Hopf Algebras, AMS Eastern Sectional Meeting in Montréal, Quebec, Canada.

Skew Schubert polynomials, 2 March 2002, Special Session on Algebraic Combinatorics, AMS Central Sectional Meeting in Ann Arbor.

The Hopf algebra of permutations of Malvenuto and Reutenauer, 9 January 2002, Special Session on Algebraic Combinatorics, AMS National Meeting in San Diego.

Common transversals and tangents in $\mathbb{P}^3$, 8 January 2002, Special Session on Computational Commutative Algebra and Algebraic Geometry, AMS National Meeting in San Diego.

A sagbi basis for the quantum Grassmannian, 21 April 2001, Algebra Weekend, University of Missouri, Columbia.

Maximally inflected curves, 13 January 2001, Special Session on Computational Algebraic Geometry for Curves and Surfaces, AMS National Meeting in New Orleans, Louisiana.

Elementary transversality in the Schubert calculus, 5 November 2000, Special Session on Algebraic Geometry, AMS Regional Meeting in New York.

Polytopes and isotropic Schubert calculus, 20 October 2000, Bay Area Discrete Mathematics Day, University of California at Davis.

Real rational curves in Grassmannians, 2 April 2000, Special Session on Enumerative Geometry in Physics, AMS Spring regional meeting in Lowell, Massachusetts.

A Pieri-type formula for the symplectic flag manifold, 20 March 1998, Combinatorics and Enumerative Geometry Special Session, AMS regional meeting in Liousville, Kentucky.

Real enumerative geometry and Shapiros' conjecture, 8 November 1997, Applications of Algebraic Geometry Session, Midwest algebraic geometry conference, University of Notre Dame.

The control of linear systems and Shapiros's conjecture, 18 October 1997, Concrete aspects of real polynomials Special Session, AMS regional meeting in Atlanta.

Monoids, orders, and Schubert polynomials, 18 June 1997, Atelier Combinatoire Algebrique, centre de recherches de mathématiques, Montréal, Quebec.

Multiplying Schubert polynomials and chains in the Bruhat order, 3 May 1997, Algebraic Combinatorics Special Session, AMS regional meeting in Detroit.

Numerical Schubert calculus, 12 April 1997, Algorithms in Real Algebraic Geometry Special Session, AMS regional meeting in College Park.

Enumerative geometry for real varieties, 8 January 1997, Computational Geometry Special Session, AMS National Meeting in San Diego.

Symmetries of Littlewood-Richardson coefficients for flag manifolds, 2 November 1996, Algebraic Geometry Special Session, AMS regional meeting in Columbia, Missouri.

Symmetries of Littlewood-Richardson coefficients for Schubert polynomials, 26 April 1996, Ontario Combinatorics Workshop, Fields Institute, Toronto, Canada.

Symmetries of Littlewood-Richardson coefficients for Schubert polynomials and flag varieties, 28 October 1995, Route 81 Conference on Commutative Algebra and Algebraic Geometry, Syracuse.

Real enumerative geometry for the Grassmannian of lines in projective space, 1 October 1994, Route 81 Conference on Commutative Algebra and Algebraic Geometry, Queen's University.

Real enumerative geometry for the Grassmann variety of lines in projective space, 20 December 1993, Real Algebraic Geometry/Topology Conference, Michigan State University.

Colloquia

Bounds for real solutions to structured polynomial systems, University of Illinois-Chicago, 26 October 2007.

Frontiers of reality in Schubert calculus, Sam Houston State University, 21 September 2007.

Bounds for real solutions to structured polynomial systems, 11 January 2007, University of North Carolina.

Bounds for real solutions to structured polynomial systems, 1 December 2006, Texas State University, San Marcos.

Bounds for real solutions to structured polynomial systems, 13 October 2006, IUPUI.

Bounds for real solutions to structured polynomial systems, 8 May 2006, Universität Stuttgart.

Bounds for real solutions to structured polynomial systems, 4 April 2006, Universität Innsbruck.

Polytopes and Polynomial Systems, 13 February 2006, Vorlesung lecture at the Graduiertenkolleg, Technische Universität Berlin.

Bounds on real solutions to polynomial systems, 12 January 2006, Universität Konstanz.

Bounds on real solutions to polynomial systems, 17 November 2005, Université Genève.

Bounds on real solutions to polynomial systems, 11 October, Texas A&M University.

Tropical Interpolation, 12 January 2005, University of British Columbia.

