

GEUNHYEONG LEE

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ACADEMIC EXPERIENCE

Scientist (Staff) 12 / 2023 ~ Present	Facility for Rare Isotope Beams, Michigan State University (FRIB) High Power Targetry Department (<i>Line manager: Takuji Kanemura</i>) <i>Role: Heat removal system AI optimization and validation</i>	Michigan, US
Postdoc 08 / 2021 ~ 12 / 2023	Korea Atomic Energy Research Institute (KAERI) Applied Artificial Intelligence Lab (<i>Line manager: Yonggyun Yu</i>) <i>Role: SMR heat exchanger 3D printing AI optimization</i>	Daejeon, Korea

EDUCATION

Ph.D. & M.S. 03 / 2016 ~ 08 / 2021	Ulsan National Institute of Science and Technology (UNIST) Nuclear Engineering (<i>Advisor: HeeReyoung Kim</i>) <i>Thesis: Optimization of Lithium Charge Stripper through MHD Circulator Development</i>	Ulsan, Korea
B.S. 03 / 2010 ~ 02 / 2016	Ulsan National Institute of Science and Technology (UNIST) Nuclear Engineering & Mechanical Engineering (Dual Major)	Ulsan, Korea

RESEARCH INTERESTS

AI design optimization, Heat exchanger, Electromagnetic pump, Small modular reactor (SMR), 3D printing.

SCIE JOURNAL (Total 13, First Author¹: 12, Corresponding Author^{*}: 4)

- (2026) **Lee, G^{1*}**. Conceptual Design of a 3D-Printable DC Electromagnetic Pump for Additive Manufacturing, *Nuclear Engineering and Technology*, 58(1),103916.
<https://doi.org/10.1016/j.net.2025.103916>
- (2025) Kim, D¹., Kim, H., Kwon, H., Yu, Y., & **Lee, G^{*}**. Deep learning-based anomaly detection in drift tube quadrupole operation for the KOMAC linac, *Journal of Nuclear Science and Technology*, 1-6.
<https://doi.org/10.1080/00223131.2025.2464742>
- (2024) **Lee, G^{1*}**., Joo, Y., Lee, S.U., Kim, T., Yu, Y., & Kim, H.G. (2024). Design optimization of heat exchanger using deep reinforcement learning. *International Communications in Heat and Mass Transfer*, 159, 107991. <https://doi.org/10.1016/j.icheatmasstransfer.2024.107991>
(IF: 6.4, JCR Top 5.1% in Mechanics)
- (2023) **Lee, G^{1*}**, Joo, Y¹., Yu, Y., & Kim, H.G. Dual-fluid Topology Optimization of Printed-circuit Heat Exchanger with Low-pumping-power Design. *Case studies in thermal engineering*, 49, 103318.
<https://doi.org/10.1016/j.csite.2023.103318> (IF: 6.4, JCR Top 5.8% in Thermodynamics)
- (2023) Kang, T¹., **Lee, G¹**., & Kim, H.R^{*}. Experimental characterization of the flowline of a lithium film formed using an electromagnetic thruster for a RAON prototype charge stripper. *Nuclear Engineering and Design*, 412, 112481. <https://doi.org/10.1016/j.nucengdes.2023.112481>
- (2021) **Lee, G¹**., & Kim, H.R^{*}. Numerical study of Faraday-type nitrogen plasma magnetohydrodynamic generator. *Journal of the Korean Physical Society*, 78(7), 600-606.
<https://doi.org/10.1007/s40042-021-00116-z>

