Jaewoo Kim

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RESEARCH INTERESTS

Design Optimization of Space Systems

- Quantitative modeling of various space systems
- Designing engineering system considering its lifecycle, from inception to retirement
- Deriving design solutions from a holistic viewpoint balancing needs of diverse stakeholders
- Exploring potentials of emerging technologies, strategies, and system concepts

Decision-Making in Real-World Problems

- Defining real-world problems with highly dynamic and uncertain nature and identifying key factors
- Developing decision-making framework based on fundamentals of quantitative reasoning
- Connecting the result of analysis to intuition and achieving an explainable conclusion

EDUCATION

Korea Advanced Institute of Science & Technology (KAIST) Daejeon, Korea

Ph.D. in Aerospace Engineering *Feb. 2024 – Present*

- Advisor: Prof. Jaemyung Ahn

M.S. in Aerospace Engineering *Feb. 2024*

- Thesis Title: Optimal Satellite System Architecting Considering On-Orbit Refueling
- Advisor: Prof. Jaemyung Ahn

Seoul National University (SNU) Seoul, Korea

B.S. in Mechanical and Aerospace Engineering *Feb. 2022*

- Thesis Title: Celestial Navigation Using Stars and Planets on Lunar Exploration Orbit
- Advisor: Prof. Changdon Kee

RESEARCH EXPERIENCE

Strategic Aerospace Initiative, KAIST | *Graduate Research Associate* *Feb. 2022 – Present*

- Maintenance Strategy for Satellite Mega-Constellation
  - Developed an inventory management model of replenishment strategy for a satellite mega-constellation with an auxiliary launch option [J3]
  - Developed an inventory management model of joint spare replenishment for multiple satellite mega-constellations [IC1, DC2]
- Optimal Satellite System Architecting Considering On-Orbit Servicing
  - Developed an optimal satellite system architecting framework based on a lifecycle simulation [J1][DC5]
- Development of Risk Analysis Framework for Korea Space Situational Awareness
  - Fund: Korea Astronomy and Space Science Institute
  - Surveyed models and propagation methodologies of the space environment, and risk analysis techniques for space assets
  - Developed Korea orbital debris evolutionary and engineering model [IC2, DC1]
- A Study on the Principle of Modular Architecture Engineering to Improve Level of Completion for Vehicle Architecture
  - Fund: Hyundai Motor Company

- Developed an integer programming approach to design structure matrix-based system modularization with various constraints [J2]
- Performed several case studies of automobile subsystems and obtained improved design solutions

- Research on ADR/OOS Applications for National Security Space Assets
  - Fund: Funded by Korean Society for Aeronautical and Space Sciences
  - Reviewed on-orbit servicing technologies and related projects [DC6]
  - Designed ConOps of ADR/OOS
- Development of Launch Vehicle Mission & Conceptual Design Software (Funded by Hanwha Aerospace)
  - Developed analysis tools for the propulsion module and the staging module for multi-disciplinary design optimization
  - Contributed to developing all-at-once design optimization framework of launch vehicles considering flight requirements [J4][DC3, DC4]

GNSS Laboratory, SNU | *Undergraduate Researcher* *Mar. 2021 – Aug. 2021*

- Deep Space Navigation with Optical Sensor Data
  - Reviewed some non-inertial deep space navigation algorithms
  - Analyzed the performance of the selected algorithm based on the basic linear algebra and Monte-Carlo simulation

ACADEMIC ACTIVITIES

Journal Article

[J1] **Kim, J.** and Ahn, J.*, "Optimal satellite system architecting considering on-orbit refueling," in preparation.

[J2] **Kim, J.**, Choi, E., Ahn, J.*, Suh, E. S., Kim, J.-H., and Lim, D. G., "Mathematical programming-based design structure matrix clustering for modular architecture design," under review.

[J3] **Kim, J.**, Ahn, J., and Sung, T.*, "Optimal replenishment strategy for satellite constellation with dual supply modes," *arXiv:2408.09696*.
doi: https://doi.org/10.48550/arXiv.2408.09696

[J4] Ko, J., **Kim, J.**, Choi, J., and Ahn, J.*, "Simultaneous optimization of launch vehicle stage and trajectory considering flight-requirement constraints," *International Journal of Aeronautical and Space Sciences*, 2024.
doi: https://doi.org/10.1007/s42405-024-00737-1

International Conference

[IC1] **Kim, J.**, Sung, T., and Ahn, J., "Joint replenishment strategy for multiple satellite constellations," in *AIAA Scitech 2025 Forum*, Orlando, Florida, US, Jan. 6-10, 2025, accepted.

