Mingyu Lee

PRISM-AI Center
Korea Advanced Institute of Science and Technology
291 Daehak-ro, Yuseong-gu, Daejeon 34141, Korea

Phone: +82 – 10 – 7125 –7204
Email: mglee91@kaist.ac.kr
ORCID: https://orcid.org/0009-0007-9594-0837

PERSONAL DATA

Gender:	Male	Nationality:	Republic of Korea (South Korea)
Date of Birth:	January 25, 1991	Place of Birth:	Republic of Korea (South Korea)
Military Service:	Republic of Korea Air Force (Jan. 2012 ~ Jan. 2014)		

PROFESSIONAL EXPERIENCE

Post Doc. Aug. 2025 ~	**Korea Advanced Institute of Science and Technology (KAIST),** Daejeon, South Korea PRISM-AI Center (Platform for Real-world Innovation in Smart Manufacturing and AI) • Advisor: Prof. Ikjin Lee (KAIST) & Prof. Seunghwa Ryu (KAIST)
Post Doc. Sep. 2023 ~	**Korea Advanced Institute of Science and Technology (KAIST),** Daejeon, South Korea (Mechanical Engineering Research Institute) • Advisor: Prof. Ikjin Lee (KAIST)

EDUCATION

Ph.D. Mar. 2019 ~ Aug. 2023	**Korea Advanced Institute of Science and Technology (KAIST),** Daejeon, South Korea Department of Mechanical Engineering • Dissertation: *A study on advanced surrogate model-based optimization using auxiliary information* • Advisor: Prof. Ikjin Lee (KAIST) • GPA: 3.95/4.3
MS. Mar. 2017 ~ Feb. 2019	**Korea Advanced Institute of Science and Technology (KAIST),** Daejeon, South Korea Department of Mechanical Engineering • Thesis: *Sequential approximate optimization with reanalysis data and its application to structural optimization* • Advisor: Prof. Byung-Chai Lee (KAIST)
B.S. Mar. 2011 ~ Feb. 2017	**Pusan National University (PNU),** Busan, Korea School of Mechanical Engineering • GPA: 4.03/4.5 (Cum Laude) • Received National Science & Technology Scholarship for all semesters

RESEARCH AREA

Data-Driven Modeling (Surrogate Model Generation)

AI-Based Design Optimization

Physics-Informed Neural Networks (PINNs)

Engineering Applications of Large Language Model (LLM)
Uncertainty Quantification (UQ) / Reliability-Based Design Optimization (RBDO)
Engineering Optimization
Structural Optimization (Topology, shape, and size optimizations)
Engineering Applications of Matrix Computation
Mobility Systems

JOURNAL PUBLICATIONS (SCI & SCIE ONLY)

◎ **Published or Accepted (Lead author #: 8, Co-author #: 9)**

1. Jung, Y., Lee, J., **Lee, M.**, Kang, N., & Lee, I., "Probabilistic analytical target cascading using kernel density estimation for accurate uncertainty propagation," *Structural and Multidisciplinary Optimization*, *61*, 2077-2095, 2020. (IF: 4.0, JCR: Top 16.9%, Q1)

2. Jo, H., Lee, K., **Lee, M.**, Jung, Y., & Lee, I., "Optimization-based model calibration of marginal and joint output distributions utilizing analytical gradients," *Structural and Multidisciplinary Optimization*, *63*, 2853-2868, 2021. (IF: 4.0, JCR: Top 16.9%, Q1)

3. **Lee, M.**, Park, Y., Jo, H., Kim, K., Lee, S., & Lee, I., "Deep generative tread pattern design framework for efficient conceptual design," *Journal of Mechanical Design*, *144*(7), 071703, 2022. (IF: 3.0, JCR: Top 31.6%, Q2)

4. Kim, M., Jung, Y., **Lee, M.**, & Lee, I., "An expected uncertainty reduction of reliability: adaptive sampling convergence criterion for Kriging-based reliability analysis," *Structural and Multidisciplinary Optimization*, *65*(7), 1-11, 2022. (IF: 4.0, JCR: Top 16.9%, Q1)

