

# CHRISTOPHER J. HILLAR

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## EDUCATION

**University of California, Berkeley**, Berkeley, CA, 2001 – 2005

- Ph.D. Mathematics (advisor: Bernd Sturmfels)
- Thesis Topic: Solving Polynomial Systems with Special Structure

**Yale University**, New Haven, CT, 1996 – 2000

- Graduated Cum Laude.
- B.S. Intensive Mathematics (with distinction in the major), B.S. Computer Science (with distinction in the major)

Honors/Awards:

- **NSF Postdoctoral Fellowship** (Mathematics) 2005 – 2008
- **NSF Graduate Research Fellowship** (Mathematics) 2001 – 2004
- **John DeForest Prize** for excellence in pure and applied mathematics 2000
- **Anthony Stanley Memorial Prize** for excellence in mathematics 1998, 1999

## EXPERIENCE

**Texas A&M University**, College Station, TX, Fall 2005 –  
**Visiting Assistant Professor**

**Art Institute at San Francisco**, San Francisco, CA, Fall 2004 – Spring 2005  
**Instructor**

- Teach a class titled *Data Structures*, covering basic computer algorithms with programming component in C++. Topics include *Discrete Mathematics*, *Trees*, *Sorting*, *Hashing*, *Graph Theoretical Algorithms*.

**College of William and Mary**, Williamsburg, VA, Summer 1999, 2002  
**Matrix Analysis and its Applications**

- (1999) One of eight U.S. undergraduates selected to participate in intensive research experience. NSF-funded, eight week program involved one-on-one interaction with research faculty to solve open problems.
- (2002) Served as graduate mentor to the students selected to participate in above program. Lectured, supervised research, and collaborated on several projects.

**Southwest Texas State University (SWT)**, San Marcos, TX, Summers 1997, 1998  
**Teaching Assistant and Supervisor**

- Supervised and taught gifted high school students selected for Intensive Summer Honors Math Program. Topics included *Abstract Algebra*, *Number Theory*, *Analysis*, *Discrete Mathematics*.

## PUBLICATIONS

- *Iterated line intersections of rational point-sets in the plane*, in preparation.
- *Sums of polynomial squares over totally real fields are rational sums of squares*, submitted.
- *Towards a proof of Chez Panisse conjecture on cyclic resultants and generalizations*, in progress.
- (with J. Nie) *An elementary and constructive solution to Hilbert's 17th Problem for matrices*, Proc. Amer. Math. Soc., to appear.
- (with L. Garcia) *Groebner bases and partial sums of Catalan numbers*, in preparation.
- *Algorithms for finding Groebner bases of symmetric ideals*, in preparation.
- (with S. Armstrong). *Solving symmetric word equations in positive definite letters*, J. Lond. Math. Soc, to appear.
- (with T. Windfeldt). *An algebraic characterization of uniquely vertex colorable graphs*, J. Comb. Th. Ser. B., to appear.
- *Advances on the the Bessis-Moussa-Villani trace conjecture*, Lin. Alg. Appl., to appear.
- *Uniqueness of certain binomial factorizations in group algebras*, in preparation.
- *Word equations in groups with unique root extraction*, in preparation.
- *Cyclic resultants*, J. Symb. Comp., 39 (2005), 653-669.
- (with L. Levine) *Polynomial recurrences and cyclic resultants*, Proc. Amer. Math. Soc., 135 (2007), 1607-1618.
- (with M. Aschenbrenner) *Finite generation of symmetric ideals*, to appear Trans. Amer. Math. Soc.
- (with D. L. Rhea). *A result about the density of iterated line intersections in the plane*, Comp. Geom.: Theory Appl., 33 (2006), 106-114.
- (with C. R. Johnson). *The 3-by-3, exponent 6 case of the Bessis, Moussa, and Villani trace conjecture*, J. Stat. Phys., 118 (2005), 781-789.

- *Appendix to the article “New coins from old: computing with unknown bias,”* by E. Mossel and Y. Peres, *Combinatorica*, 25 (2005), 707-724.
- *Logarithmic derivatives of solutions to linear differential equations*, *Proc. Amer. Math. Soc.*, 132 (2004), no. 9, 2693-2701.
- (with C. R. Johnson). *Symmetric word equations in two positive definite letters*, *Proc. Amer. Math. Soc.*, 132 (2004), no. 4, 945-953.
- (with C. R. Johnson, Y. Harel, J. Groves, P. Rault). *Absolutely flat idempotents*, *Electron. J. Linear Algebra*, 10 (2003), pp. 190-200.
- (with C. R. Johnson). *Positive eigenvalues of generalized words in two Hermitian positive definite matrices*, in: *Novel Approaches to Hard Discrete Optimization* (P. Pardalos and H. Wolkowicz, eds.), *Fields Institute Communications* 37, 2003, pp. 111-122.
- (with C. R. Johnson). *Eigenvalues of words in two positive definite letters*, *SIAM J. Matrix Anal. Appl.*, 23 (2002), pp. 916-928.
- (with C. R. Johnson and I. M. Spitkovsky). *Positive eigenvalues and two-letter generalized words*, *Electron. J. Linear Algebra*, 9 (2002), pp. 21-26.

## RESEARCH INTERESTS

Structured polynomial systems, algebraic combinatorics, computational algebra, matrix equations.

