Curriculum Vitae

Department of Mathematics and
Research Institute for Natural Sciences,
Hanyang University,
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Appointments

- Department of Mathematics and Research Institute for Natural Sciences, College of Natural Sciences, Hanyang University, Seoul, Korea,
  - Associate Professor, March 2024 - Present.
  - Assistant Professor, March 2018 - February 2024.
  - Department Chair, March 2023 - February 2025.
- School of Mathematics, Korea Institute for Advanced Study
  - Visiting Professor, March 2025 - February 2026.

Degrees & Academic Experiences

- B.S. Mathematics, Seoul National University, August 2010.
- M.S. Mathematics, Seoul National University, August 2013.
  - Thesis Title: Asymptotic alignment of particle model with attractive-repulsive coupling.
  - Thesis Advisor : Prof. Seung-Yeal Ha.
- Ph.D. Mathematics, Seoul National University, August 2016.
  - Thesis Title: On the asymptotic dynamics of particle and kinetic Kuramoto synchronization models
  - Thesis Advisor : Prof. Seung-Yeal Ha.
- Postdoctoral Researcher (Mentor: Prof. Juan Soler), Departamento de Matemática Aplicada, Facultad de Ciencias, Universidad de Granada, Spain, November 2016 - January 2018.

Publications

MathSciNet Google Scholar

1. Aggregation and clustering of the multi-agent dynamics with density-dependent influence (with M. Kang, D. Kim, and B. Moon) Nonlinear Analysis: Real World Applications, Volume 94, (2027) 104722.

2. Convergence analysis of incidence angle-dependent alignment in planar active matter (with J. Kim and B. Moon) Communications in Nonlinear Science and Numerical Simulation, Volume 154, (2026) 109544.

3. A kinetic description for the electromagnetic response of the charged particles to Chern-Simons gauge fields (with J. Kim and B. Moon) Physica D, Volume 470, (2024), 134409.

4. Fast and slow clustering dynamics of Cucker-Smale ensemble with internal oscillatory phases (with S.-Y. Ha and J. Kim) Mathematical Models and Methods in Applied Sciences, 33(5) 1053-1097 (2023).

5. Filippov trajectories and clustering in the Kuramoto model with singular couplings (with D. Poyato and J. Soler). Journal of the European Mathematical Society, 23(10) (2021) 3193–3278. Preprint arXiv:1809.04307.

6. A mean-field limit of the swarmalator model (with S.-Y. Ha, J. Jung, J. Kim and X, Zhang). Kinetic & Related Models, 14(3) (2021) 429-468.

7. Fast and slow velocity alignments in a Cucker-Smale ensemble with adaptive couplings (with S.-Y. Ha and D. Kim) Communications on Pure and Applied Analysis, 19(9) (2020) 4621-4654.

8. A global well-posedness and asymptotic dynamics of the kinetic Winfree equation (with S.-Y. Ha, and X. Zhang). Discrete and Continuous Dynamical Systems Series B, 25(4) (2020) 1317 - 1344.

9. Emergence of phase concentration for the Kuramoto-Sakaguchi equation (with S.-Y. Ha, Y. H. Kim, and J. Morales). Physica D, 401 (2020) 132154. Preprint arXiv:1610.01703

10. Emergent behaviors of the swarmalator model for position-phase aggregation (with S.-Y. Ha, J. Jung, J. Kim and X, Zhang). Mathematical Models and Methods in Applied Sciences, 29 (2019) no. 12, 2225 - 2269.

11. Complete cluster predictability of the Cucker-Smale flocking model on the line (with S.-Y. Ha, J. Kim and X. Zhang). Archive for Rational Mechanics and Analysis, 231 (2019) no. 1, 319-365.

12. A first-order reduction of the Cucker-Smale model and its clustering dynamics (with S.-Y. Ha and X. Zhang). Communications in Mathematical Sciences, 16 (2018) no. 7, 1907 - 1931.