5. **Lee, M.**, Jung, Y., Choi, J., & Lee, I., "A reanalysis-based multi-fidelity (RBMF) surrogate framework for efficient structural optimization," *Computers & Structures*, *273*, 106895, 2022. (IF: 4.8, JCR: Top 16.7%, Q1)

6. Yang, S., **Lee, M.**, & Lee, I., "A new sampling approach for system reliability-based design optimization under multiple simulation models," *Reliability Engineering & System Safety*, *231*, 109024, 2023. (IF: 11.0, JCR: Top 1.40%, Q1)

7. Lee, J., Park, D., **Lee, M.**, Lee, H., Park, K., Lee, I., & Ryu, S., "Machine learning-based inverse design methods considering data characteristics and design space size in materials design and manufacturing: a review," *Materials Horizons, 10*(12), 5436-5456, 2023. (IF: 10.7, JCR: Top 11.1%, Q1)

8. Yang, S., **Lee, M.**, Jung, Y., Cho, H., Hu, W., & Lee, I., "An effective active learning strategy for reliability-based design optimization under multiple simulation models," *Structural Safety*, *107*, 102426, 2023. (IF: 6.3, JCR: Top 9.60%, Q1)

9. **Lee, M.**, Noh, Y., & Lee, I, "A novel sampling method for adaptive gradient-enhanced Kriging," *Computer Methods in Applied Mechanics and Engineering*, *418*, 116456, 2024. (IF: 7.3, JCR: Top 2.6%, Q1)

10. Lee, J., **Lee, M.**, Lee, B., & Lee, I., "A comprehensive multi-fidelity surrogate framework based on Gaussian process for datasets with heterogeneous responses," *Knowledge-Based Systems*, *295*, 111827, 2024. (IF: 7.6, JCR: Top 12.5%, Q1)

11. Lee, H.*, **Lee, M.***, Jung, J., Lee, I., & Ryu, S., "Enhancing injection molding optimization for SFRPs through multi-fidelity data-driven approaches incorporating prior information in limited data environments," *Advanced Theory & Simulations*, *7*(8), 2400130, 2024. (IF: 2.9, JCR: Top 27.0%, Q2)

    * Equally contributed.

12. **Lee, M.***, Jung, Y.*, Hwang, C., Kim, M., Kim, M., Lee, U., & Lee, I., "An efficient multi-fidelity design optimization framework for a thermoelectric generator system," *Energy Conversion and Management*, *315*, 118788, 2024. (IF: 10.9, JCR: Top 1.9%, Q1)

    * Equally contributed.

13. Jeong, J., **Lee, M.**, Yang, S., Baek, S., Park, B., Kim, D., & Lee, I., "Optimization framework for surveillance camera layouts considering infiltration routes in general outposts (GOPs)," *Expert Systems with Applications*, *263*, 125804, 2025. (IF: 7.5,

14. **Lee, M.***, Jeong, M.*, Lee, J., Lee, B. J., & Lee, I., "Efficient and robust thermal battery design optimization leveraging physically similar data". *Applied Thermal Engineering*, *269*, 126009, 2025. (IF: 6.9, JCR: Top 4.7%, Q1)

   * Equally contributed.

15. **Lee, M.**, Lee, J., Choi, J. H., Kim, N. H., & Lee, I., "A novel adaptive quality-based multi-fidelity surrogate framework for multiple low-fidelity data sources". *Advanced Engineering Informatics*, *69*, 103973, 2026. (IF: 9.9, JCR: Top 2%, Q1)

16. Lee, G., **Lee, M.**, & Lee, I., "Domain-embedded deep learning frameworks for topology optimization: Enhancing structural performance under data scarce environments". *Advances in Engineering Software*, *212*, 104064, 2026. (IF: 5.7, JCR: Top 8.7%, Q1)

17. **Lee, M.***, Lee, J.*, Song, B., & Lee, I., "A novel low-fidelity-guided design of experiments for multi-fidelity surrogate modeling". *Advanced Engineering Informatics*, *69*, 104076, 2026. (IF: 9.9, JCR: Top 2%, Q1)

   * Equally contributed.

