

Catherine Huafei Yan

Current address:

Department of Mathematics
102 Milner Hall
Texas A&M University
College Station, TX 77843
E-mail: cyan@math.tamu.edu

Home address:

3204 Caterina Lane
College Station, TX 77845
Tel: (979)-862-4476 (office)
(979) 764-2919 (home)
Fax: (979)-845-6028

Research Interests

Algebraic Combinatorics, Probabilistic Methods, Ordered Algebraic Structures, and Discrete Structures.

Education

Massachusetts Institute of Technology Cambridge, MA
School of Science, Department of Mathematics
Doctor of Philosophy in Pure Mathematics, June 1997
–Dissertation description below

Beijing University Beijing, China
Bachelor of Science in Mathematics, July 1993.

Academic Positions

Professor of Mathematics, *September, 2004*, Texas A&M University.

Associate Professor, *2002–2004*, Texas A&M University.

Assistant Professor, *1999–2002*. Texas A&M University.

Member, *Academic Year 2000*. Institute for Advanced Study.

Courant Instructor. *1997–1999*. Courant Institute of Mathematical Sciences, New York University.

Graduate Teaching Assistant. *1993–1997*. Department of Mathematics, Massachusetts Institute of Technology.

Other Experiences

Nankai University, Tianjin, China
May 2005–August 2008, Chern Professor at Center of Combinatorics.

Graduate School of Academic Sinica, Beijing, China.
June, 2005–June, 2008. Special Invited Professor at Department of Mathematics.

Dalian University of Technology, Dalian, China
January, 2003–December, 2005, Invited Professor at the Institute of Higher Technology.

Graduate School of Academic Sinica, China Beijing, China
Summer, 2002. Visiting Scholar at the Department of Mathematics.

Institute for Advanced Study Princeton, NJ
Academic year 2000–2001. Member. Attending the special year for Complexity Theory and Discrete Mathematics.

Graduate School of Academic Sinica, China Beijing, China
August, 2000. Visiting Scholar in Department of Mathematics.

Courant Institute of Mathematical Sciences New York, NY

- AT&T Labs.** Florham Park, NJ
Summer 1998 & 1999. Consultant in Mathematics. Did research on recurrence relations of Turan numbers and on the Apollonian circle packings.
- Massachusetts Institute of Technology** Cambridge, MA
Summer 1997. Mentor in the Summer Program of Undergraduate Research. Supervised students in doing mathematics research.
- Massachusetts Institute of Technology** Cambridge, MA
- Massachusetts Institute of Technology** Cambridge, MA
Summer 1996. Lecturer. Department of Mathematics. Taught and graded for differential equations.
- Massachusetts Institute of Technology** Cambridge, MA
Academic year 1993–97. Graduate Teaching Assistant, Department of Mathematics.
- Research Science Institute** Cambridge, MA
Summer 1995. Mentor. Led student discussion groups. Supervised students in doing research program.
- High School Olympiad in Mathematics** Beijing, China
Summer 1991, 92, 93. Lecturer. Taught topics in discrete mathematics and led problem solving seminars.