7. (2020) **Lee, G¹.**, & Kim, H.R*. The variable analysis of an MHD generator with electrical output of 10 kW for application to bi-plant method electricity generation. *International Journal of Energy Research*, 44(10), 8125-8132. <https://doi.org/10.1002/er.5100> (IF: 5.2, JCR Top 1.5% in Nuclear Science & Technology)
8. (2019) **Lee, G¹.**, & Kim, H.R*. Mathematical approach for optimization of magnetohydrodynamic circulation system. *Nuclear Engineering and Technology*, 51(3), 654-664. <https://doi.org/10.1016/j.net.2018.12.008>
9. (2018) **Lee, G¹.**, & Kim, H.R*. Magnetohydrodynamics approach for active decay heat removal system in future generation IV reactor. *International Journal of Energy Research*, 42(10), 3266-3278. <https://doi.org/10.1002/er.4080> (IF: 3.3, JCR Top 1.5% in Nuclear Science & Technology)
10. (2018) **Lee, G¹.**, & Kim, H.R*. Numerical analysis of the electromagnetic force for design optimization of a rectangular direct current electromagnetic pump. *Nuclear Engineering and Technology*, 50(6), 869-876. <https://doi.org/10.1016/j.net.2018.04.010>
11. (2018) **Lee, G¹.**, & Kim, H.R*. Magnetic-field analysis of an MHD channel in a liquid-metal circulation system of a prototype GenIV sodium fast reactor. *Annals of Nuclear Energy*, 115, 343-351. <https://doi.org/10.1016/j.anucene.2018.01.049>
12. (2017) **Lee, G¹.**, & Kim, H.R*. Design analysis of DC electromagnetic pump for liquid sodium-CO₂ reaction experimental characterization. *Annals of Nuclear Energy*, 109, 490-497. <https://doi.org/10.1016/j.anucene.2017.05.054>
13. (2017) **Lee, G¹.**, & Kim, H.R*. NUMERICAL INVESTIGATION AND COMPARISON OF THE RECTANGULAR, CYLINDRICAL, AND HELICAL-TYPE DC ELECTROMAGNETIC PUMPS. *Magnetohydrodynamics*, 53(2). <https://doi.org/10.22364/mhd.53.2.23>
14. (Under Review) **Lee, G¹***, Song, J., Quispe-Adab, R., Patil, M., & Kanemura, T. Optimization of the FRIB Beam Dump: A Hybrid Genetic Algorithm and Reinforcement Learning Approach, *Nuclear Science and Techniques*.

PATENT

1. (2021) Kim, H. R., Kang, T & **Lee, G.** Thermal storage heat exchanger using liquid metal. Republic of Korea – Registration No. 10-2237876 / Application No. 10-2019-0171058
2. (2019) Kim, H. R., & **Lee, G.** Conductive material transfer device. Republic of Korea – Registration No. 10-1971612 / Application No. 10-2017-0075794
3. (2019) Kim, H. R., & **Lee, G.** Conductive material transfer device. Republic of Korea – Registration No. 10-2017117 / Application No. 10-2017-0063580
4. (2018) Kim, H. R., & **Lee, G.** Conductive material transfer device. Republic of Korea – Registration No. 10-1860895 / Application No. 10-2017-0025724
5. (2018) Kim, H. R., & **Lee, G.** Conductive material transfer device. Republic of Korea – Registration No. 10-1860898 / Application No. 10-2017-0015538
6. (2018) Kim, H. R., & **Lee, G.** Electromagnetic pump. Republic of Korea – Registration No. 10-1908115 / Application No. 10-2016-0177052