13. On the global existence of weak solutions for the Cucker-Smale-Navier-Stokes system with shear thickening (with S.-Y. Ha, H. K. Kim, and J.-M. Kim). SCIENCE CHINA Mathematics, 61 (2018) no. 11, 2033 - 2052.

14. Emergent Dynamics for the Kinetic Kuramoto Equation (with D. Amadori). Theory, Numerics and Applications of Hyperbolic Problems I, Springer Proceedings in Mathematics & Statistics (2018)

15. Remarks on the complete synchronization for the Kuramoto model with interaction frustrations (with S.-Y. Ha and H. K. Kim). Analysis and Applications, 15 (2018), no. 4, 525 - 563

16. Uniform stability and mean-field limit for the augmented Kuramoto model (with S.-Y. Ha, J. Kim, and X. Zhang). Networks and Heterogeneous Media, 13 (2018), no. 2, 297 - 322.

17. Emergent dynamics of Kuramoto oscillators with adaptive couplings: conservation law and fast learning (with S.-Y. Ha, J. Lee, and Z. Li). SIAM Journal on Applied Dynamical Systems, 17 (2018), no. 2, 1560 - 1588.

18. A nonlocal version of Wavefront tracking motivated by Kuramoto-Sakaguchi equation (with D. Amadori and S.-Y. Ha). Springer INdAM Inovative Algorithms and Analysis.

19. Interplay of inertia and heterogeneous dynamics in an ensemble of Kuramoto oscillators (with S.-Y. Ha and S. E. Noh). Analysis and Applications, 15 (2017), no. 6, 837 - 861.

20. On the global well-posedness of BV weak solutions to the Kuramoto-Sakaguchi equation (with D. Amadori and S.-Y. Ha). Journal of Differential Equations, 262 (2017), no. 2, 978 - 1022.

21. Emergence of partial locking states from the ensemble of Winfree oscillators (with S.-Y. Ha, D. Ko, and S. W. Ryoo). Quarterly of Applied Mathematics, 75 (2017), 39 - 68.

22. Collective synchronization of classical and quantum oscillators (with S.-Y. Ha, D. Ko, and X. Zhang) EMS Surveys in Mathematical Sciences, 3 (2016), no. 2, 209 - 267

23. Synchronization of the Kuramoto oscillators with adaptive couplings (with S.-Y. Ha and S. E. Noh). SIAM Journal on Applied Dynamical Systems, 15 (2016), no. 1, 162-194.

24. Emergent dynamics of Winfree oscillators on locally coupled networks (with S.-Y. Ha, D. Ko, and S. W. Ryoo). Journal of Differential Equations, 260 (2016), no. 5, 4203 - 4236.

25. Practical synchronization of generalized Kuramoto systems with an intrinsic dynamics (with S.-Y. Ha and S. E. Noh). Networks and Heterogeneous Media, 10 (2015), no. 4, 787 - 807.

26. Emergence of phase-locked states for the Winfree model in a large coupling regime (with S.-Y. Ha and S. W. Ryoo). Discrete and Continuous Dynamical Systems - Series A, 35 (2015), no. 8, 3417-3436.

27. Remarks on the complete synchronization of the Kuramoto oscillators (with S.-Y. Ha and H. K. Kim). Nonlinearity, 28 (2015), no. 5, 1441-1462.