Algebraic Certificates of Positivity, 15 September 2004, Sam Houston State University.

Algebraic Certificates of Positivity, 9 September 2004, Rice University.

Algebraic Certificates of Positivity, 21 April 2004, San Fransisco State University.

Algebraic Certificates of Positivity, 8 April 2004, University of California at San Diego.
Real rational curves, 24 November 2003, Fachbereich Mathematik und Informatik, Universität Marburg.
Enumerative Real Algebraic Geometry, 12 September 2003. Virginia Polytechnic Institute and State University.
Enumerative Real Algebraic Geometry, 4 April 2003. University of Saskatchewan.
Enumerative Real Algebraic Geometry, 28 February 2003, Texas A&M University.
Enumerative Real Algebraic Geometry, 3 February 2003, North Carolina State University.
Enumerative real algebraic geometry, 29 January 2003, University of Colorado, Boulder.
A Gromov-Witten invariant in the real world, 15 November 2002, Michigan State University.
A Gromov-Witten invariant in the real world, 27 November 2001, Purdue University.
A Gromov-Witten invariant in the real world, 9 November 2001, SUNY Albany.
A Gromov-Witten invariant in the real world, 8 March 2001, University of Massachusetts at Amherst.
A Gromov-Witten invariant in the real world, 17 January 2001, Texas Tech University.
Quantum cohomology in the real world, 30 November 2000, Dartmouth College.
Control of linear systems and the real Schubert calculus, 3 December 1999, University of Wisconsin, Parkside.
Control of linear systems and the real Schubert calculus, 26 October 1999, University of California, Santa Cruz.
The Control of linear systems and the real Schubert calculus, 23 September 1999, University of North Carolina.
Real Schubert calculus, 10 February 1999, University of Colorado, Boulder.
Real Schubert calculus, 21 January 1999, University of Notre Dame.
Feedback control of linear systems and the real Schubert calculus, 17 November 1998, University of Washington.
Feedback control of linear systems and the real Schubert calculus, 27 October 1998, Santa Clara University.
The real, complete story on conics, 9 October 1998, California State University, Hayward.
Concrete Schubert calculus, 2 February 1998, Texas A&M University.
Combinatorics of the symmetric Group and flag manifolds, 11 March 1997, New Mexico State University.
Making the Schubert calculus effective, 7 March 1997, University of Texas at El Paso.
Is the Schubert calculus effective?, 24 September 1996, University of Notre Dame.
Combinatorics of symmetric groups and flag manifolds, 21 September 1995, SUNY Buffalo.

Research Seminars

Betti number bounds for fewnomial hypersurfaces via stratified Morse theory, Texas A&M University, 28 January 2008.
Galois groups of Schubert problems via numerical homotopy computation, Texas A&M University, 14 January 2008.
A Littlewood-Richardson rule for Grassmannian Schubert problems, Texas A&M, 12 November 2007.
Khovanskii-Rolle continuation for real solutions, University of Illinois-Chicago, 25 October 2007.
Khovanskii-Rolle continuation for real solutions Texas A&M University, 22 October 2007.
Lower bounds for real solutions to equations, Texas A&M, 5 October 2007.

Bounds in real algebraic geometry from Gale dual polynomial systems, Technische Universität München, 14 September 2007.

A commutative algebra approach to Pieri and Littlewood-Richardson rules, Texas A&M, 7 September 2007.

On "Towards a Schubert calculus for the complex reflection groups", Texas A&M, 29 August 2007.

Gale duality for complete intersections, Texas A&M, 27 August 2007.

Gale dual systems and bounds in real algebraic geometry, IMA PI Summer Graduate School on Applicable Algebraic Geometry. 2 August 2007.

On "Towards a Schubert calculus for the complex reflection groups", University of Minnesota, 28 June 2007.

The Horn recursion in the Schubert calculus, University of Minnesota. 6 April 2007.

Optimal fewnomial bounds from Gale dual polynomial systems, University of Wisconsin-Madison, 27 April 2007.

The Horn recursion in the Schubert calculus University of Minnesota. 6 April 2007.

Optimal fewnomial bounds from Gale dual polynomial systems, Institute for Mathematics and its Applications, 4 April 2007.

Optimal fewnomial bounds from Gale dual polynomial systems, Institute for Mathematics and its Applications, 4 April 2007. University of Texas. 8 February 2007.

Optimal fewnomial bounds from Gale dual polynomial systems, UNC-Chapel Hill. 12 January 2007.