Grants and Awards

- National Science Foundation, “Interdisciplinary Grants in the Mathematical Sciences: Combinatorial Methods in Manufacturing”, DMS-0308827, September 1, 2003 – August 31, 2004. \$ 99,999.
- National Science Foundation Research Grant, DMS-0245526, Titled “Research on Enumerative and Probabilistic Combinatorics.” June 1, 2003 – May 31, 2006. \$ 124,933.
- General Motors Research and Development. “An Exploration of New Approaches for Identifying and Mitigating Enterprise Risk,” joint with M.A. Wortman and G-A. Klutke, Department of Industrial Engineering. June 1, 2003–May 31, 2004. \$100,000.
- National Science Foundation Conference Grant, DMS-0300205. Titled “CombinaTexas: A Combinatorics Conference for the South-Central U.S.,” April 1, 2003 – March 31, 2006. \$31,800
- Alfred P. Sloan Foundation Research Fellow, 2001–2003, extended to 2005. \$40,000
- National Science Foundation Research Grant, DMS-0070574, Titled “Enumerative Combinatorics and Probabilistic Method.” July 2000 to June 2003. \$ 77,864
- NSF research grant through Institute for Advanced Study. DMS 97-29992. Academic year 2000–01. \$35,500
- Travel support for FoataFest: A Conference on Classical Combinatorics. July, 2000. \$ 500
- NSF-AWM Travel Grant from Association for Women in Mathematics, May, 2000. \$ 800.
- Challenge Fund Awards for Research, New York University. Title: Modular Lattices in Invariant Theory, June 1999 to May 2000. \$4,500.
- Morse Academic Plan Teaching Fund, New York University. September 1998 to August 1999. \$2,000.
- Gold medal in the third Youth Science Awards of Beijing, China, 1991.
- Jiu-Zhang Mathematics Prize, highest honor in Department of Mathematics, Peking University, 1991.

Top Fellowship for Freshman, Peking University, 1989.

Top Award of Science Prize Competition, Beijing, China, 1989.

Silver medal in International Olympiad Mathematics, Germany, 1989.

Silver-Sail Prize for Science, Beijing, China, 1989.

Presentations

Invited Conference Talks

- The Second National Conference on Combinatorics and Graph Theory, Nankai University, Tianjin, China. August 16–19, 2006.
- Conference on Probabilistic Combinatorics & Algorithms: a Conference in Honor of Joel Spencer’s 60th Birthday. DIMACS, Rutgers, NJ. April 2006. “An Algorithmic Approach to Enumeration”.
- Canada Mathematical Society Winter Meeting 2005, Special Session on Discrete and Convex Geometry, Victoria, December 9–12, 2005. “Crossings and nestings on chord configurations”.
- Combinatorial and Additive Number Theory, New York, NY. May, 2005. “Crossings and nestings of matchings and partitions”.
- AMS Eastern Section Meeting, Special session on *Probabilistic paradigms in Combinatorics*, Newark, Delaware, April, 2005. “On the diameter of random geometric graphs”.
- The sixth joint meeting of AMS-SMM, special session on graph theory and combinatorics, Houston, May 2004. “On Random Points in the Unit Disk”.
- Canada Mathematical Society Summer Meeting 2002, Symposium in Combinatorics, Quebec City, Canada. June, 2002. “Goncarov polynomials and Parking Functions”.
- Joint Mathematics Meetings of AMS, MAA and SIAM, special session of *Many Lives of Lattice Theory and the Theory of Ordered Sets with Connections to Combinatorics*, San Diego, CA January, 2002. “Lattice of Commuting Boolean Subalgebras”.
- AMS 2001 Spring Western Section meeting, Las Vegas, April, 2001. Invited talk in the special session on Number Theory with a Geometric Flavor. “Apollonian Circle Packings: Number Theory”.
- Ninth Quadrennial International Conference on Graph Theory, Combinatorics, Algorithms, and Applications. Michigan, June, 2000, invited talk, “Generalized Parking Functions, Tree Inversions and Multicolored Graphs”.
- CombinaTexas Conference, College Station, Texas, March, 2000, plenary talk, “Integral Apollonian Packings”.
- Joint Mathematics Meetings of AMS, MAA and SIAM, special session of *In Memory of Gian-Carlo Rota*, Washington DC, January, 2000. “Geometric Identities in Linear Lattices”.

Contributed Conference Talks

- CombinaTexas Conference 2006, Houston, TX. February 2006. “Extended Goncarov polynomials, parking functions, and lattice paths”.
- CombinaTexas Conference 2005, San Marcos, TX, February, 2005. “Crossings and nestings in matchings and partitions”.
- International Congress of Mathematicians. Beijing, 2002. Short communication in the session of combinatorics, August, 2002. “Goncarov polynomials and Parking Functions”.

