
CONTACT INFORMATION	Department of Mathematics University of Wisconsin–Madison 322 Van Vleck Hall, 480 Lincoln Dr Madison, Wisconsin 53706, United States	<i>E-mail:</i> hhong78@wisc.edu <i>Web:</i> https://people.math.wisc.edu/~hhong78
APPOINTMENTS	University of Wisconsin–Madison , Madison, Wisconsin, United States Van Vleck Assistant Professor, Department of Mathematics Aug. 2023–present	
EDUCATION	KAIST , Daejeon, South Korea Ph.D. in Mathematical Sciences Feb. 2018–Aug. 2023 Advisor: Jae Kyoung Kim (jaekkim@kaist.ac.kr) Thesis: Development of stochastic model reduction framework for analysis and inference of biochemical reaction networks B.S. in Mathematical Sciences Mar. 2013–Feb. 2018	
RESEARCH INTERESTS	Fields of research: Mathematical biology, Dynamical systems, Bayesian statistics, Digital medicine Research interests: Set of steady states of a system of ODEs, stationary distribution of a continuous-time Markov chain, Koopman operator theory, MCMC methods, parameter estimation for non-Markovian stochastic models, Metabolic control analysis, Homeostasis and adaptation in biological systems, Neurodegenerative disease-related alteration of human motor activity	
PAPERS	†: (co-)1st author, *: (co-)corresponding author. In preparation or preprint: 1. Ella Buelling, Wolfram Liebermeister, Hyukpyo Hong , Connections between structural sensitivity analysis and metabolic control analysis, <i>in preparation</i> 2. Hyukpyo Hong , Seewoo Lee, Necessary and sufficient conditions of the existence of finite dimensional subspace invariant under polynomial ODEs, <i>in preparation</i> 3. Hyukpyo Hong , Matthew Colbrook, Qin Li, Hanbaek Lyu, Efficient algorithm for finding a finite-dimensional Koopman representation, <i>in preparation</i> 4. Hyukpyo Hong , Diego Rojas La Luz, Gheorghe Craciun, Ubiquitous asymptotic robustness in biochemical systems, <i>preprint</i> ; [arXiv] Published or accepted: 1. Dongju Lim†, Kyeong Tae Ko†, Hyukpyo Hong , Hyojung Lee, Boseung Choi, Won Chang, Sunhwa Choi*, Jae Kyoung Kim*, A history-dependent approach for accurate initial condition estimation in epidemic models, <i>PLoS Computational Biology</i> , 2025; [journal] 2. Hyukpyo Hong †, Seokhwan Moon†, Yuji Hirono†,*, Jae Kyoung Kim*, Topological criterion for robust perfect adaptation of reaction fluxes in biological networks, <i>iScience</i> , 2025; [arXiv , journal] 3. Hyukpyo Hong †, Eunjin Eom†, Hyojung Lee, Sunhwa Choi*, Boseung Choi*, Jae Kyoung Kim*, Overcoming bias in estimating epidemiological parameters with realistic history-dependent disease spread dynamics, <i>Nature Communications</i> , 2024; [journal] 4. Hyeontae Jo†, Hyukpyo Hong †, Hyung Ju Hwang, Won Chang, Jae Kyoung Kim*, Density physics-informed neural networks reveal sources of cell heterogeneity in signal transduction, <i>Patterns</i> , 2023; [bioRxiv , journal] 5. Hyukpyo Hong †, Mark Jayson Cortez, Yu-Yu Cheng, Hang J. Kim, Boseung Choi*, Krešimir Josić*, Jae Kyoung Kim*, Inferring delays in partially observed gene regulation processes, <i>Bioinformatics</i> , 2023; [bioRxiv , journal]	