Talks

- Feb. 2, 2026, 17th International conference on dynamical systems applied to biology and natural sciences (DSABNS 2026), Granada, Spain: "Convergence analysis of incidence angle-dependent alignment in planar active matter"
- Oct 22, 2025, 2025 KMS Annual Meeting, Korea Science and Technology Center(ST Convention Center), Seoul, Korea: *"Convergence analysis of incidence angle-dependent alignment in planar active matter"*
- May 15, 2025, SIAM Conference on Applications of Dynamical Systems (DS25), Denver, USA: *"Fast and slow clustering dynamics of Cucker-Smale ensemble with internal oscillatory phases"*
- Feb. 16, 2023, Kinetic Equations in Korea, Gangneung, Korea : *"Emergent dynamics of the swarmalator model and its mean-field limit"*
- Oct. 26, 2019, 2019 KMS Annual Meeting, Hongik University, Korea : *"Emergent behaviors of the swarmalator model for position-phase aggregation"*
- Sep. 8, 2019, Workshop on Complex Dynamics of Swarm Intelligence (Modeling, Analysis and Applications), Department of Mathematical Sciences, Seoul National University, Korea : *"Emergent behaviors of the swarmalator model for position-phase aggregation"*
- Apr. 3. 2019, Seminar for undergraudate students, Kyung Hee University, Korea: *"Mathematical Modeling"*
- Feb. 15. 2019, Macroscopic Modeling of Vehicular and Pedestrian Traffic, University of Modena & Reggio Emilia, Italy: *"Emergent behaviors of the swarmalator model for position-phase aggregation"*
- Feb. 15. 2019, Macroscopic Modeling of Vehicular and Pedestrian Traffic, University of Modena & Reggio Emilia, Italy: *"Emergent behaviors of the swarmalator model for position-phase aggregation"*
- Aug. 29. 2018, Department of Information Engineering, Computer Science and Mathematics, University of L'Aquila, Italy: *"Hebbian learning and clustering in Kuramoto models with singular weighted couplings"*
- Aug. 6. 2018, International workshop on "Modeling and analysis of multi-agent systems", Harbin Institute of Technology, China: *"Hebbian learning and clustering in Kuramoto models with singular weighted couplings"*

- Jun. 28. 2018, XVII International Conference on Hyperbolic Problems: Theory, Numerics, Applications, Penn State University, USA: *"Hebbian learning and clustering in Kuramoto models with singular weighted couplings"*
- Jun. 21. 2018, Korea PDE Workshop 2018, National Institute for Mathematical Sciences, Korea: *"Complete cluster predictability of the Cucker-Smale flocking model on the real line"*
- Dec. 28. 2017, One day workshop on Mathematical Modelling of Swarming, Department of Mathemaitcs, Inha University, Korea: *"Hebbian learning in the Kuramoto model with regular and singular weighted couplings"*
- Nov. 16. 2017, Department of Information Engineering, Computer Science and Mathematics, University of L'Aquila, Italy: *"Complete cluster predictability of the Cucker-Smale flocking model on the real line"*
- Aug. 22. 2017, CMC Conference: Nonlinear dynamics of many-body systems and related topics, KIAS and Seoul National University, Korea: *"Hebbian learning in the Kuramoto model with regular and singular weighted couplings"*
- Aug. 17. 2017, Department of Mathematics, Inha University, Korea: *"Uniform stability and mean-field limit for the augmented Kuramoto model"*
- Aug. 16. 2017, Department of Mathematics, Sungkyunkwan University, Korea: *"Multi-cluster flocking of the Cucker-Smale model in one spatial dimension"*
- Jun. 26. 2017, XXV Conference on Differential Equations and Applications / XV Conference on Applied Mathematics, Technical University of Cartagena(UPCT), Spain: *"Uniform stability and mean-field limit for the augmented Kuramoto model"*
- Dec. 28. 2016, Department of Mathematics, Sungkyunkwan University, Korea: *"Emergence of synchronization for the Kuramoto-Sakaguchi equation"*
- Dec. 12. 2016, CMC Winter School on Applied Math and Math. Physics, KIAS and Seoul National University, Korea: *"Emergence of synchronization for the Kuramoto-Sakaguchi equation"*
- Dec. 1. 2016, Departamento de Matemática Aplicada, Universidad de Granada, Spain: *"Emergence of synchronization in the Kuramoto model"*
- Aug. 4. 2016, XVI International Conference on Hyperbolic Problems: Theory, Numerics, Applications, RWTH Aachen University, Germany: *"Emergence of synchronization for the Kuramoto-Sakaguchi equation"*
- May. 21. 2016, KSIAM 2016 Spring Conference, National Institute for Mathematical Sciences, Korea: *"Synchronization of Kuramoto oscillators with adaptive couplings"*
- Apr. 27. 2016, Department of Mathematics and Computer Science, University of Ferrara, Italy: *"Synchronization of Kuramoto oscillators with adaptive couplings"*
- Jan. 08. 2016, PARC Annual Research Performance Report, Seoul National University, Korea: *"Emergent dynamics of Winfree oscillators on locally coupled networks"*