- Finite and Infinite Combinatorics, Budapest, Hungary, January, 2001, invited talk. “Asymptotics for Branching Processes”.
- 31st Southeast International Conference on Combinatorics, Graph Theory, and Computing. Florida, March, 2000. “On the Enumeration of Generalized Parking Functions”.

Colloquium

- Beijing University, June 9th, 2006.
- Center of Combinatorics, Nankai University, Tianjin, China. May, 2006.
- Center of Combinatorics, Nankai University, Tianjin, China. June – August, 2005. Summer Colloquium Series.
- Graduate School of Academic Sinica, Beijing, China. June 13–25, 2005. Summer Colloquium Series. (Delivered five colloquium talks.)
- Texas A&M University, Department Colloquium, Department of Industrial Engineering, September, 2003.
- Texas A&M University, College Station, September, 2003,
- Dalian University of Technology, colloquium, Dalian, China. July, 2002.
- Southwest Texas State University, colloquium. San Marcos, TX. April, 2002.
- Texas A&M University, College Station, October, 2001,
- Temple University, Pennsylvania, invited talk, April 2001.
- William Paterson University, New Jersey, colloquium talk, October 2000.
- Vanderbilt University, Tennessee, colloquium talk, January 1999,
- Texas A&M University, Texas, colloquium talk, November 1998,
- Dartmouth College, New Hampshire, invited talk, February 1998,
- Denver University, Colorado, colloquium talk, February 1997,
- Virginia Polytechnic Institute and State University, Virginia, invited talk, January 1997,
- Texas A&M University, Texas, invited talk, January 1997, “ k -Parking Functions, Tree Inversions, and Hyperplane Arrangements”.

Seminar Talks

- Georgia Institute of Technology, Combinatorics seminar, March 2006.
- Texas A&M University, Algebra and Combinatorics seminar, November, 2005.
- University of Texas at Arlington, Applied Mathematics Seminar, November, 2004.
- University of Wisconsin-Madison, Combinatorics Seminar, October, 2004.
- Texas A&M University, Algebra and Combinatorics seminar, September, 2004.
- Texas A&M University, Department of Industrial Engineering, Seminar of Combinatorics, Optimization, Computing and Algorithms (COCA), December, 2003.
- Texas A&M University, Seminar of Group and Dynamics, April, 2003.

- University of Washington and Microsoft Research, Combinatorics Seminar, April, 2003.
- Texas A&M University, Department of Industrial Engineering, Applied Probability Seminar, March, 2003.
- Texas A&M University, Algebra and Combinatorics Seminar, January, 2003.
- Texas A&M University, Department of Industrial Engineering, Applied Probability Seminar, April, 2002.
- University of Florida, Combinatorics Seminar, February, 2001.
- University of Minnesota, Combinatorics Seminar, December, 2000.
- Massachusetts Institute of Technology, Combinatorics Seminar, November, 2000.
- University of Pennsylvania, Combinatorics Seminar, October, 2000.
- Texas A&M University, Algebra and Combinatorics Seminar, September, 2000.
- Texas A&M University, Algebra and Combinatorics Seminar, February, 2000.
- Texas A&M University, Algebra and Combinatorics Seminar, October, 1999.
- University of Pennsylvania, Combinatorics Seminar, February, 1998.
- Massachusetts Institute of Technology, Combinatorics seminar, November 1996.

Doctoral Dissertation

TITLE: Theory of Commuting Boolean Algebras.

ADVISER: Gian-Carlo Rota, Professor of Mathematics, Massachusetts Institute of Technology.

ABSTRACT: In the thesis we give a definition of commutativity for Boolean subalgebras which generalizes the notion of commutativity for equivalence relations. We characterize the commutativity for complete Boolean subalgebras by a structure theorem.

We study lattices of commuting Boolean subalgebras of a complete Boolean algebra. We characterize this class of lattices, and more generally, a similar class of lattices in a complete Heyting algebra by developing a proof theory which extends Haiman’s proof theory for lattices of commuting equivalence relations.