6. **Hyukpyo Hong**, Bryan S. Hernandez, Jinsu Kim, Jae Kyoung Kim*, Computational translation framework identifies biochemical reaction networks with special topologies and their long-term dynamics, *SIAM Journal on Applied Mathematics*, 2023; [[arXiv](#), [journal](#)]
7. **Hyukpyo Hong**†, Ji Yun Noh†, Hyojung Lee, Sunhwa Choi, Boseung Choi, Jae Kyoung Kim*, Eui-Cheol Shin*, Modeling incorporating the severity-reducing long-term immunity: higher viral transmission paradoxically reduces severe COVID-19 during endemic transition, *Immune Network*, 2022 [[medRxiv](#), [journal](#)]
8. Dae Wook Kim†, **Hyukpyo Hong**†, Jae Kyoung Kim*, Systematic inference identifies a major source of heterogeneity in cell signaling dynamics: the rate-limiting step number, *Science Advances*, 2022; [[journal](#)]
9. Yun Min Song†, **Hyukpyo Hong**†, Jae Kyoung Kim*, Universally valid reduction of multiscale stochastic biochemical systems with simple non-elementary propensities, *PLoS Computational Biology*, 2021; [[bioRxiv](#), [journal](#)]
10. Mark Jayson Cortez†, **Hyukpyo Hong**, Boseung Choi*, Jae Kyoung Kim*, Krešimir Josić*, Hierarchical Bayesian models for inference in biochemical reactions with delays, *Bioinformatics*, 2021; [[bioRxiv](#), [journal](#)]
11. Jaehyoung Hong†, Su Jung Choi†, Se Ho Park, **Hyukpyo Hong**, Victoria Booth, Eun Yeon Joo*, Jae Kyoung Kim*, Personalized sleep-wake patterns aligned with circadian rhythm relieve daytime sleepiness, *iScience*, 2021; [[bioRxiv](#), [journal](#)]
12. **Hyukpyo Hong**†, Jinsu Kim†, M. Ali Al-Radhawi, Eduardo D. Sontag, Jae Kyoung Kim*, Derivation of stationary distributions of biochemical reaction networks via structure transformation, *Communications Biology*, 2021; [[bioRxiv](#), [journal](#)]

BOOK CHAPTERS

1. **Hyukpyo Hong**, Boseung Choi, and Jae Kyoung Kim, *Beyond the Michaelis-Menten: Bayesian inference for enzyme kinetic analysis*, Quentin Vanhaelen (Ed.), *Computational Methods for Estimating the Kinetics Parameters of Biological Systems*, Methods in Molecular Biology, vol 2385. Humana, New York, NY.

RESEARCH GRANTS

2019–2023 National Research Foundation of Korea, NRF-2019-Fostering Core Leaders of the Future Basic Science Program/Global Ph.D. Fellowship Program, 2019H1A2A1075303, **Principal Investigator** (\$120,000)
 Title: *Development of Stochastic Model Reduction Methodology and its Application to an Optogenetic System*

HONORS AND AWARDS

2025 Postdoctoral Excellence in Teaching Award, Dept. of Mathematics, UW–Madison
 2025 KMS Excellent Dissertation Award, KMS
 2024 KSIAM Next Generation Researcher Award, KSIAM
 2022 SIAM Student Travel Awards, SIAM
 2022 Blood Donor Hall of Fame for 100 times of blood donations, Korean Red Cross
 2021 KSIAM Conference Poster Presentation Award, KSIAM
 2019–2023 Global Ph.D. Fellowship (Full Tuition), NRF
 2017 36th National Undergraduate Mathematics Competition Silver Award, KMS
 2014 33rd National Undergraduate Mathematics Competition Silver Award, KMS
 2016 Mirae Asset Global Exchange Scholarship, Mirae Asset Park Hyeon Joo Foundation
 2014 Dean’s List Award, College of Natural Sciences, KAIST
 2013 32nd National Undergraduate Mathematics Competition Silver Award, KMS
 2013–2017 The National Scholarship for Science and Engineering (Full Tuition), KOSAF

Abbreviations

NRF: National Research Foundation of Korea,

KMS: Korean Mathematical Society

KSIAM: Korean Society for Industrial and Applied Mathematics

KOSAF: Korea Student Aid Foundation,

TEACHING

UW–Madison

- Spring 2026 (planned): [Instructor] Introductory Probability (MATH331)
- Fall 2025: [Instructor] Introductory Probability (MATH331)
- Spring 2025: [Instructor] Introductory Probability (MATH331)
- Fall 2024: [Instructor] Elementary Matrix and Linear Algebra (MATH340)
- Spring 2024: [Instructor] Linear Algebra and Differential Equations (MATH320)
- Fall 2023: [Instructor] Linear Algebra and Differential Equations (MATH320)

KAIST

- 2019 Spring: [Teaching Assistant] Differential Equations and Applications (MAS201)
- 2018 Fall: [Teaching Assistant] Differential Equations and Applications (MAS201)
- 2018 Spring: [Teaching Assistant] Introduction to Linear Algebra (MAS109), Linear Algebra (MAS212)

MENTORING

UW–Madison

- June 2024–present: Ella Buelling, a junior student at Edgewood High School
Mentoring a talented and passionate high school student. Working on connections between the hypergraph representation of biochemical reaction networks and metabolic control analysis.