1. (2025) **Lee, G^{1*}**, Kim, T., Kim, Y., & Kim, G. Design and Analysis of an OLED Display Susceptor System Using Reinforcement Learning, *Journal of Korean Applied Artificial Intelligence*.
2. (2025) **Lee, G^{1*}**, Song, J., Patil, M., Quispe-Abad, R., Bultman, N., & Kanemura, T. Design Improvements of a Minichannel Beam Dump Wing through AI-Driven Genetic Algorithms, 16th International Conference on Heavy Ion Accelerator Technology.
3. (2025) **Lee, G^{1*}**, Song, J., Patil, M., Quispe-Abad, R., Bultman, N., & Kanemura, T. Design Optimization of the FRIB Beam Dump through Reinforcement Learning with Genetic Algorithm, 2025 American Nuclear Society Annual Conference.
4. (2025) Wei, J. ^{1*}, Alleman, C., Ao, H., Arend, B., Barofsky, D., Beher, S., Berryman, J.S., Bollen, G., Brandon, J., Bultman, N., Casagrande, F., Chang, W., Cheng, H., Choi, Y., Cogan, S., Cole, P., Compton, C., Cortesi, M., Curtin, J., Davidson, K., Di Carlo, S., Dombos, A., Du, X., Elliott, K., Ewert, B., Facco, A., Ferrell, F., Fila, A., Fukushima, K., Gade, A., Ganni, V., Ganshyn, A., Ginter, T., Glasmacher, T., Gonzalez, A., Guo, J., Gutierrez, E., Hao, Y., Hartung, W., Hasan, N., Hausmann, M., Holland, K., Hseuh, H.C., Ikegami, M., Iwai, R., Jager, D., Jones, S., Joseph, N., Kahl, D., Kanemura, T., Kim, J., Kim, S.H., Knowles, C., Konomi, T., Kortum, B., Kulkarni, N., Kwan, E., Lange, T., Larmann, M., Larter, T., Laturkar, K., LaVere, M., Laxdal, R.E., **Lee, G.**, LeTourneau, J., Li, Z.-Y., Lidia, S., Machicoane, G., Manwiller, P., Marti, F., Maruta, T., McNanney, D., Metzgar, E., Miller, S., Momozaki, Y., Morton, A.C., Mugerian, M., Morris, D., Nariyoshi, P., Nesterenko, I., Newhart, D., Nguyen, C., Noji, S., Ostroumov, P., Patil, M., Plastun, A., Popielarski, L., Portillo, M., Powers, A., Priller, J., Rao, X., Reaume, M., Rodriguez, S., Rogers, S., Saito, K., Sherrill, B.M., Smith, M.K., Song, J., Steiner, M., Stolz, A., Tarasov, O., Timko, G., Tousignant, B., Wakai, E., Walker, R., Wan, J., Wang, L., Wang, X., Wenstrom, J., West, G., Wright, M., Xu, T., Yeck, M., Zegers, R.G.T., Zhang, D., Zhang, T., Zhao, Q., & Zhao, S. FRIB OPERATIONS: FIRST THREE YEARS, 16th International Conference on Heavy Ion Accelerator Technology.
5. (2025) Song, J. ^{1*}, Bultman, N., Cole, D., Jockheck, N., Kanemura, T., Larmann, M., Lee, D., **Lee, G.**, Miller, S., Patil, M., Portillo, M., Quispe-Abad, R., Reaume, M., Simon, J., Steiner, M., & Wei, J. A SINGLE-SLICE ROTATING GRAPHITE TARGET AT FRIB, 16th International Conference on Heavy Ion Accelerator Technology.
6. (2025) Kanemura, T^{1*}, Abdelmegied, B., Bultman, N., Fletcher, E., Ginter, T., Iwai, R., Jockheck, N., LaVere, M., **Lee, G.**, Marti, F., Maruta, T., Miller, S., Momozaki, Y., Ostroumov, P., Patil M., Plastun, A., Quispe-Abad, R., Reaume, M., Simon, D., Song, J., Wakai, E., Wang, X., Wei, J., & Zhao, Q. HIGH POWER TARGETRY DEVICES AT FRIB: CHALLENGES, STATUS AND PLAN, 16th International Conference on Heavy Ion Accelerator Technology.
7. (2023) **Lee, G.**, Yu, Y., Kim, H.G., & Kim, T. Application of Deep Learning Reinforcement Learning for Enhancement of Thermal Fluid Topology Optimization Performance, 3rd *Applied Artificial Intelligence Conference*.
8. (2023) **Lee, G.**, Yu, Y., & Kim, H.G. Design of the Optimal Nuclear Heat Exchanger using Deep Reinforcement Learning, 10th *Korea-China Workshop on Nuclear Reactor Thermal-Hydraulics*.
9. (2023) Kim, D.H^{1*}, **Lee, G¹**, Cho, S.Y., Lee, S.H., Kim, D., Kim, H.S., Kwon, H.J., Yu, Y. Machine Learning-based Anomaly Detection in Drift Tube Quadrupole Operation for the KOMAC Linac, *The 25th International Conference on Accelerators and Beam Utilizations*.
10. (2023) **Lee, G^{1*}**, Yu, Y., & Kim, H.G. Optimal Design of Nuclear Heat Exchanger Using 3D Printing-Based Deep Learning Reinforcement Learning, 2023 *Korean Institute of Metals and Materials Fall Conference*.
11. (2023) Lee, S.U^{1*}, Kim, H.G., **Lee, G.**, Kim, H., Yu, S., Oh, H., & Kim, Y. Development of Nuclear Component Manufacturing and Hybrid Fabrication Technology for Dissimilar Materials, 2023 *Korean Institute of Metals and Materials Fall Conference*.
12. (2023) **Lee, G^{1*}**, & Kim, T. Formation of the LCD susceptor heat exchanger path using the deep reinforcement learning, 2nd *Applied Artificial Intelligence Conference*.