◎ **Under review or Revision (Lead author #: 3, Co-author #: 2)**

18. Park, Y., **Lee, M.**, & Lee, I., "Linear embedding-enhanced co-Kriging incorporating distinct projection matrices across fidelity levels". (**Minor revision**) (*Journal of Mechanical Design*) (IF: 3.0, JCR: Top 31.6%, Q2)

19. Jung Y., **Lee, M.**, & Lee, I., "Data-driven time-variant reliability analysis using deep Gaussian processes". (**Minor revision**) (*Reliability Engineering & System Safety*) (IF: 11.0, JCR: Top 1.40%, Q1)

20. Jung, Y.*, & **Lee, M.***, "System confidence-based design optimization using multi-output Gaussian process accounting for epistemic uncertainty". (**Major revision**) (*Structural Safety*) (IF: 6.3, JCR: Top 9.60%, Q1)

   * Equally contributed.

21. Park, J.*, **Lee, M.***, & Lee, I., "Outlier-aware multi-fidelity surrogate framework for hyperparameter tuning in topology optimization: Mitigating local-optimum trapping". (**Under review**) (*Computer Methods in Applied Mechanics and Engineering*) (IF: 7.3, JCR: Top 2.6%, Q1)

   * Equally contributed.

22. **Lee, M.***, Lee, G.*, Ryu, S., & Lee, I., "A physics-control latent generative framework for physically consistent and diverse design under data scarcity". (**Submitted**)

   * Equally contributed.

◎ **In preparation (Lead author #: 6, Co-author #: 0)**

23. **Lee, M.**, Song, B., & Lee, I., "Physical similarity-informed hyperparameter optimization for multi-fidelity data-driven modeling". (**In preparation**)

24. **Lee, M.**, Lee, J., Choi, J. H., Jung, Y., & Lee, I., "Efficient hyperparameter optimization strategy of Gaussian process model for big data". (**In preparation**)

25. Lee, S.*, **Lee, M.***, Jung, Y., & Lee, I., "Sequential deep multi-fidelity Gaussian processes with variance decomposition". (**In preparation**)

   * Equally contributed.

26. **Lee, M.**, Islam, S., Lee, G., Kim, D. B., & Lee, I., "Integrated computational materials engineering (ICME) for predicting tensile properties of wire arc directed energy deposited refractory NbZr1 alloy". (**In preparation**)

27. Jung, J.*, **Lee, M.***, Jung, Y., Lee, U., & Lee, I., "A novel multi-fidelity Bayesian optimization for multiple data sources". (**In preparation**)

   * Equally contributed.

28. **Lee, M.**, Park, Y., & Lee, I., "A parametric study on surrogate modeling: which steps critically affect the performance of Kriging?" (**In preparation**)

INTERNATIONAL CONFERENCE

1. **Lee, M.**, Lee, I., "Improving the Efficiency of Structural Optimization using Reanalysis-assisted Surrogate Modeling," in Proceedings of the Asian Congress of Structural and Multidisciplinary Optimization (ACSMO), Virtual conference, November 23-25, 2020.

2. **Lee, M.**, Park, Y., Jo, Hw., Kim, K., Lee, S., Lee, I., "Efficient tire pattern design using deep learning methodology," in Proceedings of the 14th World Congress of Structural and Multidisciplinary Optimization (WCSMO), Virtual conference, June 13-18, 2021.

3. **Lee, M.**, Lee, I., "Adaptive Infill Sampling Method for Gradient-Enhanced Kriging," in Proceedings of the 15th World Congress on Computational Mechanics (WCCM-XV) - 8th Asian Pacific Congress on Computational Mechanics (APCOM-VIII), 2022, Virtual conference, July 31–August 5, 2022.