KAIST

- June 2023–March 2025: Seokhwan Moon, who was an undergraduate student in the Department of Mathematics at POSTECH
We investigated how bacteria and plants maintain robust intracellular functioning despite environmental fluctuations. We derived structural conditions under which the steady-state solutions of a system of ODEs remain independent of system parameters. This work was published in the interdisciplinary journal *iScience*.
- Spring 2019: Minyoo Kim, who was an undergraduate student in the Department of Mathematics at KAIST
Discussed with and guided the student to investigate *the total quasi-steady-state approximation for a competitive system*. The student won a poster presentation prize at the 2019 KSIAM spring conference and a prize in the URP final evaluation.

INVITED TALKS

October 31, 2025: UW–Madison Applied and Computational Mathematics Seminar
TBD

Madison, WI, USA

October 28, 2025: Midwest Mathematical Biology Seminar
TBD

Online

September 27, 2025: 2025 SIAM Great Lakes Section Annual Meeting Chicago, IL, USA
Digital biomarker of cognitive impairment: fractal patterns of human activity data

July 17, 2025: SMB Annual Meeting
Inferring delay distributions in partially observed biological processes.

Edmonton, Canada

July 8, 2025: SIAM Conference on Applied Algebraic Geometry
Ubiquitous Asymptotic Robustness in Biochemical Systems

Madison, WI, USA

June 20, 2025: Pusan National University Math Seminar Busan, Korea
Parameter inference in Markovian and non-Markovian models

June 4, 2025: KAIST Brain & Cognitive Sciences Seminar Daejeon, Korea
Digital biomarker of cognitive impairment: fractal patterns of human activity data

June 2, 2025: Konkuk University Math Seminar Seoul, Korea
Parameter inference in Markovian and non-Markovian models

May 17, 2025: KSIAM Spring Conference Seoul, Korea
KSIAM Next Generation Researcher Award speech

May 15, 2025: SIAM Conference on Applications of Dynamical Systems Denver, CO, USA
Network Translation of a Stochastic Reaction Network to Reveal Stationary Distributions

March 3, 2025: Computational and Applied Math / Data Science seminar in the School of Math and Stats at Arizona State University Online
Koopman representation: Linear representation of nonlinear dynamics

October 25, 2024: Applied Math Seminar at the University of Cincinnati Cincinnati, OH, USA
Koopman representation: Linear representation of nonlinear dynamics

October 7, 2024: Seminar at the University of the Philippines Diliman Online
Accurate epidemiological parameters estimation with realistic history-dependent disease spread dynamics

August 1, 2024: Seminar at Pusan National University Busan, Korea
Analysis of dynamical systems using “easier” representations

July 31, 2024: Biomedical Mathematics Seminar at Institute for Basic Science Daejeon, Korea
Koopman representation:
Linear representation—not an approximation—of nonlinear dynamics

July 2–4, 2024: SMB Annual Meeting Seoul, Korea
1. Inferring delays in partially observed gene regulation processes
2. Density-PINNs reveal that multiple pathways reduce cell-to-cell heterogeneity in antibiotic responses

June 4, 2024: Data Computational Sciences Special Lecture at Korea University, Sejong Campus Sejong, Korea
How to sample random numbers from a target distribution

June 3, 2024: Data Science Seminar at Sogang University Seoul, Korea
Analysis of dynamical systems using “easier” representations

May 23, 2024: Center for Mathematical Machine Learning and its Applications (CM2LA) Seminar at POSTECH Pohang, Korea
Analysis of dynamical systems using “easier” representations

April 25, 2024: Mathematical Biology Seminar at UIUC Champaign, IL, USA
Analyzing long-term behavior of dynamical systems using “easy-to-handle” representations

August 17, 2023: ICIAM 2023 Satellite Workshop: Stochastic Modeling and Data Analysis for Biological Systems Daejeon, Korea
Network translation allows for revealing long-term dynamics of stochastic reaction networks

July 17, 2023: SMB Annual Meeting Columbus, OH, USA
Network translation allows for revealing long-term dynamics of stochastic reaction networks