- Dec. 11. 2015, Departamento de Matemática Aplicada, Universidad de Granada, Spain: *"Emergent dynamics of Winfree oscillators on locally coupled networks"*
- Oct. 22. 2015, Séminaire Analyse à Lyon, École Normale Supérieure de Lyon, France: *"Emergent dynamics of Winfree oscillators on locally coupled networks"*
- Feb. 25. 2015, PARC Monthly Colloquium, Seoul National University, Korea: *"Emergence of phase-locked states for the Winfree model in a large coupling regime"*
- Jan. 27, 2015, Department of Information Engineering, Computer Science and Mathematics, University of L'Aquila, Italy : *"Practical synchronization of Kuramoto system with an intrinsic dynamics"*
- Oct. 28, 2014, Young Researchers Workshop: Multiscale phenomena: modeling, analysis and computation, CSCAMM, University of Maryland, USA: *"Practical synchronization of Kuramoto system with an intrinsic dynamics"*
- Jan. 23, 2014, East Asian Core Doctorial Forum on Mathematics, Kyoto University, Japan : *"Practical synchronization of Kuramoto system with an intrinsic dynamics"*
- Dec. 6, 2013, PARC Annual Research Performance Report, Seoul National University, Korea : *"Practical synchronization of Kuramoto system with an intrinsic dynamics"*

Organize

- The 5th Meeting of Young Researchers in PDEs, Hanyang University, Korea, January 14-16, 2026.
- HYKE meeting 2024, Hanyang University, Korea, August 22nd, 2024.
- HYKE meeting 2022, Hanyang University, Korea, August 29th, 2022.
- HY-PDE workshop, Hanyang University, Korea, July 18th - 20th, 2022.
- HY-PDE workshop, Online conference, May 26th - 28th, 2021.
- Special session "Organized Behaviors Arising from Non-organized Dynamic Rules: Particle, Kinetic and Fluid", 2020 KMS Spring meeting, Online conference, July 3, 2020.
- The 4th Meeting of Young Researchers in PDEs, Hanyang University, Korea, October 11-12, 2019.
- HY-PDE workshop on hyperbolic and kinetic problems, Hanyang University, Korea, May 3, 2019.
- Special session "Nonlocal Differential Equation: Analysis and Numerics", 2019 KMS Spring meeting, Kangwon National University, Korea, April 20, 2019.
- Seminar on particle and kinetic models describing collective behaviors, Hanyang University, Korea, June 18, 2018.

Research Grant

- Core Research Program(type B), National Research Foundation of Korea, 2026. 3 – 2031. 2
- Basic Research Program, National Research Foundation of Korea, 2023. 6 – 2026. 2
- Basic Research Laboratory "The Research Laboratory for Quantum Analysis and Quantum Differential Equations", National Research Foundation of Korea, 2020. 7 – 2023. 2
- First Research in Career, National Research Foundation of Korea, 2018. 3 – 2021. 2
- Faculty Start-up Research Fund, Hanyang University, 2018, 3 – 2019, 8
- Foster Core Leaders of the Future Basic Science Program, National Research Foundation of Korea, 2014. 3 – 2016. 8

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