We study the representation theory of commuting Boolean subalgebras. To each complete subalgebra, we associate a normal, closed, completely additive operator. We prove that the commutativity of Boolean subalgebras is equivalent to the commutativity of the associated completely additive operators under composition. We then represent subalgebras of a Boolean algebra by partitions on the Boolean space, and obtain the following representation theorem: Two complete Boolean subalgebras commute if and only if they commute as partitions on the Boolean space.

As the conclusion of the thesis, we propose a notion of stochastic commutativity, which is a generalization of stochastic independence. We obtain a structure theorem for pairwise stochastically commuting σ -algebras and develop various applications in Probability and Universal Algebra.

Publications

1. “G-parking Functions, Graph Search, and Tutte Polynomial”, joint with Dimitrije Kostic, submitted to Advances in Applied Mathematics, 2006.
2. “Linked partitions and cycles”, joint with B. Chen and S. Wu. Submitted to European Journal of Combinatorics, 2006.
3. “A Major Index for Matchings and Set Partitions”, joint with W.Y.C. Chen, I. Gessel and A.L . Yang. Submitted to Journal of Combinatorial Theory A, 2006. (17 pages)

4. “How to play the one-lie Renyi-Ulam game”, joint with R. Ellis and V. Ponomarenko, submitted to Graphs and Combinatorics.
5. “Two boundary lattice path and parking functions”, joint with J. Kung and X. Sun. accepted by Advances in Applied Mathematics, 2006.
6. “Random Geometric Graph Diameter in the Unit Ball”, joint with R. Ellis, J. Martin. Accepted by Algorithmica.
7. “Crossings and Nestings of Matchings and Partitions”, joint with W.Y.C. Chen, E. Deng, R. Du, and R. Stanley. To appear in Transaction of AMS, April, 2007.
8. “Apollonian Circle Packings: Geometry and Group Theory II. Super-Apollonian Group and Integral Packings”, joint work with R. Graham, J. Lagarias, C. Mallows and A. Wilks. Discrete & Computational Geometry, 25(2006), 1–36.
9. “Apollonian Circle Packings: Geometry and Group Theory III. Higher Dimensions”, joint work with R. Graham, J. Lagarias, C. Mallows and A. Wilks. Discrete & Computational Geometry, 35(2006), 37–72.
10. “On the Random Points in the Unit Disk”, joint with R. Ellis and X. Jia. Accepted by Random Structures and Algorithms. Volume 29, Issue 1 (2006), 14–25.
11. “Apollonian Circle Packings: Geometry and Group Theory I. The Apollonian Group”, joint work with R. Graham, J. Lagarias, C. Mallows and A. Wilks. Discrete & Computational Geometry, 34(2005), 547–585.
12. “The Renyi-Ulam Pathological Liar Game with a Fixed Number of Lies”, joint with R. Ellis, V. Ponomarenko. Journal of Combinatorial Theory, Series A, 112(2005), 328–336.
13. “Random Geometric Graph Diameter in the Unit Disk with ℓ_p Metric, (Extended Abstract)”, joint with R. Ellis and J. Martin. in Lecture Notes in Computer Science, Vol. 3383, pp167. Springer-Verlag, 2005.
14. “The Modeling of Random Graphs and Its Applications”. Technique report. General Motor R&D, May, 2004.
15. “Ulam’s Covering Game with One Half-lie”, joint work with R. Ellis. International Journal of Mathematics and Mathematical Sciences, special issue for CombinaTexas’03, vol. 29 (2004), 1523–1532.
16. “Apollonian Circle Packings: Number Theory”, R. Graham, J.C. Lagarias, C.L. Mallows, A.R. Wilks, and C.H. Yan. Journal of Number Theory, vol.100, no.1 (2003), 1–45. Preprint available at e-Print archive math.NT/0009113.
17. “Expected Sums of Moments for General Parking Functions”, joint work with J. Kung. Annals of Combinatorics, vol. 7 (2003), 481–493.
18. “The Halfie Problem”, joint with J. Spencer. Journal of Combinatorial Theory, Series A, vol. 103 (2003) 69–89.
19. “Exact Formulas for Moments of Sums of Classical Parking Functions”, joint with J. Kung. Advances in Applied Mathematics, vol. 31 (2003) 215–241.
20. “Branching Processes with Negative Poisson Offspring Distribution”, joint work with J. Spencer and I. Dumitriu. Annals of Combinatorics, vol. 7 (2003) 35–47.
21. “Goncarov Polynomials and Parking Functions”, joint with J.P. Kung, Journal of Combinatorial Theory, Series A, vol. 102, no.1 (2003), 16–37.
22. “Generating Functions for Moments of the Quasi-nilpotent DT-operator”, joint with K. Dykema. Advances in Applied Mathematics, vol. 30, no.3 (2003), 545–561.

