

Seokhwan Moon

📍 Republic of Korea

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🔗 seokhwan-moon.github.io

in sh-moon

Education

B.S. Pohang University of Science and Technology (POSTECH) , Mathematics <ul style="list-style-type: none"> GPA: 3.93/4.30 (Expected to graduate at Feb 2025 with <i>Summa Cum Laude</i>) Absence due to mandatory military service (Feb 2021 – Nov 2022) 	Feb 2019 – Present
	Pohang, ROK
University of Illinois, Urbana-Champaign (UIUC) , Mathematics <ul style="list-style-type: none"> Exchange student with approximately \$5,000 funding from POSTECH 	Jan 2024 – May 2024
	Illinois, USA
H.S. Gwangju Science Academy for the Gifted <ul style="list-style-type: none"> High school for the gifted in mathematics and science 	Mar 2016 – Feb 2019
	Gwangju, ROK

Research Interest

Mathematical Interest : Mathematical biology, Probability, Dynamical Systems, Stochastic Process, Reaction Network Theory, Markov Chain, Evolutionary Game Theory

Biological Interest : Systems Biology, Biological Circuit, Evolutionary Dynamics, Pattern Formation

Publications/Preprints

† : (co-) first author (for interdisciplinary journals), * : (co-) corresponding author

- Hyukpyo Hong[†], **Seokhwan Moon[†]**, Yuji Hirono[†], and Jae Kyoung Kim*. Topological criterion for robust perfect adaptation of reaction fluxes in biological networks. Under review in *Cell*.
- Minjoon Kim[†], **Seokhwan Moon[†]**, and Jinsu Kim*. Exponential ergodicity of one-dimensional stochastic reaction networks. *In preparation*.

Research Experience

Spatial Models of Evolutionary Dynamics <ul style="list-style-type: none"> As a participant of Illinois Mathematics Lab, co-work with Daniel Cooney. Formulate a PDE model describing the evolutionary game with spatial dynamics, and analyze spatial patterns. Studied evolutionary dynamics, game theory, partial differential equations, linear/nonlinear stability analysis. 	Jan 2024 – Ongoing
Exponential ergodicity for 1D stochastic reaction networks <ul style="list-style-type: none"> Co-work with Minjoon Kim and Jinsu Kim. Proving that in 1D stochastic reaction network, ergodic reaction networks are always exponential ergodic. Studied about the ergodicity of continuous-time Markov chain, birth-death process, and mixing time. 	Dec 2023 – Jul 2024
Variance controller for stochastic chemical reaction networks <ul style="list-style-type: none"> Co-work with Dongju Lim, Yun Min Song, Jinsu Kim, and Jae Kyoung Kim. As an undergraduate research intern in the Biomedical Mathematics Group, Institute for Basic Science. Convert deterministic theorem to stochastic theorem, and applied control theoretic viewpoint. 	Sep 2023 – Ongoing

- Studied antithetic integral feedback motif, infinitesimal generator of continuous-time Markov chain, and control theory.

Robust perfect adaptation of reaction fluxes

Jun 2023 – Nov 2023

- Co-work with [Hyukpyo Hong](#), [Yuji Hirono](#), and Jae Kyoung Kim.
- As an undergraduate research intern in the Biomedical Mathematics Group, Institute for Basic Science.
- Identifying the structural conditions for the RPA of fluxes, and finding its biological examples.
- Studied robust perfect adaptation, reaction networks, and how to apply mathematics to biology.

Moment closure method for stochastic reaction networks

Jan 2023 – Sep 2023

- Advised by Jinsu Kim.
- Applying various moment closure approximation to stochastic reaction networks.
- Studied chemical reaction network theory, moment closure approximation, stationary distribution of reaction network.
- Notes for this project is available [here](#).

Presentations

Contributed Talk

Exponential ergodicity of stochastic chemical reaction networks with a single species

Jul 2024

2024 Society for Mathematical Biology Annual Meeting, Seoul, ROK

Poster presentation

Topological criterion for robust perfect adaptation of reaction fluxes in biological networks

Jun 2024

2024 SMB Satellite Workshop : Recent Advances in Methods for Biomedical Mathematics, Daejeon, ROK

Spatial models of evolutionary dynamics

Apr 2024

2024 UIUC Undergraduate Research Symposium, Illinois, USA

Robust perfect adaption of reaction fluxes ensured by network topology

Aug 2023

ICIAM 2023 Satellite Workshop : Stochastic Modeling and Data Analysis for Biological Systems, Daejeon, ROK

Seminars

Reading Group on PDE Models in Mathematical Biology, UIUC

Apr 2024

Woolley, Thomas E. "Boundary conditions cause different generic bifurcation structures in Turing systems." *Bulletin of Mathematical Biology* 84.9 (2022): 101.

