

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

PUBLICATIONS **Journal Publications**

1. A. Chan, B. Johnson, M. Liu, M. Schmidt, Z. Yin, H. Zhan, *Laplacian fractional revival on graphs*. Electronic Journal of Combinatorics (2021) 28(3): P3.22.
2. 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
3. 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
4. H. Zhan, *Quantum walks on embeddings*. Journal of Algebraic Combinatorics (2020). doi.org/10.1007/s10801-020-00958-z
5. H. Zhan, *An infinite family of circulant graphs with perfect state transfer in discrete quantum walks*. Quantum Information Processing (2019) 18(12): pp. 369.
6. 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.
7. C. Godsil, H. Zhan, *Discrete-time quantum walks and graph structures*. Journal of Combinatorial Theory, Series A (2019), pp. 181212.
8. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Quantum fractional revival on graphs*. Discrete Applied Mathematics (2019) 269, pp. 86-98.
9. 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.
10. C. Godsil, H. Zhan, *Uniform mixing on Cayley graphs*. Electronic Journal of Combinatorics (2017) 24(3): P3.20.
11. 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.
12. 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

13. A. Chan, H. Zhan, *Pretty good state transfer in discrete-time quantum walks*. arXiv:2105.03762 (2021).
14. A. Chan, B. Johnson, M. Liu, M. Schmidt, Z. Yin, H. Zhan, *Laplacian pretty good fractional revival*. arXiv:2010.10465 (2020). Submitted.
15. H. Zhan, *Factoring discrete quantum walks on distance regular graphs into continuous quantum walks*. arXiv:2008.01224 (2020). Submitted.
16. 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

18. 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 [1] and [14] as a result of this program.

PRESENTATIONS **Invited Talks**

1. *The average search probability in a quantum walk with an oracle.* In: Algebraic Graph Theory Seminar, University of Waterloo, Waterloo, ON, Canada, August 2, 2021.
2. *Arc-reversal quantum walks.* In: Discrete Math Seminar, Simon Fraser University, Vancouver, BC, Canada, February 24, 2021.
3. *DRACKNs and their applications in quantum information.* In: Codes and Expansions, United States, September 8, 2020.
4. *Factoring discrete quantum walks into continuous quantum walks.* In: Algebraic Graph Theory Seminar, University of Waterloo, Waterloo, ON, Canada, August 3, 2020.
5. *Quantum fractional revival.* In: Discrete Math Seminar, University of Delaware, Newark, DE, United States, April 23, 2020.
6. *New advances in quantum walks.* In: AMS Joint Mathematics Meetings, Colorado Convention Center, Denver, CO, United States, January 15 - 18, 2020.
7. *State transfer via orthogonal polynomials.* In: AMS Sectional Meeting, University of Wisconsin-Madison, Madison, WI, United States, September 14 - 15, 2019.
8. *Quantum state transfer in the algebra of the Johnson scheme.* In: CMS Summer Meeting, University of Regina, Regina, SK, Canada, June 7 - 10, 2019.
9. *Some elegant results in algebraic graph theory.* In: Canadian Discrete and Algorithmic Mathematics Conference, Simon Fraser University, Vancouver, BC, Canada, May 28 - 31, 2019.
10. *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.
11. *Generating entanglement using quantum walks.* In: David A. Walsh Seminar Series, Clarkson University, Potsdam, NY, United States, February 8, 2019.
12. *Some open problems in discrete quantum walks.* In: Algebraic Graph Theory and Quantum Walks, University of Waterloo, Waterloo, ON, Canada, April 23 - 27, 2018.
13. *Recent progress in discrete quantum walks.* In: AMS Sectional Meeting, Northeastern University, Boston, MA, United States, April 21 - 22, 2018, 2018.
14. *Graph covers and equiangular frames.* In: AMS Sectional Meeting, Ohio State University, Columbus, OH, United States, March 16 - 18, 2018.
15. *From covers to tight frames.* In: AMS Sectional Meeting, College of Charleston, Charleston, SC, United States, March 10 - 12, 2017.

16. *Spectra of discrete quantum walks*. In: CMS Summer Meeting, University of Alberta, Edmonton, AB, Canada, June 24 - 27, 2016.
17. *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.
18. *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

Online Graduate Courses

- Instructor Winter 2021
Combinatorics and Quantum Walks

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 Combinatorial Theory A
- 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