23. “Six Problems of Gian-Carlo Rota in Lattice Theory and Universal Algebra”, joint work with J. P. Kung. *Algebra Universalis*, vol. 49(2003), 113–127.
24. “Hirzebruch χ_y Genus of Hilbert Schemes from Fixed Point Formula”, joint work with K. Liu and J. Zhou. *Sci. China (Zhong Guo Ke Xie) Ser. A* 45 (2002), no. 4, 420–431.
25. “Generalized Parking Functions, Tree Inversions and Multicolored Graphs”, C. H. Yan. *Advances in Applied Mathematics*, vol. 27 (2001), 641–670.
26. “On Discrepancy of Strongly Unimodular Matrices”, H. Peng and C. H. Yan. *Discrete Mathematics* vol. 219 (2000), 223–333.
27. “On the Enumeration of Generalized Parking Functions”, C.H. Yan. *Proceedings of the Thirty-first Southeastern International Conference on Combinatorics, Graph Theory and Computing (Boca Raton, FL, 2000)*. *Congressus Numerantium*, 147 (2000), 201–209.
28. “Geometric Identities in Lattice Theory”, joint work with M. Mainetti. *Journal of Combinatorial Theory, Ser. A*, vol. 91, No. 1/2, (2000), 411–450.
29. “Arguesian Identities in the Congruence Variety of Abelian Groups”, C. H. Yan. *Advances in Mathematics*, vol. 150, (2000), 36–79.
30. “On the Limit of a Recurrence Relation”, R. L. Graham and C. H. Yan. *Journal of Difference Equations and Applications*, vol. 5, (1999) 71–95.
31. “Theory of Commuting Boolean σ -algebras”, C. H. Yan. *Advances in Mathematics*, vol. 144, (1999) 94–116.
32. “Arguesian Identities in Linear Lattices”, M. Mainetti and C. H. Yan. *Advances in Mathematics*, vol. 144, (1999) 50–93.
33. “Graphical Operations on Projective Spaces”, M. Mainetti and C. H. Yan. *Annals of Combinatorics*, vol.2 (1998) 245–291.
34. “The Theory of Commuting Subalgebras of a Complete Heyting Algebra”, J. Crants and C. H. Yan. *Advances in Mathematics*, vol. 139(2), (1998) 260–292.
35. “Decomposition of Lebesgue Spaces”, C. H. Yan. *Advances in Mathematics*, vol. 138(2), (1998) 330–350.
36. “Balancing Game with a Buffer”, H. Peng and C. H. Yan, *Advances in Applied Mathematics*, vol. 21(2), (1998) 193–204.
37. “Quasifinite Representations of Classical Lie Subalgebras of $\mathcal{W}_{1+\infty}$ ”, V. G. Kac, W. Wang and C. H. Yan. *Advances in Mathematics*, vol. 139(1), (1998) 56–140.
38. “Quasifinite Highest Weight Modules over the Lie Algebra of Matrix Differential Operators on the Circle”, C. Boyallian, V. G. Kac, J. I. Liberati and C. H. Yan. *Journal of Mathematical Physics*, vol. 39(5), (1998) 2910–2928.
39. “Commuting Quasi-order Relations”, C. H. Yan. *Discrete Mathematics*, vol. 183(1–3), (1998) 285–292.
40. “Distributive Laws for Commuting Equivalence Relations”, C. H. Yan. *Discrete mathematics*, vol. 181(1–3), (1998) 295–298.
41. “Generalized Tree Inversions and k -Parking Functions”, C. H. Yan. *Journal of combinatorial theory A*, vol. 79(2) (1997) 268–280.