Reading Group on PDE Models in Mathematical Biology, UIUC

Feb 2024

Hillen, Thomas, and Kevin J. Painter. "A user's guide to PDE models for chemotaxis." *Journal of mathematical biology* 58.1-2 (2009): 183-217.

Journal Club for stochastic analysis of biochemical systems, POSTECH

Nov 2023

Briat, Corentin, Ankit Gupta, and Mustafa Khammash. "Antithetic proportional-integral feedback for reduced variance and improved control performance of stochastic reaction networks." *Journal of The Royal Society Interface* 15.143 (2018)

Journal Club, IBS Biomedical Mathematics Group

Aug 2023

Ankit Gupta, and Mustafa Khammash. "The Internal Model Principle for Biomolecular Control Theory", *IEEE Open Journal of Control Systems* 2 (2023): 63-69

POSTECH SIAM Student Chapter, POSTECH

May 2023

What is the chemical master equation, and how to solve it?

Journal Club for stochastic analysis of biochemical systems [🔗](#), POSTECH
 Lee, Chang Hyeong, Kyeong-Hun Kim, and Pilwon Kim. "A moment closure method for stochastic reaction networks." The Journal of chemical physics 130.13 (2009)

Mar 2023

Scholarship/Award

Exchange Program Scholarship , POSTECH Mathematics (\approx \$2,500)	Sep 2024
Exchange Program Scholarship , POSTECH (\approx \$2,500)	Apr 2024
Dean's List , POSTECH Mathematics	Fall 2023
Dean's List , POSTECH Mathematics	Spring 2023
National Scholarship of Excellence (Science & Engineering)	Feb 2023 – Continued
Jigok Scholarship	Feb 2019 – Jan 2023

Teaching/Mentoring

Student Mentoring Program , POSTECH Tutor for MATH203 <i>Applied Linear Algebra</i>	Sep 2023 – Dec 2023
Student Advisor , POSTECH Teaching Assistant for MSUS102, MSUS103 <i>Future Planning for College Life I, II</i>	Mar 2023 – Dec 2023
Educational Outreach Organization , POSTECH Visited local children's center weekly to teach mathematics and science	Mar 2023 – Dec 2023
1st Pohang Academy of AI and Mathematics , POSTECH MINDS Teaching Assistant for the practice section using Python	Jan 2021 – Feb 2021
Student Mentoring Program , POSTECH Tutor for MATH203 <i>Applied Linear Algebra</i>	Mar 2020 – Jun 2020
Educational Outreach Organization , POSTECH Visited local middle school weekly and help learning math and science	Sep 2019 – Dec 2019
2019 Summer Educational Outreach Science Camp , POSTECH Invited middle school students, teaching scientific program and lead the students	Jul 2019 – Aug 2019

Other Activities attended

Workshop on chemical reaction network theory: satellite workshop of SMB 2024 Pohang, ROK	Jul 2024
2023 KSIAM Annual Meeting Gwangju, ROK	Nov 2024
The 8th CIJK Conference on Mathematical and Theoretical Biology Jeju, ROK	Jun 2023
2023 KSIAM-NIMS School on Biomathematics : Statistical Tools for Mathematical Modeling Jeju, ROK	Jun 2023
2023 KMS Spring Meeting Daejeon, ROK	Apr 2023

Extracurricular Activities

Educational Outreach Organization	Jul 2019 – Ongoing
<ul style="list-style-type: none"> Helping local student's study in mathematics and science Continued except for inevitable reasons (COVID, Military Service, Exchange student) 	

Signal Intelligence Soldier at ROK Defense Security Agency

Feb 2021 – Nov 2022

- Mandatory military service in the Republic of Korea
- Worked with [303rd Intelligence Squadron](#) at the OSAN Air Base

POSTECH Baseball Club (Tachyons)

Spring 2019 – Fall 2023

- Played as a 1st and 3rd Basemen
- Played as a university representative player in official events

POSTECH Freshmen Student Council

Fall 2019 – Spring 2020

- Worked as a member of the Design force

Skills/Languages

Korean, English, C, Python, Matlab, \LaTeX , Julia, Mathematica, Adobe Illustrator & Photoshop

References

Prof. Jinsu Kim [✉](#), jinsukim@postech.ac.kr

- *Assistant professor* at Department of Mathematics, POSTECH

Prof. Jae Kyong Kim [✉](#), jaekkim@kaist.ac.kr

- *Associate Professor* at Department of Mathematical Sciences, KAIST.
- *Chief Investigator* at [Blomedical Mathematics Group \(BIMAG\)](#) [✉](#), Center for Mathematical and Computational Sciences, Institute for Basic Sciences (IBS)

Prof. Daniel Cooney [✉](#), dbcoone2@illinois.edu

- *Assistant Professor* at Department of Mathematics, University of Illinois, Urbana-Champaign

Prof. Hyukpyo Hong [✉](#), hhong78@wisc.edu

- *Van Vleck Assistant Professor* at the Department of Mathematics, University of Wisconsin–Madison