New Fewnomial Upper Bounds from Gale Dual Polynomial Systems, Algebra and Combinatorics Seminar, TAMU. 1 September 2006.

Equivariant Chow ring of the quot scheme , Geometry Seminar, Universitt Zrich. 6 June 2006.

Combinatorial Hopf Algebra s, Oberseminar Hopfalgebren und Quantengruppen, Universität München, 1 June 2006.

The Horn recursion in the Schubert calculus, Algebraic Geometry Seminar, Universität Bayreuth, 10 Mai 2006.

Polytopes and Polynomial Systems, Seminar, Universität Innsbruck, 4 April 2006.

Linear precision for multi-sided toric patches, CMA guest lecture, Centre of Mathematics for Applications, University of Oslo. 15 March 2006.

Equivariant Chow ring of the quot scheme, Topology/Algebra Seminar, University of Bergen. 14 March 2006.

The Horn recursion in the Schubert calculus Seminar in Algebra and Algebraic Geometry, University of Oslo, 13 Mars 2006.

The convexity behind Santaló's Helley-type Theorem , 1 February 2006. Mittagsseminar, Technische Universität Müchen.

The Horn recursion for the Schubert calculus, Geometry Seminar, Université Grenoble, 12 December 2005.

The Horn recursion for the Schubert calculus, COWS seminar, Warwick University, 1 December 2005.

Equivariant Chow ring of the quot scheme, Algebra Seminar, Institut de Mathematiques de Jussieu, 24 November 2005. University, 1 December 2005.

The Shapiro Conjecture, Geometry Seminar, LAMA, Université de Savoie, Chambéry 18 November 2005.

Bounds for real solutions to polynomial systems, Mittagsseminar, Technische Universit Universität München 26 October 2005.

Bounds on real solutiosn to polynomial systems, 7 October, Algebraic Geometry Seminar, University of Illinois at Chicago.

Equivariant Cohomology of the Quot Scheme, 3 May 2005, Algebra Seminar, University of Texas.

The Horn recursion in the cominuscule Schubert calculus, 6 April 2005, Geometry Seminar, The Ohio State University.

The Horn recursion in the cominuscule Schubert calculus, 24 March 2005, Geometry Seminar, Texas A&M University.

Equivariant Cohomology of the Quot Scheme, 3 December 2004, Algebraic Geometry Seminar, Texas A&M University.

Tropical Interpolation, 25 November 2004, UNAM, Mexico.

Equivariant Cohomology of the Quot Scheme, 24 November 2004, CINVESTAV, Mexico City.

Lower bounds for real polynomial systems from sign-imbalanced posets, 23 November 2004, Algebraic Geoemtry Seminar, UNAM, Mexico.

Tropical Interpolation, 19 November 2004, Joint CIMAT-U. Morelia, Algebraic Geometry Seminar.

Lower bounds for real polynomial systems from sign-imbalanced posets, 28 May 2004, Combinatorics Seminar, University of California at Davis.

Lower bounds for real polynomial systems from sign-imbalanced posets, 3 May 2004, Algebra Seminar, Stanford University.

Lower bounds for real polynomial systems from sign-imbalanced posets, 26 March 2004, Combinatorics Seminar, University of Michigan.

Lower bounds for real polynomial systems from sign-imbalanced posets, 4 March 2004, Algebraic Geometry Seminar, Colorado State University.

Lower bounds in Enumerative Real Algebraic Geometry, 17 February 2004, Commutative Algebra and Algebraic Geometry Seminar, University of California, Berkeley.

Lower bounds for real polynomial systems from sign-imbalanced posets, 4 February 2004, Combinatorics and Geometry Seminar, University of Washington.

Grothendieck Polynomial Formulas, 26 January 2004, Combinatorics Seminar, University of California at Berkeley.

The $\mathbb{R}$eal story of linear series on $\mathbb{P}^1$, 7 November 2003, Columbia University.

Tropical Varieties, 28 October 2003, University of Massachusetts.

Toric Ideals, 21 October 2003, University of Massachusetts.

Common transversals and tangents, 16 June 2003, INRIA, Nancy.

Enumerative real algebraic geometry, 31 January 2003, Valley Geometry Seminar, University of Massachusetts, Amherst.

Combinatorial Hopf algebras, University of Michigan, 15 Novemnber 2002.

Enumerative real algebraic geometry, TU-München, 11 April 2002.