June 27, 2023: The 8th CIJK International Conference on

	Mathematical and Theoretical Biology	Jeju, Korea
	Things we have been overlooking in infectious disease modeling	
	May 19, 2023: KSIAM Spring Conference	Pyeongchang, Korea
	Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	
	December 19, 2022: Mini-workshop on Recent Trends in Pure and Applied Mathematics	Daejeon, Korea
	Inferring delays in partially observed gene regulatory networks	
	November 21, 2022: Population Approach Group Korea Annual Meeting	Seoul, Korea
	Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	
	October 19, 2022: Global KMS International Conference	Seoul, Korea
	Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics	
	June 25, 2022: KSMB Annual Meeting	Yeosu, Korea
	Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	
	June 22, 2022: BRIC Webinar [link]	Online
	Systematic inference for cell signalling pathways identifies a key determinant of cell-to-cell variability	
	May 28, 2022: KSIAM Spring Conference	Daejeon, Korea
	Systematic inference for cell signalling pathways identifies a key determinant of cell-to-cell variability	
	August 27, 2021: KSMB Annual Meeting	Jeju, Korea
	Inference of stochastic dynamics in biochemical reaction networks	
	June 16, 2021: SMB Annual Meeting	Online
	Inference of stochastic dynamics in biochemical reaction networks	
	May 27, 2021: SIAM Conference on Applications of Dynamical Systems	Online
	Derivation of stationary distributions of stochastic chemical reaction networks via network translation	
	May 13, 2021: Seminar on the Mathematics of Reaction Networks [video]	Online
	Derivation of stationary distributions of stochastic chemical reaction networks via network translation.	
	October 24, 2020: KMS Annual Meeting	Online
	Derivation of stationary distributions of biochemical reaction networks via structure transformation	
CONTRIBUTED TALKS AND POSTERS	June 27, 2024: KSMB-SMB Satellite Workshop: Tutorials for Recent Advances in Methods of Biomedical Mathematics	Daejeon, Korea Poster
	June 10, 2024: SPT Workshop on Reaction Networks	Cagliari, Italy Poster
	July 14, 2023: Dynamical Systems in the Life Sciences	Columbus, OH, USA Poster
	December 6, 2022: Workshop on Non-equilibrium Phenomena in Physics and Biology	Gyeongju, Korea
	Network translation allows for revealing long-term dynamics of stochastic	

reaction networks	Poster
November 26, 2022: KSIAM Annual Conference	Jeju, Korea
Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition	General session
October 11, 2022: International Conference on Systems Biology	Berlin, Germany
Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics: the rate-limiting step number	Short talk
July 14, 2022: SIAM Conference on the Life Sciences	Pittsburgh, USA
Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics: the rate-limiting step number	Contributed talk
May 17, 2022: SRBR Biennial Conference	Jacksonville, USA
Personalized sleep-wake patterns aligned with circadian rhythm relieve daytime sleepiness	Poster
December 17, 2021: KSMB Winter Conference	Jeju, Korea
Derivation of stationary distributions of stochastic chemical reaction networks via network translation	Poster
December 04, 2021: KSIAM Annual Conference	Busan, Korea
Derivation of stationary distributions of stochastic chemical reaction networks via network translation	Poster
September 28, 2021: Non-equilibrium collective phenomena workshop	Gyeongju, Korea
Derivation of stationary distributions of stochastic chemical reaction networks via network translation	Poster
June 26, 2021: KSIAM Spring Conference	Gangneung, Korea
Derivation of stationary distributions of biochemical reaction networks via structure transformation	Contributed talk
November 13, 2020: KSIAM Annual Meeting	Online
Derivation of stationary distributions of biochemical reaction networks via structure transformation	Poster
August 20, 2020: SMB Annual Meeting	Online
Derivation of stationary distributions of biochemical reaction networks via structure transformation	Contributed talk
July 23, 2019: SMB Annual Meeting	Montreal, Canada
Product-form stationary distributions for non-complex balanced networks	Poster
July 8, 2019: Chemical Reaction Networks Workshop	Torino, Italy
Product-form stationary distributions for non-complex balanced networks	Short talk
May 18, 2019: KSIAM Spring Conference	Seoul, Korea
Product-form stationary distributions for non-complex balanced networks	Contributed talk
May 11, 2019: A3 Workshop on Mathematical Life Science	Beijing, China
Product-form stationary distributions for non-complex balanced networks	Student talk
June 13–17, 2021: Support Staff, SMB Annual Meeting	
Hosted Zoom sessions for the Asia time zone.	

ACADEMIC
SERVICE

OUTREACH

September 16, 2022: Science Slam-D Public Lecture at Yongsan High School, Daejeon, Korea
 Delivered a public lecture for high school students. Hosted by NST (National Research Council of Science and Technology), IBS (Institute for Basic Science), Daejeon MBC (TV network) and Hello DD (STEM-focused news organization).
 Title: *Mathematics Meets Biology: Discovering the Optimal Sleep Pattern through Mathematical Modeling.*

April 27, 2021: Mobile Science Classroom with the National Research Foundation of Korea [video]

Delivered a public lecture for middle school students. Hosted by NRF Korea.

Title: *Mathematical Biology: Bridging Mathematics and the Life Sciences*.

PEER REVIEW

PLoS Computational Biology, Acta Biotheoretica, Stat, PCI Math Comp Biol