

Hanmeng (Harmony) Zhan

CONTACT INFORMATION	Department of Mathematics and Statistics N520 Ross, York University 4700 Keele Street, Toronto, ON M3J 1P3	h3zhan@yorku.ca (416) 736-5250 hanmengzhan.com
RESEARCH INTERESTS	Algebraic graph theory, quantum walks, orthogonal polynomials, equiangular lines, association schemes, covering graphs, graph embeddings	
CURRENT POSITION	York Science Fellow <ul style="list-style-type: none">Department of Mathematics and Statistics, York University, Toronto, ON, Canada Supervisor: Ada Chan	Oct 2019 - Present
PREVIOUS POSITIONS	Postdoctoral Fellow <ul style="list-style-type: none">Centre de Recherches Mathématiques, Université de Montréal, Montréal, QC, Canada Supervisor: Luc Vinet	Oct 2018 - Sep 2018
EDUCATION	University of Waterloo , Waterloo, ON, Canada <ul style="list-style-type: none">Ph.D. Department of Combinatorics and Optimization, Faculty of Mathematics Thesis: <i>Discrete Quantum Walks on Graphs and Digraphs</i> Supervisor: Chris Godsil Thesis awards:<ul style="list-style-type: none">University Finalist for the Governor General's Gold MedalInaugural Mathematics Doctoral PrizeMaster of Mathematics Department of Combinatorics and Optimization, Faculty of Mathematics Thesis: <i>Uniform Mixing on Cayley Graphs over \mathbb{Z}_3^d</i> Supervisor: Chris Godsil Thesis award:<ul style="list-style-type: none">Outstanding Achievement in Graduate StudiesBachelor of Arts Department of Economics, Faculty of Arts Thesis: <i>Second-Price Auction with Resale</i> Supervisor: Philip Curry Xiamen University , Xiamen, Fujian, China <ul style="list-style-type: none">Bachelor of Economics Department of Statistics, Faculty of Economics Thesis: <i>Multi-Player Multi-State Quantum Games</i> Supervisor: Zhengming Qian	May 2014 - Sep 2018 Sep 2012 - Apr 2014 Jan 2010 - Aug 2012 Sep 2008 - Jun 2014

1. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Fractional revival and association schemes*. Discrete Mathematics (2020) 343(11), 112018. doi:10.1016/j.disc.2020.112018
2. L. Vinet, H. Zhan, *Perfect state transfer on weighted graphs of the Johnson scheme*. Letter in Mathematical Physics (2020). doi.org/10.1007/s11005-020-01298-6
3. H. Zhan, *Quantum walks on embeddings*. Journal of Algebraic Combinatorics (2020). doi.org/10.1007/s10801-020-00958-z
4. H. Zhan, *An infinite family of circulant graphs with perfect state transfer in discrete quantum walks*. Quantum Information Processing (2019) 18(12): pp. 369.
5. G. Coutinho, L. Vinet, H. Zhan, A. Zhedanov. *Perfect state transfer in a spin chain without mirror symmetry*. Journal of Physics A: Mathematical and Theoretical (2019) 52(45), pp. 455302.
6. C. Godsil, H. Zhan, *Discrete-time quantum walks and graph structures*. Journal of Combinatorial Theory, Series A (2019), pp. 181212.
7. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Quantum fractional revival on graphs*. Discrete Applied Mathematics (2019) 269, pp. 86-98.
8. G. Coutinho, C. Godsil, K. Guo, H. Zhan, *A new perspective on the average mixing matrix*. Electronic Journal of Combinatorics (2018) 25(4): P4.14.
9. C. Godsil, H. Zhan, *Uniform mixing on Cayley graphs*. Electronic Journal of Combinatorics (2017) 24(3): P3.20.
10. G. Coutinho, C. Godsil, M. Shirazi, H. Zhan, *Equiangular lines and covers of the complete graph*. Linear Algebra and its Applications (2016) 488: pp. 264-283.
11. R. Alvir, S. Dever, B. Lovitz, J. Myer, C. Tamon, Y. Xu, H. Zhan. *Perfect state transfer in Laplacian quantum walk*. Journal of Algebraic Combinatorics (2016) 43(4): pp. 801-826.

Preprints

12. A. Chan, B. Johnson, M. Liu, M. Schmidt, Z. Yin, H. Zhan, *Laplacian pretty good fractional revival*. arXiv:2010.10465 (2020). Submitted.
13. A. Chan, B. Johnson, M. Liu, M. Schmidt, Z. Yin, H. Zhan, *Laplacian fractional revival on graphs*. arXiv:2010.1041 (2020). Submitted.
14. H. Zhan, *Factoring discrete quantum walks on distance regular graphs into continuous quantum walks*. arXiv:2008.01224 (2020). Submitted.
15. A. Chan, G. Coutinho, W. Drazen, O. Eisenberg, C. Godsil, G. Lippner, M. Kempton, C. Tamon, H. Zhan, *Fundamentals of fractional revival in graph*. arXiv:2004.01129 (2020). Submitted.

Book in Preparation

14. C. Godsil, H. Zhan, *Discrete Quantum Walks*. Submitted.

SUPERVISION
EXPERIENCE

Undergraduate Research Programs

- Fields Undergraduate Summer Research Program Jul 2 - Aug 28, 2020
Co-supervised an undergraduate research project with Ada Chan on Laplacian fractional revival. We have submitted two papers [12] and [13] as a result of this program.