Common transversals and tangents in $\mathbb{P}^3$, 20 March 2002, SUNY Albany.

Common transversals and tangents in $\mathbb{P}^3$, 14 March 2002, Rutgers University.

Common transversals and tangents in $\mathbb{P}^3$, 30 November 2001, Valley Geometry Seminar, University of Massachusetts, Amherst.

The Malvenuto–Reutenauer Hopf algebra of permutations, October 30 2001, SUNY Binghamton.

Common transversals and tangents in $\mathbb{P}^3$, October 29 2001, Cornell University.

The Hopf algebra of permutations of Malvenuto and Reutenauer, 24 October 2001, MIT.

Enumerative real algebraic geometry, 1 July 2001, UMIST, Manchester, England.

Enumerative real algebraic geometry, 18 June 2001, IRMA Strasbourg, France.

Elementary transversality in the Schubert calculus, 9 April 2001, Northeastern University.

A sagbi basis for the quantum Grassmannian, 23 March 2001, University of Michigan.

Some real and unreal enumerative geometry, 12 February 2001, Boston University.

Maximally inflected curves, 16 January 2001, Texas Tech University.

Quantum reality: rational curves in real Grassmannians, 21 November 2000, Courant Institute for the Mathematical Sciences.

Eulerian actions on posets and the combinatorics of peaks, 28 April 2000, University of Minnesota, Minneapolis.

A sagbi basis for the quantum Grassmannian, 3 April 2000, Northeastern University.

Schubert calculus in the control of linear systems, 31 March 2000, University of Massachusetts-Amherst.

Some real and unreal enumerative geometry for flag manifolds, 14 March 2000, University of California, Berkeley.

Eulerian actions on posets and the combinatorics of peaks, 13 March 2000, University of California, Berkeley.

Pieri operators on posets, 16 February 2000, MIT.

Real rational curves in Grassmannians, 19 January 2000, University of Toronto.

A sagbi basis for the quantum Grassmannian, 17 January 2000, York University, Toronto.

Maximally inflected curves, 27 October 1999, University of California, Davis..

Pieri operators on posets, 25 October 1999, University of California, Berkeley.

Non-commutative Pieri operators on posets, 4 October 1999, Michigan State University.

Feedback control of linear systems and the real Schubert calculus, 24 Juin 1999, Université de Genève, Switzerland.

Standard monomial theory for the quantum Grassmannian, 15 Juin 1999, IRMA, Université de Strasbourg, France.

Real rational curves in, and from, Grassmannians, 10 Juin 1999, IRMAR, Université de Rennes 1, France.

Feedback control of linear systems and the real Schubert calculus, 27 mai 1999, IRMA, Université de Strasbourg, France.

A sagbi basis for the quantum Grassmannian, 3 May 1999, University of Wisconsin-Madison.

Real rational curves in Grassmannians, 22 March 1999, University of Wisconsin-Madison.

Real Schubert calculus, 29 January 1999, Northeastern University.

Real Schubert calculus, 27 January 1999, University of Massachusetts, Amherst.

Pieri operators on posets, 20 January 1999, University of Notre Dame.

Real Schubert calculus, 19 January 1999, University of Illinois, Urbana-Champaign.

Real Schubert calculus, 10 January 1999, Georgia Institute of Technology.

The special Schubert calculus is real, 9 December 1998, University of Utah.

Real Schubert calculus: special and quantum, 1 December 1998, University of California at Berkeley.

Non-commutative Pieri operators on posets, 19 November 1998, University of Washington.