4. Lee, J., **Lee, M.**, Lee, B., Lee, I., "Hierarchical Gaussian process surrogate modeling framework for heterogeneous multi-fidelity dataset," in Proceedings of the ASME 2023, International design engineering technical conferences and computers and information in engineering conference, IDETC/CIE2023, Boston, Massachusetts, August 20–23, 2023.

5. Lee, J., **Lee, M.**, Song, B., Lee, I., "An efficient sampling strategy for a multi-fidelity surrogate," in Proceedings of the 16th World Congress of Structural and Multidisciplinary Optimization (WCSMO), Kobe, Japan, May 18–23, 2025.

6. Lee, G., **Lee, M.**, Lee, I., "Physics-informed generative design framework for efficient conceptual design," in Proceedings of the 16th World Congress of Structural and Multidisciplinary Optimization (WCSMO), Kobe, Japan, May 18–23, 2025.

7. Park J., **Lee, M.**, Lee, I., "Improving local optima exploration in topology optimization using multi-fidelity framework," in Proceedings of the 16th World Congress of Structural and Multidisciplinary Optimization (WCSMO), Kobe, Japan, May 18–23, 2025.

8. Jeong J., **Lee, M.**, Lee, U., Lee, I., "Multi-fidelity parallel Bayesian optimization for efficient budget utilization," in Proceedings of the 16th World Congress of Structural and Multidisciplinary Optimization (WCSMO), Kobe, Japan, May 18–23, 2025.

9. **Lee, M.**, Lee, J., Lee, I., "A study on multi-fidelity surrogate for multiple data sources," in Proceedings of the 16th World Congress of Structural and Multidisciplinary Optimization (WCSMO), Kobe, Japan, May 18–23, 2025.

DOMESTIC CONFERENCE (IN KOREAN)

1. **이민규** & 이익진. (2019). 재분석 기법 기반 순차적 근사 최적화 및 구조 최적화에 대한 응용. 대한기계학회 CAE 및 응용역학 부문 춘계학술대회.

2. 정문경, 박정우, **이민규**, 이익진, & 이봉재. (2020). 다중 충실도 대리 모델링을 이용한 열전지의 대리 모델 및 최적화. 대한기계학회 CAE 및 응용역학 부문 춘계학술대회.

3. **이민규**, 박영서, 조휘상, 김기범, 이승규, & 이익진. (2021). 생성적 적대 신경망을 이용한 효율적인 타이어 패턴 설계 프레임워크. 대한기계학회 춘추학술대회.

4. **이민규**, & 이익진. (2021). 대리모델링의 최근 기술 동향. 한국전산구조공학회 정기학술대회.

5. **이민규**, & 이익진. (2023). 기울기 정보를 활용한 대리 모델 기반 최적화. 한국전산구조공학회 정기학술대회.

6. 추정환, **이민규**, & 이익진. (2023). 진동피로해석을 위한 주파수응답 가진조건 최적화. 대한기계학회 CAE 및 응용역학 부문 춘계학술대회.

7. **이민규**, 이주영, 이봉재, & 이익진. (2023). 다중 충실도 대리 모델링에서 데이터 세트 선택을 위한 개선된 방법. 대한기계학회 CAE 및 응용역학 부문 춘계학술대회.

8. 이준형, 박동근, **이민규**, 박건도, 이후곤, 이인효, 이익진, & 유승화. (2024). 재료 설계 및 제조에서 머신러닝 기반 역설계 방법론에 대한 리뷰. 대한기계학회 CAE 및 응용역학 부문 춘계학술대회.

9. 이주영, <u>이민규</u>, 송병욱, & 이익진. (2024). 다중 충실도 대리 모델을 위한 라틴하이퍼 큐브 샘플링. 대한기계학회 CAE 및 응용역학 부문 춘계학술대회.

10. 박지환, <u>이민규</u>, & 이익진. (2024). 지역 최적해 개선을 위한 위상최적화 방법. 대한기계학회 춘추학술대회.