[IC2] **Kim, J.**, Lee, J., Kim, H., Choi, E. J., Choi, J., Yu, J., Jo, J., and Ahn, J., "Development of Korea orbital debris evolutionary and engineering model," in *75th International Astronautical Congress*, Milan, Italy, Oct. 14-18, 2024, accepted.

Domestic Conference

[DC1] **Kim, J.**, Lee, J., Choi, E. J., Jin, C., Yu, J., Jo, J., and Ahn, J.,"Development of Korean 3D cell model for space debris environment analysis," in *Korean Space Science Society Fall Conference*, Sacheon, Korea, Oct. 28-30, 2024.

[DC2] **Kim, J.** and Ahn, J., "An integrated inventory management model for maintenance of multiple satellite constellations," in *Korean Society for Aeronautical and Space Sciences (KSAS) Space Conference*, Changwon, Korea, Jun. 26-28, 2024.

[DC3] **Kim, J.**, Ko, J., Choi, J., Ahn, J., Yoon, N., and Kim, H., "Conceptual design of launch vehicle considering axial acceleration constraints," in *Korean Society for Aeronautical and Space Sciences (KSAS) Space Conference*, Changwon, Korea, Jun. 26-28, 2024.

[DC4] Ko, J., **Kim, J.**, Choi, J., Ahn, J., Yoon, N., and Kim, H., "Development of conceptual design software for space launch vehicle," in *Korean Society for Aeronautical and Space Sciences (KSAS) Spring Conference*, Jeju, Korea, Apr. 3-5, 2024.

[DC5] **Kim, J.**, and Ahn, J., "Multiobjective design optimization of commercial satellite considering on-orbit refueling policy," in *Korean Society for Aeronautical and Space Sciences (KSAS) Spring Conference*, Jeju, Korea, Apr. 19-21, 2023.

[DC6] **Kim, J.**, Lee. D. U., and Ahn, J., "Research on the overseas on-orbit servicing trends and implications," in *Korean Society for Aeronautical and Space Sciences (KSAS) Fall Conference*, Jeju, Korea, Nov. 16-18, 2022.

AWARD & HONORS

Hanhwa-KAIST Space Hub Space Grand Challenge | *Bronze* *Nov. 2023*

- Team Name: LETA (Lunar Exploration Trajectory Analytics)
- Topic: Lunar exploration trajectory design with low-thrust propulsion and multiple gravity assist

TEACHING EXPERIENCE

Teaching Assistant | *KAIST* *Fall 2023 - Present*

- AE401 Aerospace System Design II, Fall 2023
- AE210 Aerospace Thermodynamics, Spring 2024

EXTRACURRICULAR EXPERIENCE

Part-Time Lecturer | *Data Diving co.* *Aug. 2022 – Present*

- Provided lectures and created educational content about basic concepts and programming tools for data science
- Institutions: Busan City Government, Korea Education & Research Information Service (KERIS), Statistics Korea (KOSTAT), Ewha Womans University, Sookmyung Women's University, Seoul Digital Foundation

Military Service | *Defense Security Command (DSC)* *Apr. 2018 – Nov. 2019*

- Supported educational programs in DSC
- Squad leader
- Commendation from Brigadier General

Interviewer | *Humans of SNU* *Jul. 2017 – Dec. 2017*

- Interviewed diverse members of SNU and discovered insightful and interesting stories from them

President of SNU Chapter and Univ. Union | *People to People International* *Mar. 2016 – Feb. 2018*

- Supported underprivileged members of the urban community
- Supported conferences for the promotion of international friendship

OTHER SKILLS

Problem Solving

- Identifying problematic situations and key components to tackle them
- Dividing complex tasks into solvable subtasks and designing the overall workflow
- Designing a viable timeline for task completion
- Leading and encouraging with passion and commitment in teamwork situations

Programming

- Python, MATLAB, Julia, C, C++ for various quantitative analysis techniques including optimization, simulation, and machine learning

Language

- Korean (first), English (second, professional working proficiency)