New advances in enumerative real algebraic geometry, 12 November 1998, MSRI, Berkeley.
Maps of flag manifolds: Schubert classes and singularities, 20 April 1998, McMaster University.
Pieri-type formulas for flag manifolds, 23 February 1998, Universität Zürich, Switzerland.
Hopf algebras of edge-labeled posets, 20 February 1998, University of Wisconsin-Madison.
Pieri-type formulas for flag manifolds, 18 February 1998, University of Chicago.
Pieri-type formulas for Schubert polynomials, 9 February 1998, York University.
A Pieri-type formula for flag manifolds, 6 February 1998, The Ohio State University.
Hopf algebras and edge-labeled posets, 6 October 1997, York University.
Control theory, numerical Schubert calculus, and real polynomial systems, 3 July 1997, Université de Nice & INRIA Sophia-Antipolis, France.
The control of linear systems and real enumerative geometry, 24 June 1997, Université de Genève, Switzerland.
Orders on the symmetric group and the multiplication of Schubert polynomials, 11 April 1997, George Washington University.
Numerical Schubert calculus, 8 April 1997, Couraunt Institute of Mathematical Sciences.
The intersection form for flag varieties, 6 March 1997, Texas A&M University.
The intersection form for flag varieties, 4 February 1997, University of Utah.
Schubert polynomials and chains in the Bruhat order on S_n, 22 October 1996, University of California, San Diego.
Intersection theory for spherical varieties, 3 October 1996, University of Illinois at Urbana-Champaign.
Structure constants for Schubert polynomials and the Bruhat order, 1 October 1996, University of Illinois, Urbana-Champaign.
Enumerative geometry for real varieties, 25 September 1996, University of Notre Dame.
Is the Schubert calculus effective?, 9 September 1996, University of California at Berkeley.
Symmetries of Littlewood-Richardson coefficients for flag varieties, 24 July 1996, University of British Columbia.
Real enumerative geometry and effective algebraic equivalence, 20 May 1996, Northeastern University.
Symmetries of Littlewood-Richardson coefficients for Schubert polynomials, 17 May 1996, MIT.
Symmetries of Littlewood-Richardson coefficients for Schubert polynomials and flag Varieties, 30 November 1995, University of Waterloo.
Real enumerative geometry for the Grassmannian of lines in projective space, 16 June 1995, Université de Genève, Switzerland.
Pieri's rule for flag varieties, 16 February 1995, Centre de recherches de mathématiques, Montréal, Canada.
Pieri's rule for Schubert polynomials, 2 December 1994, MIT.
A geometric Pieri's rule, 20 October 1994, University of Illinois, Urbana-Champaign.
The Schubert calculus for the Grassmannian of lines in projective space is totally real, 25 October 1993, Michigan State University.

Scientific Outreach

General Mathematical talks

Introduction to moduli spaces, 20 May 2005, Special Seminar, Texas A&M University.

Convexity for lines in $\mathbb{R}^d$, 23 September 2004, Graduate Student Seminar, Texas A&M University.

What Is a Real Algebraic Curve?, 10 March 2003, TWIGS Seminar, University of Massachusetts.

What is a Hopf algebra, and what do Hopf algebras have to do with combinatorics?, 16 October 2002, TWIGS Seminar, University of Massachusetts, Amherst.

Common tangents and transversals, 11 December 2001, TAP Seminar, University of Massachusetts, Amherst.

The real, complete story of conics, 6 December 2000, TAP Seminar, University of Massachusetts, Amherst.

The complete story of conics, 23 February 2000, Undergraduate Mathematics Club, University of Wisconsin, Madison.

The complete story of conics, 7 March 1997, 'Club Zero', University of Texas El Paso Undergraduate Mathematics Club.

Groups + cohomology = group cohomology ?, 16 & 23 October 1995, Graduate Seminar on Group Cohomology, University of Toronto.

The complete story of conics, 18 Spetember 1995, Graduate Student Seminar, University of Toronto.

Employment in the mathematical sciences, 1 September 1995, Special Graduate Student Seminar, Illinois at Urbana-Champaign.

The geometry of Grassmann manifolds, 24 March 1995, Graduate Student Seminar, University of Toronto.

Talks and Activities with High School Students

Organized the *Valley Mathematical Sciences Day*, 18 May 2002, University of Massachusetts.

Euler island, 25 October 1997, University of Toronto's Mathematical Sciences Day.

Lines in space, 27 May 1996, Upper Canada College Mathematics Club.

Lines in space, 27 April 1996, University of Toronto's Mathematical Sciences Day.

The Cantor set, 26 February 1996, Upper Canada College Mathematics Club.

Symmetry and card shuffling, 3 December 1995, University of Toronto Mathematics club.

Transfinite numbers, 5 November 1995, Upper Canada College Mathematics Club.

The five colour theorem, 23 May 1995, Upper Canada College Mathematics Club.

Cantor's theory of infinity, 14 May 1995, University of Toronto Mathematics Club.

The combinatorial classification of surfaces, 29 April 1995, University of Toronto Mathematical Sciences Day.

Ran: *The science of shapes* for the Mathematics Department on Discover Science Day, a University-wide initiative to encourage High School girls to study Science or Engineering. 22 November 1994, 22 February 1995, 9 November 1995, and 9 May 1996.

Faculty advisor for the University of Toronto Math Club (for Toronto area secondary students), Autumn 1995–Summer 1996.