PRESENTATIONS **Invited Talks**

1. *DRACKNs and their applications in quantum information*. In: Codes and Expansions, United States, September 8, 2020.
2. *Factoring discrete quantum walks into continuous quantum walks*. In: Algebraic Graph Theory Seminar, University of Waterloo, Waterloo, ON, Canada, August 3, 2020.
3. *Quantum fractional revival*. In: Discrete Math Seminar, University of Delaware, Newark, DE, United States, April 23, 2020.
4. *New advances in quantum walks*. In: AMS Joint Mathematics Meetings, Colorado Convention Center, Denver, CO, United States, January 15 - 18, 2020.
5. *State transfer via orthogonal polynomials*. In: AMS Sectional Meeting, University of Wisconsin-Madison, Madison, WI, United States, September 14 - 15, 2019.
6. *Quantum state transfer in the algebra of the Johnson scheme*. In: CMS Summer Meeting, University of Regina, Regina, SK, Canada, June 7 - 10, 2019.
7. *Some elegant results in algebraic graph theory*. In: Canadian Discrete and Algorithmic Mathematics Conference, Simon Fraser University, Vancouver, BC, Canada, May 28 - 31, 2019.
8. *Quantum walks, orthogonal polynomials, and spectral graph theory*. In: Quantum Walks and Information Tasks, Banff International Research Station for Mathematical Innovation and Discovery, Banff, AB, Canada, April 21 - 26, 2019.
9. *Generating entanglement using quantum walks*. In: David A. Walsh Seminar Series, Clarkson University, Potsdam, NY, United States, February 8, 2019.
10. *Some open problems in discrete quantum walks*. In: Algebraic Graph Theory and Quantum Walks, University of Waterloo, Waterloo, ON, Canada, April 23 - 27, 2018.
11. *Recent progress in discrete quantum walks*. In: AMS Sectional Meeting, Northeastern University, Boston, MA, United States, April 21 - 22, 2018, 2018.
12. *Graph covers and equiangular frames*. In: AMS Sectional Meeting, Ohio State University, Columbus, OH, United States, March 16 - 18, 2018.
13. *From covers to tight frames*. In: AMS Sectional Meeting, College of Charleston, Charleston, SC, United States, March 10 - 12, 2017.
14. *Spectra of discrete quantum walks*. In: CMS Summer Meeting, University of Alberta, Edmonton, AB, Canada, June 24 - 27, 2016.
15. *Lines and covers of complete graphs 2*. In: Systems of Lines: Applications of Algebraic Combinatorics, Worcester Polytechnic Institute, Worcester, MA, United States, August 10 - 14, 2015.

16. *Some open problems in uniform mixing.* In: Summer Research Program, Clarkson University, Potsdam, NY, United States, July 20, 2015.

Conference Talks

1. *How far can the quantum walker go.* In: 9th International Conference on Quantum Simulation and Quantum Walks, Centre International de Rencontres Mathématiques, Marseille, Bouches-du-Rhone, France, January 20 - 24, 2020.
2. *Discrete quantum walks on Cayley graphs.* In: CMS Winter Meeting, York University, Toronto, ON, Canada, December 6 - 9, 2019.
3. *The vertex-face walk.* In: Finite Geometry and Extremal Combinatorics, University of Delaware, Newark, DE, United States, August 21 - 24, 2019.
4. *Combinatorial aspects of quantum walks.* In: Prairie Discrete Math Workshop, Brandon University, Brandon, MB, Canada, June 12 - 15, 2018.
5. *Discrete-time quantum walks and graph embeddings.* In: CMS Winter Meeting, University of Waterloo, Waterloo, ON, Canada, December 8 - 11, 2017.
6. *Quantum walks and mixing.* In: Algebraic and Extremal Graph Theory, University of Delaware, Newark, DE, United States, August 7 - 10, 2017.
7. *Discrete-time quantum walks and graph structures.* In: Canadian Discrete and Algorithmic Mathematics Conference, Ryerson University, Toronto, ON, Canada, June 12 - 15, 2017.
8. *Uniform mixing in quantum walks.* In: 22nd Ontario Combinatorics Workshop, York University, Toronto, ON, Canada, May 16 - 17, 2014.

TEACHING EXPERIENCE

York University

- Instructor Winter 2020, Fall 2020
MATH 1014: Applied Calculus II (class size: 180 - 280)

University of Waterloo

- Instructor Winter 2018
MATH 135: Algebra for Honors Mathematics (class size: 60)
- Substitute Instructor Winter 2017
CO 444/644: Algebraic Graph Theory (class size: 20)
- Teaching Assistant 2012 – 2017

Algebraic Enumeration	Algebraic Graph Theory
Calculus	Coding Theory
Introduction to Graph Theory	Graph Theory
Introduction to Combinatorics	Linear Algebra
Portfolio Optimization Models	Special Topics in Mathematical Connections

SERVICE

Conference, Workshop and Seminar Organizer

- Algebraic Graph Theory and Quantum Information, Fields Institute 2021
- Quantum Information on Graphs, CMS Winter Meeting Dec 6 - 9, 2019

- Discrete Mathematics Seminar, York University Fall, 2019
- Algebraic Graph Theory Seminar, University of Waterloo Spring 2016, Fall 2017

Journal Refereeing

- Communications in Algebra
- Discrete Mathematics
- Electronic Journal of Combinatorics
- Journal of Physics A: Mathematical and Theoretical
- Linear Algebra and Its Applications
- Linear and Multilinear Algebra

Conference Refereeing

- International Colloquium on Automata, Languages and Programming
- Sampling Theory and Applications

AWARDS AND DISTINCTIONS

University of Waterloo

- University Finalist for the Governor General's Gold Medal 2019
- Inaugural Mathematics Doctoral Prize 2019
- Outstanding Achievement in Graduate Studies 2015
- Cotton Family Women in Mathematics Graduate Scholarship 2014, 2016, 2017
- Faculty of Arts Upper-Year Scholarship 2011-2012
- Robin K. Banks Scholarship 2011-2012
- Dean's Honours List 2011-2012