13. (2022) Jeon, B^{1*}., Ryu, S., Seo, H., Kim, M., Kim, S., **Lee, G^{1*}**., Lim, H., & Yu, Y. Development of Deep Learning-based Operator Support Systems for HANARO, *2022 HANARO Symposium*.
14. (2022) **Lee, G^{1*}**., Yu, Y., Kim, T., & Kim, S. Formation of a thermofluid temperature equalization flow path using reinforcement learning, *1st Applied Artificial Intelligence Conference*.
15. (2022) **Lee, G^{1*}**., Yu, Y., & Kim, H.G. Development of 3D Printing AI-Based Component Optimization Design Technology for Small Nuclear Reactor Materials, *2022 Korean Institute of Metals and Materials Spring Conference*.
16. (2021) **Lee, G^{1*}**., Joo, Y., Kim, H.G., & Yu, Y. The Analysis of Topology Optimized 3D Printing Heat Exchanger for the Small Nuclear Reactor, *2021 Korean Nuclear Society Autumn Meeting*.
17. (2020) **Lee, G^{1*}**., & Kim, H.R., THE ELECTROMAGNETIC VARIABLE ANALYSIS OF 10 KW MHD GENERATOR, *47th IEEE International Conference on Plasma Physics*.
18. (2020) **Lee, G^{1*}**., & Kim, H.R., A Tendency of Electromagnetic Field Change in MHD Plasma Fluid Generator, *2020 Korean Physical Society Spring Meeting*.
19. (2019) Kang, T^{1*}., **Lee, G.**, & Kim, H.R., Review Study on Reduction of Nox by Combining Thermal Power and Plasma MHD Power Generation, *2019 Korean Institute of Electrical Engineers Fall Conference on Electrical Machines and Energy Conversion Systems*.
20. (2019) **Lee, G^{1*}**., Kang, T., & Kim, H.R., Simulation Analysis of the Characteristics of an Experimental MHD Generator, *2019 Korean Institute of Electrical Engineers Fall Conference on Electrical Machines and Energy Conversion Systems*.
21. (2019) **Lee, G^{1*}**., & Kim, H.R., THE VARIABLE OPTIMIZATION OF MHD GENERATOR WITH ELECTRIC OUTPUT OF 10 KW, *11th PAMIR International Conference*.
22. (2019) **Lee, G^{1*}**., Kwak, J., & Kim, H.R., The Analysis of Experimental Magnetohydrodynamic Generator for Cogeneration Plant, *2019 Korean Institute of Electrical Engineers Spring Conference on Power Systems, Power Economics, and Power System Protection*.
23. (2018) **Lee, G^{1*}**., & Kim, H.R., Design Analysis of 10kW Magnetohydrodynamic Generator using Off-gas Plasma, *60th Annual Meeting of the APS Division of Plasma Physics*.
24. (2018) Kang, T^{1*}., **Lee, G.**, & Kim, H.R., Analysis and Review of Basic Research on MHD Power Generation Technology, *2018 Korean Institute of Electrical Engineers Fall Conference of the Power Technology Division*.
25. (2018) **Lee, G^{1*}**., & Kim, H.R., Characteristic Analysis of 10-kW Electric Output Faraday-type MHD Generator, *6th International Conference on Nuclear and Renewable Energy Resources*.
26. (2018) **Lee, G^{1*}**., & Kim, H.R., Finite Element Method Analysis of Rectangular-type DC Electromagnetic Pump for Active Heat Decay Removal System of Prototype Gen-IV Sodium Fast Reactor, *2018 Korean Physical Society Spring Meeting*.
27. (2017) **Lee, G^{1*}**., & Kim, H.R., The Comparative Analysis of Rectangular- and Helical-type DC Electromagnetic Pump for ADHRS in PGSFR, *2017 Korean Physical Society Autumn Meeting*.
28. (2017) **Lee, G^{1*}**., & Kim, H.R., THE OPTIMIZATION OF HELICAL-TYPE DC ELECTROMAGNETIC PUMP FOR ACTIVE DECAY HEAT REMOVAL SYSTEM, *Global 2017 International Nuclear Fuel Cycle Conference*.
29. (2016) **Lee, G^{1*}**., & Kim, H.R., The Pressure and Magnetic Flux Density Analysis of Helical-Type DC Electromagnetic Pump, *2016 Korean Nuclear Society Autumn Meeting*.
30. (2016) **Lee, G^{1*}**., & Kim, H.R., The Numerical Investigation and Comparison of the Rectangular, Cylindrical and Helical Type DC Electromagnetic Pumps, *10th PAMIR International Conference*.
31. (2015) **Lee, G^{1*}**., & Kim, H.R., THE FUNDAMENTAL DESIGN ANALYSIS OF THE RECTANGULAR AND HELICAL TYPE DC CONDUCTION ELECTROMAGNETIC PUMP WITH THE FLOW RATE OF 3L/MIN, *23rd International Conference on Nuclear Engineering*.
32. (2014) **Lee, G^{1*}**., & Kim, H.R., The Design Analysis of the DC Electromagnetic Pump with the Flowrate of 3 L/min, *2014 American Nuclear Society Winter Meeting*.