11. 정재영, <u>이민규</u>, 이웅기, & 이익진. (2024). 효율적 전역 최적화를 위한 개선된 순차적 샘플링 방법. 대한기계학회 춘추학술대회.

12. 이건우, <u>이민규</u>, & 이익진. (2024). 효율적인 개념설계를 위한 물리 기반 생성 설계 프레임워크. 대한기계학회 춘추학술대회.

13. <u>이민규</u>, 이주영, & 이익진. (2024). 다양한 보조 데이터를 활용하기 위한 향상된 다중 충실도 대리 모델링. 대한기계학회 춘추학술대회.

14. 임승규, 박지환, <u>이민규</u>, & 이익진. (2025). 열전 발전 효율 향상을 위한 공간 매핑 및 위상 최적화 기반 열교환기 설계. 대한기계학회 춘추학술대회.

INVITED SEMINAR PRESENTATIONS & TEACHING EXPERIENCE

1. "AI and Optimal Design (Gaussian process-based models and Bayesian optimization)," Hanon Systems, July 28, 2023. (Lecture + hands-on: 6 hours)

2. "AI for Optimal Design: From Surrogate Modeling to Design Optimization in Simulation-Based Prediction (Fundamentals and Recent Advances in Data-Driven Models)," KAIST Industry–Academia Collaboration Special Lecture, Feb 20, 2024. (Hands-on: 2 hours)

3. "AI-Enabled Optimal Design: Theory and Practice (Hands-on Training in Surrogate Modeling and Design Optimization)," 2024 Summer School, Korean Society for Design Optimization, Aug 23, 2024. (Hands-on: 2 hours)

4. "AI-Driven Design: From Simulation to Design Optimization (Optimization Using Data-Driven Surrogate Models)," KAIST Industry–Academia Public Lecture, Feb 11, 2025. (Hands-on: 1 hour)

5. "Introduction to the Innovative Design Optimization Laboratory," KAIST–Zhejiang University Joint Workshop, Aug 29, 2025.

RESEARCH PROJECTS

Mar. 2017 ~ Feb. 2019	**Development of Linear Static Structural Analysis S/W and Their Application to Education, Research and Industry** Sponsored by National Research Foundation of Korea • Role: Project engineer • Area: Finite element code development
Jan. 2019 ~ Dec. 2019	**Light Weighting of Major Components of Medium-sized Engines Using Topology Optimization** Sponsored by Korea Shipbuilding & Offshore Engineering Co., Ltd. • Role: Project leader • Area: Structural optimization (Topology, shape, and size optimizations), Finite element analysis
Mar. 2019 ~ Feb. 2022	**Training Expert in Smart Digital Engineering** Sponsored by Engineering Development Research Center (EDRC) • Role: Project engineer

	• Area: Artificial intelligence, optimization algorithm
Jan. 2020 ~ Dec. 2020	**Automatic Generation of Tire Pattern Styling and Its Performance Optimization Using Artificial Intelligence** Sponsored by Hankook Tire & Technology Co., Ltd. • Role: Project leader • Area: Generative artificial intelligence model, engineering optimization
Apr. 2022 ~ Mar. 2023	**The Development of Robot Gripper Frame with New Material/New structure** Sponsored by Hyundai Motor Company • Role: Project engineer • Area: Structural optimization (Topology, shape, and size optimizations)
Mar. 2022 ~ Mar. 2023	**A Novel Process Design for DAC for Energy Consumption Minimization Using Efficient Multi-fidelity Bayesian Optimization** Sponsored by Hyundai Motor Company • Role: Project engineer • Area: Surrogate modeling, artificial intelligence
Sep. 2024 ~ Aug. 2025	**A Novel Process Design for DAC for Energy Consumption Minimization Using Efficient Multi-fidelity Bayesian Optimization** Sponsored by Saudi Aramco – KAIST CO_2 Management Center • Role: Project engineer • Area: Multi-fidelity surrogate modeling, Bayesian optimization
May. 2025 ~ Nov. 2025	**Optimal Design of a Multi-Purpose Mobility Support Robot** Sponsored by Korea Army Research Center for Future & Innovation • Role: Project engineer • Area: Kinematic design, structural optimization (Topology, shape, and size optimizations)
May. 2025 ~ Dec. 2025	**Development of a Workflow to Predict the Impact of Simulation Result Variability** Sponsored by Hyundai Motor Company • Role: Project engineer • Area: Finite element analysis, surrogate modeling, uncertainty quantification