Student Supervised

Dimitrije Kostic (current), Ph.D. student
Svetlana Poznanovik (current), Ph.D. student
Dimitrije Kostic, Masters, December 2003.
Lisa Sparrgrove, Masters, May, 2004.
Kris Horn, undergraduate research. Summer 2003.
Nathaniel Strawn, undergraduate research. Spring 2005.

Postdoc Supervised

Robert Ellis (2002–2005),
Xinyu Sun (2004–present)

Services

Conference Organized

Member of Organizing Committee. 19th International Conference on Formal Power Series and Algebraic Combinatorics, July 2–6, 2007, Nankai University, Tianjin, China.

Lead Organizer. Special Session on Algebraic and Enumerative Combinatorics at joint AMS-MAA-SIAM national meeting, January 12–15, 2006, San Antonio, TX. Co-organizers: Marcelo Aguiar, Joseph Kung, and Laura Matusevich.

Lead Organizer of CombinaTexas'06 at Texas Southern University, Houston, TX. February 24–25, 2006. Co-organizers: Nate Dean, Siemion Fajtlowicz, and Daniela Ferrero.

Lead Organizer of CombinaTexas'05 at Texas State University, San Marcos, TX. February 25–26, 2005. Co-organizers: Robert Ellis, Xingde Jia and Daniela Ferrero.

Organizer for the Algebra and Combinatorics Seminar, Academic year 2004.

Lead organizer of CombinaTexas'04: A Combinatorics Conference in the South-Central U.S. Held at Texas A&M University, April 9–11, 2004. Co-organizers: Robert Ellis, Xingde Jia and Daniela Ferrero.

Lead organizer of CombinaTexas'03: A Combinatorics Conference in the South-Central U.S. Held at South-west Texas State University, April 5–6, 2003. Co-organizers: Xingde Jia and Daniela Ferrero.

CombinaTexas'02: A Combinatorics Conference in the South-Central U.S. Held at University of North Texas, March, 2002. Co-organizers: Neal Brand, Joseph Kung, Jon McCammond.

CombinaTexas'01: A Combinatorics Conference in the South-Central U.S. Held at Texas A&M University, April, 2001. Co-organizers: Laura Anderson and Jon McCammond.

Journals Refereed

Advances in Applied Mathematics
American Mathematical Monthly
Annals of Combinatorics
Ars Combinatoria
Discrete Applied Mathematics
Discrete Mathematics
The Electronic Journal of Combinatorics
European Journal of Combinatorics
International Journal of Mathematics and Mathematical Sciences
Internet Mathematics
Journal of Combinatorial Theory, Series A
Order
SIAM Journal of Discrete Mathematics
Reviewer for Mathematical Reviews
Reviewed for NSF and NSA

Extra-University Activities

- American Mathematical Society. Member of Large of the Council, elected, February 2005–January 2008.
- Member of AMS Committee on Conference and Meeting, February 2005–January 2008.
- Member, Subcommittee on International meetings, AMS, March 2006–present
- Member, Subcommittee on New Conference, AMS Committee on Conference and Meeting, April 2005–present

University Activities

- Member of Promotion Subcommittee. Department of Mathematics, Texas A&M University. Mar. 2006–Mar. 2008.
- Member of Tenure Subcommittee. Department of Mathematics, Texas A&M University. Mar. 2003–Feb. 2005.
- Chair of Tenure Subcommittee. Department of Mathematics, Texas A&M University. Mar. 2004–Feb. 2005.
- Math 302 Textbook Committee, Fall 2003.