33. (2014) **Lee, G^{1*}**, & Kim, H.R., The Optimum Design Analysis of the Small DC Electromagnetic Pump with Loop-Supported Type, *2014 Korean Nuclear Society Autumn Meeting*.
34. (2014) **Lee, G^{1*}**, & Kim, H.R., Preliminary Study for Radioactivity Evaluation of MSR compared with LWR, *2014 Korean Nuclear Society Spring Meeting*.

ACHIEVEMENTS

Awards

- (2019) Doosan Heavy Industries & Construction Research Scholarship. Korean Nuclear Society.
- (2016) Excellent Poster Award. Korean Nuclear Society, Korea.
- (2015) First Award of Excellence for MAE Research Internship. *UNIST*.

Invited Talks

- (2023) The Optimal Nuclear Heat Exchanger Design through Reinforcement Learning, *BrainLink X-lab*.
- (2023) Optimal design of 3D printing-based heat exchanger using reinforcement learning, *UNIST*.
- (2023) Optimal design of nuclear power plant heat exchanger using 3D printing-based deep learning reinforcement learning, 2023 Korean Institute of Metals and Materials Fall Meeting.
- (2022) Optimal design analysis of major reactor parts using AI technology, *UNIST*.
- (2022) Development of Small Nuclear Reactor Main Part, 3D printing AI-based Optimization Design Technology, 2022 Korean Institute of Metals and Materials Spring Meeting.