FELLOWSHIPS AND FUNDING

Apr. 2024 ~ Mar. 2025	**Postdoctoral Fellowship** funded by BK21 FOUR Program of Korea (KRW 36,000,000 per year)
Aug. 2025 ~ Aug. 2026	**InnoCORE PRISM-AI Postdoctoral Fellowship** funded by Ministry of Science and ICT (KRW 90,000,000 + α per year)

HONORS AND AWARDS

Feb. 2018	**Competition Excellence Award** granted by the Korea Institute of Science and Technology Information (KISTI)

Aug. 2022	**Best Poster Paper Award**
	granted by the Korean Society for Mechanical Engineers (KSME, CAE & Applied Mechanics)
Jan. 2024	**Outstanding Doctoral Dissertation Award**
	granted by the Korean Society for Design Optimization (KSDO)
May. 2024	**Outstanding Doctoral Dissertation Award**
	granted by the Korean Society for Mechanical Engineers (KSME, CAE & Applied Mechanics)
Dec. 2024	**Mechanical Engineering Alumni Association President's Award**
	granted by the Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology (KAIST)

JOURNAL PAPER REVIEWER

1. *Aerospace Science and Technology (AESCTE)* (IF: 5.8, JCR: Top 10.0%, Q1)

2. *Applied Mathematical Modelling* (*AMMOD*) (IF: 5.1, JCR: Top 5.5%, Q1)

3. *Computers & Structures (CAS)* (IF: 4.8, JCR: Top 16.7%, Q1)

4. *Computers in Biology and Medicine (CIBM)* (IF: 6.3, JCR: Top 5.2%, Q1)

5. *Engineering Applications of Artificial Intelligence (EAAI)* (IF: 8.0, JCR: Top 2.60%, Q1)

6. *Energy (EGY)* (IF: 9.4, JCR: Top 3.2%, Q1)

7. *Engineering Optimization (GENO)* (IF: 2.2, JCR: Top 34%, Q2)

8. *Information Sciences (INS)* (IF: 6.8, JCR: Top 7.9%, Q1)

9. *Journal of Building Engineering (JBE)* (IF: 7.4, JCR: Top 5.2%, Q1)

10. *Journal of Contaminant Hydrology (CONHYD)* (IF: 4.4, JCR: Top 14.9%, Q1)

11. *Journal of Mechanical Design (JMD)* (IF: 3.0, JCR: Top 31.6%, Q2)

12. *Journal of Mechanical Science and Technology (JMST)* (IF: 1.7, JCR: Top 64.6%, Q3)

13. *Knowledge-Based Systems (KNOSYS)* (IF: 7.6, JCR: Top 12.5%, Q1)

14. *Reliability Engineering & System Safety (RESS)* (IF: 11.0, JCR: Top 1.40%, Q1)

15. *Scientific Reports* (IF: 3.9, JCR: Top 18.1%, Q1)

MEMBERSHIP

1. Korea Society of Mechanical Engineers (KSME)

2. Korea Society of Design Optimization (KSDO)

3. Computational Structural Engineering Institute of Korea (COSEIK)

COLLABORATORS

Ikjin Lee (KAIST), Seunghwa Ryu (KAIST), Yoojeong Noh (Pusan National University), Nam Ho Kim (University of Florida), Duck Bong Kim (University of Georgia), Yongsu Jung (Hongik University), Jae-Hoon Choi (Jeonbuk National University), Ungki Lee (Korea University)