HANBAEK LYU

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EMPLOYMENT

University of California, Los Angeles Hedrick Assistant Professor (Mentor: Marek Biskup) *Jul. 2018 - Jun. 2021*

EDUCATION

The Ohio State University Ph.D in Mathematics (Advised by David Sivakoff) *Aug. 2013 - Apr. 2018*

Thesis: *Combinatorial and probabilistic aspects of coupled oscillators*

Seoul National University B.S. in Mathematics *Mar. 2008 - Feb. 2013*

RESEARCH INTEREST

· **Fields of research**: probability, combinatorics, dynamical systems, statistical physics, and theoretical computer science

· **General interest**: emergent properties of spatial processes; distributed algorithms; structure of large networks; adaptive online learning algorithms

· **Topics studied**: Persistence of Markov additive functionals, firefly cellular automata (on finite trees and $\mathbb{Z}$), pulse-coupled oscillators (on finite trees), clock synchronization algorithms (on general graphs), 3-color cyclic cellular automaton and Greenberg-Hastings model (on general graphs), box-ball system (on $\mathbb{Z}$), 3-color cyclic particle system (on $\mathbb{Z}$), parking process (on transitive unimodular graphs), Euler characteristic, Lotka-Volterra model (4-dimension), stable operations on graphons and MCMC (for network data analysis), Online nonnegative matrix factorization (for streaming data analysis)

PUBLICATIONS

Journal Publications

[1] A. Kuniba, H. Lyu, and M. Okado, " *Randomized box-ball systems, limit shape of rigged configurations, and thermodynamic Bethe ansatz*" Nuclear Physics B (2018), Vol. 937, 240-271. (Journal, Preprint)

[2] M. Damron, J. Gravner, M. Junge, H. Lyu, and D. Sivakoff, "*Parking on transitive unimodular graphs.*" To appear in Annals of Applied Probability Preprint (2017)

[3] H. Lyu and D. Sivakoff "*Persistence of sums of correlated increments and clustering in cellular automata*" Stochastic Processes and Applications (2018). (Journal, Preprint)

[4] E. Foxall and H. Lyu, "*Clustering in three and four color cyclic particle systems in one dimension*" Journal of Statistical Physics (2018), Vol. 171, Issue 3, 470–483. (Journal, Preprint)

[5] H. Lyu, "*Global synchronization of pulse-coupled oscillators on trees.*" SIAM Journal on Applied Dynamical Systems (2018), Vol. 17, No. 2. (Journal, Preprint)

[6] J. Gravner, H. Lyu, and D. Sivakoff, "*Limiting behavior of 3-color excitable media on arbitrary graphs.*" Annals of Applied Probability, Vol. 28, Number 6 (2018), 3324-3357. (Journal, Preprint)

[7] H. Lyu, "*Synchronization of finite-state pulse-coupled oscillators.*", Physica D: Nonlinear Phenomena 303 (2015): 28-38. (Journal, Preprint)

Preprints

[8] M. Junge and H. Lyu, "*The phase structure in asymmetric ballistic annihilation*" Preprint (2018)

[9] A. Kuniba and H. Lyu, "*One-sided scaling limit of random multicolor box-ball system*" Preprint (2018)

[10] L. Levine, H. Lyu, and J. Pike, "*Double jump phase transition in a soliton cellular automaton.*" Submitted. Preprint (2017)

[11] H. Lyu and D. Sivakoff "*Synchronization of finite-state pulse-coupled oscillators on* $\mathbb{Z}$." Preprint (2017)

[12] H. Lyu, "*Phase transition in firefly cellular automata on finite trees.*" Preprint (2017)

[13] H. Lyu, "*Chromatic number, cycles, and non-separating cycles.*" Submitted. Preprint (2016)

In preparation

[14] H. Lyu, F. Memoli, and D. Sivakoff, "*Dynamic embedding of motifs into networks and applications*" In preparation

[15] H. Lyu, P. Pylyavskyy, and A. Sen, "*Multicolor box-ball system with random initial configuration* " In preparation

Unpublished notes

[16] H. Lyu, "*A Note on Graph Characteristics and Hadwiger's Conjecture.*" Preprint (2012)

[17] H. Lyu and P. Jablonski, "*Four-Dimensional Discrete-time Lotka-Volterra Models with an Application to Ecology.*" Prepint (2012)

REFEREED JOURNALS

Journal of Statistical Physics

Nonlinear Dynamics

Journal of Nonlinear Science

Automatica

IEEE Transations on Cybernetics

INVITED TALKS

TBD, Applied math seminar, University of Alberta, Mar 25, 2019

"Dynamic embedding of motifs into networks", Probability Seminar, University of Southern California, Mar 8, 2019