Program

- (2022) **Lee, G.**, Yu, Y., & Kim, T., Heat exchanger path generation program through reinforcement learning. Republic of Korea – Registration No.: C-2022-149451.

License

- (2021) Certified AI Expert, Korean Standards Association, No. C-2021-004668.

SERVICE

Journal Reviews

- (2025) (SCIE) [2 papers] Annals of Nuclear Energy (IF:2.3, JCR Top 20.7% in Nuclear Science & Technology)
- (2025) (SCIE) [3 papers] International Communications in Heat and Mass Transfer (IF: 6.4, JCR Top 5.1% in Mechanics)
- (2025) (SCIE) Electronic Research Archive
- (2025) (SCIE) Energy (IF: 9.4, JCR Top 3.2% in Thermodynamics)
- (2024) (ESCI) Energy Engineering
- (2024) (SCIE) Energy (IF: 9.4, JCR Top 3.2% in Thermodynamics)
- (2022) (SCIE) Journal of the Korean Physical Society.

Leadership

- (2012) Department Representative, Nuclear Engineering. UNIST, Republic of Korea.

TEACHING

Instructor

- (2023) Foundation of AI. *2023 International School on Beam Dynamics and Accelerator Technology*.
(2016) Nuclear Comprehensive Design Project. *UNIST*.

Teaching Assistance

- (2021) Liquid Metal Magnetohydrodynamics I. *UNIST*.
(2020) Liquid Metal Magnetohydrodynamics II. *UNIST*.
(2019) Special Lecture on Nuclear Engineering (MHD electrical power generation). *UNIST*.
(2019) Fundamental of Electromagnetics. *UNIST*.
(2018) Fundamental of Electromagnetics. *UNIST*.
(2017) Fundamental of Electromagnetics. *UNIST*.

SELECTED RESEARCH PROJECTS

- (2023-2025) Accelerator Operation Labor, *FRIB*.
(Role: Target thermal simulation and validation)
- (2023-2025) AIP Mini-channel and Water beam dump, *FRIB*.
(Role: AI-driven bam dump design optimization)
- (2023-2025) AIP Post-target shielding, *FRIB*.
(Role: High power system thermal simulation)
- (2022) Technical support for the application of artificial intelligence to lower module temperature uniformity on next-generation display manufacturing systems, *KAERI*.
(Role: Display susceptor flow channel optimization using artificial intelligence)
- (2021-2023) Development of Original 3D Printing Technology for Manufacturing Components of Small Nuclear Reactor Materials, *KAERI*.
(Role: Development of AI-driven 3D printing heat exchanger optimization and experiment)
- (2021-2023) Establishment of Intelligent Operation Platform for HANARO and Research Facilities, *KAERI*.
(Role: Anomaly detection in the accelerator system using AI)
- (2021-2022) Development of Deep Learning Solver for Reducing Iterations in Topology Optimization, *Hyundai*.
(Role: Supporting the topology optimization simulation)
- (2020-2021) Research on the development of prototype lithium charge stripper, *Institute for Basic Science*.
(Role: Design optimization of an electromagnetic pump and liquid lithium film formation system)
- (2020-2021) Environmental Radioactivity Monitoring Environment Gyeongju Region, *KAERI*.
(Role: Supporting radiological sample collection)
- (2018-2021) Plasma generation technology of high temperature and electric production technology of 10 kW magnetic generator, *KEPCO Research Institute*.
(Role: Investigation of MHD generator technology and design analysis)
- (2016-2018) Design and Performance Evaluation about EM Pump for Test of Coolant Loop of Prototype Gen-IV Sodium-cooled Fast Reactor, *KAERI*.
(Role: Feasibility analysis and performance evaluation of DC electromagnetic pumps for SFR)
- (2016) Development of Prototype DC Electromagnetic Pump, *Institute for Basic Science*.
(Role: Design optimization of a DC electromagnetic pump)