## TALKS

- *Algebraic Characterization of Uniquely Colorable Graphs*, Texas A&M Algebra and Combinatorics Seminar, April 6, 2007.
- *Algebraic Characterization of Uniquely Colorable Graphs*, UC Davis Discrete Mathematics & Representation Theory Seminar, March 2, 2007.
- *Advances on the BMV trace conjecture*, IMA Annual Program Year Workshop: Optimization and Control, University of Minnesota, January 16, 2007.
- *Finite generation of symmetric ideals*, FPSAC'06, San Diego, California, June 19, 2006.
- *Finite generation of symmetric ideals*, RISC Algorithmic Combinatorics Seminar, Hagenberg, Austria, May 31, 2006.
- *Finite generation of symmetric ideals*, Technische Universitat, Kaiserslautern, Germany, May 24, 2006.
- *Finite generation of symmetric ideals*, Special Semester on Groebner Bases, Linz, Austria, March 28, 2006.
- *Advances on the Bessis-Moussa-Villani trace conjecture*, Texas A&M University, Jan 19, 2006.
- *Reconstructing dynamical systems from their zeta functions*, AMS Special Session: Solving Polynomial Systems, 2004 Fall AMS Central Section Meeting, October 24, 2004
- *Finite generation of symmetric ideals*, UC Berkeley Combinatorics Seminar, October 4, 2004
- *New coins from old: computing with unknown bias*, UC Berkeley Combinatorics Seminar, May 10, 2004
- *Cyclic resultants*, FPSAC'04, Vancouver, Canada, June 29, 2004 (poster)
- *Cyclic resultants*, UC Berkeley Commutative Algebra Seminar, Nov 18, 2003
- *Words in two positive definite letters*, UC Berkeley Combinatorics Seminar, April 29, 2002
- *Absolutely flat idempotents*, Southern California Matrix Meeting, Nov 16 2002
- *Symmetric word equations*, Southern California Matrix Meeting, Nov 3 2001

## CONFERENCES

- *IMA Annual Program Year Workshop: Non-Linear Computational Geometry*, May 29 – June 2, 2007.
- *Banff Workshop on Contemporary Schubert Calculus and Schubert Geometry*, March 18 – 23, 2007.
- *IMA Annual Program Year Workshop: Optimization and Control*, January 16 – 20, 2007
- *Banff Workshop on Positive Polynomials and Optimization*, October 7 – 12, 2006.
- *IMA Annual Program Year Workshop: Algorithms in Algebraic Geometry*, September 18 – 22, 2006.
- *18<sup>th</sup> Annual Formal Power Series and Algebraic Combinatorics conference*, June 19 – 23, 2006.
- *Special Semester on Groebner Bases*, Johannes Kepler University, Linz, Austria, Feb 16 – July 6, 2006.
- *17<sup>th</sup> Annual Formal Power Series and Algebraic Combinatorics conference*, June 20 – 25, 2005.
- *Fall AMS Central Section Meeting*, October 23 – October 24, 2004
- *2004 Park City Mathematics Institute research program: geometric combinatorics*, July 11 – July 31, 2004.
- *16<sup>th</sup> Annual Formal Power Series and Algebraic Combinatorics conference*, June 28 – July 02, 2004.
- *MSRI Summer School: triangulations of point sets*, July 21 – 31, 2003.
- *GROSTAT VI and International School on Algebraic Statistics*, February 17 – February 20, 2003.

## HOBBIES

- Life-long soccer player
- Texas hold 'em aficionado
- Creating mathematical problems (American Mathematical Monthly: 11231, 11204, 11123, 11098, 10928, 10723)

## BIOGRAPHICAL SKETCH

In the summer of my junior year in high school, I was invited to attend two math programs for talented students – one at the Rose Hulman Institute for Technology and the other at Southwest Texas State University (SWT). The two environments provided a rigorous introduction to the world of mathematics outside of my high school curriculum. The next two summers, I returned to SWT and served as a counselor and teacher to a new group of SWT Honors students. A rewarding aspect of this program is that it is very successful at gathering a diverse student population with mathematics as a common bond.

As an undergraduate at Yale, I had the opportunity to serve as editor-in-chief of the Yale Scientific magazine. With my leadership, the nearly defunct publication underwent a revitalization that has been maintained to this day. In the summer of 1999, I was selected to attend the College of William and Mary REU (research experiences for undergraduates). This productive encounter with research mathematicians resulted in four journal publications. I continue to collaborate with my REU advisor.

In the spring of 2001, I accepted an NSF graduate research fellowship to attend the University of California, Berkeley. This decision was one of the best I have ever made. Within the first year, I had found a Ph.D. advisor, many good friends, and experienced first-hand the breadth and excitement of the Berkeley mathematical community. The numerous Berkeley colloquia and seminars and the proximity of MSRI (Mathematical Sciences Research Institute) have given me the opportunity to form many friendships with colleagues in my field. In the summer of 2002, I returned to the College of William and Mary as a mentor and advisor to a group of undergraduate researchers.

I finished my Ph.D. in 2005, under the supervision of my advisor Bernd Sturmfels. Currently, I am an NSF postdoctoral fellow at Texas A&M University (under the supervision of Frank Sottile). I am involved in a research group involved in questions of reality in the Schubert calculus. I also maintain my own research program on the various projects outlined in my NSF research proposal. I look forward to another productive year at Texas A&M.