"Dynamic embedding of motifs into networks", Probability Seminar, University of California, Irvine, Dec 11, 2018

"Phase transition in box-ball system and its spatial generalization", Integrable systems seminar, Tokyo University, June 19, 2018

"Double jump phase transition in soliton cellular automata", Southeastern Probability Conference, Duke University, May 14-15, 2018

"Double jump phase transition in soliton cellular automata", Probability Seminar, University of California, Los Angeles, April 19, 2018

"Double jump phase transition in soliton cellular automata", Probability Seminar, University of Pennsylvania, Mar 27, 2018

"Double jump phase transition in random soliton cellular automaton", Combinatorics seminar, University of Minnesota, March 2, 2018

"Double jump phase transition in random soliton cellular automaton", Combinatorics seminar, University of Michigan, Jan 26, 2018

"Global synchronization of pulse-coupled oscillators on trees", AMS Contributing papers on Applied Mathematics III, Joint Mathematics Meetings 2018, San Diego

"Limiting behavior of 3-color excitable media on arbitrary graphs", AMS Special Session on Emergent Phenomena in discrete models, Joint Mathematics Meetings 2018, San Diego

"Persistence of sums of correlated increments and clustering in cellular automata", AMS Special Session on Markov chains, Markov processes and applications, Joint Mathematics Meetings 2018, San Diego

"Phase transition in a random soliton cellular automaton" Combinatorics and Probability Seminar, The Ohio State University, April 12, 2017

"Discrete excitable media on graphs" Probability Seminar, Indiana University, Sep 12, 2016

"Synchronization of finite-state pulse-coupled oscillators and applications to distributed algorithms" 2016 Combinatorics Conference, KAIST, Jul 23, 2016

"Synchronization of finite-state pulse-coupled oscillators on various network topologies" Hayes Graduate Research Forum, The Ohio State university, Feb 26, 2016

"Synchronization of finite-state pulse-coupled oscillators on various graphs" Probability Seminar, Cornell University , Feb 22, 2016

"Synchronization of finite-state pulse-coupled oscillators on various graphs" Korea Institute for Advanced Study, Jan 14, 2016

"Synchronization of finite-state pulse-coupled oscillators" HYKE seminar at Seoul National University, May 14, 2015

"Synchronization of finite-state pulse-coupled oscillators on various network topologies" Combinatorics and Probability seminar at the Ohio State University, Oct 1, 2015

Synchronization of finite-state pulse-coupled oscillators" Graduate Student Seminar at the Ohio State University, Sep 22, 2015

AWARDS AND FELLOWSHIPS

Transdisciplinary Research In Principles Of Data Science (TRIPODS) grant, Spring 2018

The Ohio State University Presidential Fellowship (University research fellowship), Spring 2017 - Fall 2017

Special Graduate Associate (Departmental research fellowship), Fall 2016

Special Graduate Associate (Departmental research fellowship), Spring 2016

National Science & Technology Scholarship, 2008-2012

CONFERENCES ATTENDED

MSRI summer school in Representations of high dimensional data, July 9-20, 2018, MSRI, Berkeley, CA

4th Lake Michigan Workshop on Combinatorics and Graph Theory, April 15-16, 2017, Western Michigan University, Kalamazoo, MI

Dynamics and Geometry from High Dimensional Data, March 14-16, 2017, Carnegie Mellon University, Pittsburgh, PA

38th Midwest Probability Colloquium, October 13-15, 2016, Northwestern University, Evanston, IL

The 28th Fall meeting of the Semi-annual Workshop in Dynamical Systems and Related Topics, October 5 - 8, 2017, Penn State University, State College, PA

2016 Charles River Lectures on Probability Theory and Related Topics, October 27, 2016, Microsoft Research New England

Stochastic Networks Conference, June 20 - July 24, 2016, University of California at San Diego, CA

CRM-PIMS Summer School in Probability, June 15 - July 11, 2015, McGill University, Canada

2015 Charles River Lectures on Probability Theory and Related Topics, October 2, 2015, Microsoft Research New England

37th Midwest Probability Colloquium, October 8-10, 2015, Northwestern University, Evanston, IL

Central Spring Sectional Meeting Michigan State University, East Lansing, MI March 14-15, 2015

TEACHING

UCLA

Fall 2018: Math 170B (Probability Theory)

OSU

Fall 2015: Math 2153 (Calculus 3) (Notes)

Spring 2014: Math 1131 (Calculus for business)

Fall 2014: Fall 2014: Math 1131 (Calculus for business)

Summer 2013: Summer 2013: Math 1152 (Calculus 2)

Spring 2013: Spring 2013: Math 1151 (Calculus 1)

Fall 2013: Math 1151 (Calculus 1)