

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, Quantum Information, Equiangular Lines	
CURRENT POSITION	<b>York Science Fellow</b> <ul style="list-style-type: none"><li>Department of Mathematics and Statistics, York University, Toronto, ON, Canada</li></ul> Supervisor: Ada Chan	Oct 2019, - Present
PREVIOUS POSITIONS	<b>Postdoctoral Fellow</b> <ul style="list-style-type: none"><li>Centre de Recherches Mathématiques, Université de Montréal, Montréal, QC, Canada</li></ul> Supervisor: Luc Vinet	Oct 2018 - Sep 2018
EDUCATION	<b>University of Waterloo</b> , Waterloo, ON, Canada <ul style="list-style-type: none"><li>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"><li>University Finalist for the Governor General's Gold Medal</li><li>First Place in the Inaugural Mathematics Doctoral Prize Competition</li></ul></li><li>Master of Mathematics Department of Combinatorics and Optimization, Faculty of Mathematics Thesis: <i>Uniform Mixing on Cayley Graphs over <math>\mathbb{Z}_3^d</math></i> Supervisor: Chris Godsil Thesis award:<ul style="list-style-type: none"><li>Outstanding Achievement in Graduate Studies</li></ul></li><li>Bachelor of Arts Department of Economics, Faculty of Arts Thesis: <i>Second-Price Auction with Resale</i> Supervisor: Philip Curry</li></ul> <b>Xiamen University</b> , Xiamen, Fujian, China <ul style="list-style-type: none"><li>Bachelor of Economics Department of Statistics, Faculty of Economics Thesis: <i>Multi-Player Multi-State Quantum Games</i> Supervisor: Zhengming Qian</li></ul>	May 2014 - Sept 2018 Sep 2012 - Apr 2014 Jan 2010 - Aug 2012 Sep 2008 - Jun 2014

## PUBLICATIONS    **Journal Publications**

1. H. Zhan, *An infinite family of circulant graphs with perfect state transfer in discrete quantum walks*, accepted to Quantum Information Processing, arXiv:1707.06703.
2. 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 52 (2019), 455302.
3. C. Godsil, H. Zhan, *Discrete-time quantum walks and graph structures*. Journal of Combinatorial Theory, Series A (2019), 181212.
4. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Quantum fractional revival on graphs*. Discrete Applied Mathematics (2019).
5. 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.
6. C. Godsil, H. Zhan, *Uniform mixing on Cayley graphs*. Electronic Journal of Combinatorics (2017) 24(3): P3.20.
7. G. Coutinho, C. Godsil, M. Shirazi, H. Zhan, *Equiangular lines and covers of the complete graph*. Linear Algebra and its Applications (2016) 488: 264-283.
8. 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): 801-826.

## **Preprints**

9. A. Chan, G. Coutinho, C. Tamon, L. Vinet, H. Zhan, *Fractional revival and association schemes*. arXiv:1907.04729 (2019). Submitted.
10. L. Vinet, H. Zhan, *Perfect state transfer on weighted graphs of the Johnson scheme*. arXiv:1904.08838 (2019).
11. H. Zhan, *Quantum walks on embeddings*. arXiv:1711.08831 (2017). Submitted.

## **Book in Preparation**

12. C. Godsil, H. Zhan, *Discrete Quantum Walks*.

## PRESENTATIONS    **Invited Talks**

1. *State transfer via orthogonal polynomials*. In: AMS Sectional Meeting, University of Wisconsin-Madison, Madison, WI, United States, September 14 - 15, 2019.
2. *Quantum state transfer in the algebra of the Johnson scheme*. In: CMS Summer Meeting, University of Regina, Regina, SK, Canada, June 7 - 10, 2019.
3. *Some elegant results in algebraic graph theory*. In: Canadian Discrete and Algorithmic Mathematics Conference, Simon Fraser University, Vancouver, BC, Canada, May 28 - 31, 2019.
4. *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.

5. *Generating entanglement using quantum walks*. In: David A. Walsh Seminar Series, Clarkson University, Potsdam, NY, United States, February 8, 2019.
6. *Some open problems in discrete quantum walks*. In: Algebraic Graph Theory and Quantum Walks, University of Waterloo, Waterloo, ON, Canada, April 23 - 27, 2018.
7. *Recent progress in discrete quantum walks*. In: AMS Sectional Meeting, Northeastern University, Boston, MA, United States, April 21 - 22, 2018, 2018.
8. *Graph covers and equiangular frames*. In: AMS Sectional Meeting, Ohio State University, Columbus, OH, United States, March 16 - 18, 2018.
9. *From covers to tight frames*. In: AMS Sectional Meeting, College of Charleston, Charleston, SC, United States, March 10 - 12, 2017.
10. *Spectra of discrete quantum walks*. In: CMS Summer Meeting, University of Alberta, Edmonton, AB, Canada, June 24 - 27, 2016.
11. *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.
12. *Some open problems in uniform mixing*. In: Summer Research Program, Clarkson University, Potsdam, NY, United States, July 20, 2015.

### Conference Talks

1. *The vertex-face walk*. In: Finite Geometry and Extremal Combinatorics, University of Delaware, Newark, DE, United States, August 21 - 24, 2019.
2. *Combinatorial aspects of quantum walks*. In: Prairie Discrete Math Workshop, Brandon University, Brandon, MB, Canada, June 12 - 15, 2018.
3. *Discrete-time quantum walks and graph embeddings*. In: CMS Winter Meeting, University of Waterloo, Waterloo, ON, Canada, December 8 - 11, 2017.
4. *Quantum walks and mixing*. In: Algebraic and Extremal Graph Theory, University of Delaware, Newark, DE, United States, August 7 - 10, 2017.
5. *Discrete-time quantum walks and graph structures*. In: Canadian Discrete and Algorithmic Mathematics Conference, Ryerson University, Toronto, ON, Canada, June 12 - 15, 2017.
6. *Uniform mixing in quantum walks*. In: 22nd Ontario Combinatorics Workshop, York University, Toronto, ON, Canada, May 16 - 17, 2014.

### RESEARCH EXPERIENCE

#### University of Waterloo

- Graduate Research Assistant 2014 – 2016  
Generated data on continuous and discrete quantum walks, and created websites introducing average mixing matrices, periodic vertices and strongly cospectral vertices

TEACHING  
EXPERIENCE

**University of Waterloo**

- Instructor Winter 2018  
MATH 135: Algebra for Honors Mathematics
- Substitute Instructor Winter 2017  
CO 444/644: Algebraic Graph Theory
- 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 May 4 - 8, 2020
- 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 Reviewer**

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

AWARDS AND  
DISTICTIONS

**University of Waterloo**

- University Finalist for the Governor General's Gold Medal 2019
- First Place in the Inaugural Mathematics Doctoral Prize Competition 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