

# Jaewoo Kim

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## RESEARCH INTERESTS

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### Design Optimization of Space Systems

- Mathematical modeling of various space systems
- Designing engineering system considering the 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 result of analysis to intuition and achieving explainable conclusion

## EDUCATION

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### 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

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### Strategic Aerospace Initiative, KAIST 🇰🇷 | Graduate Research Associate

Feb. 2022 – Present

- Maintenance Strategy for Satellite Mega-Constellation
  - Developed an inventory management model of spare strategy for a satellite mega-constellation with an auxiliary launch option [J1]
  - Developed an inventory management model of joint spare strategy for multiple satellite mega-constellations [C2]
- Optimal Satellite System Architecting Considering On-Orbit Servicing
  - Developed an optimal satellite system architecting framework based on a lifecycle simulation [J2][C5]
- Modular Architecting Based on Multi-Criteria Decision Making
  - Fund: Hyundai Motor Company
  - Surveyed general multi-criteria decision making methods and their applications to concept selection in the system design process
- 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 [C1]

- 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 [J3]
  - 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 [C6]
  - 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 [J4][C3, C4]

**GNSS Laboratory, SNU** | Undergraduate Researcher

Mar. 2021 – Aug. 2021

1. 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 Articles

- [J1] Sung, T.<sup>†</sup>, Kim, J.<sup>†</sup>, and Ahn, J.<sup>\*</sup>, “Optimal spare strategy for satellite mega-constellation with auxiliary launch option,” in preparation. (<sup>†</sup>these authors contributed equally to this work.)
- [J2] Kim, J. and Ahn, J.<sup>\*</sup>, “Optimal satellite system architecting considering on-orbit refueling,” in preparation.
- [J3] Kim, J., Choi, E., Ahn, J.<sup>\*</sup>, Suh, E. S., Kim, J.-H., and Lim, D. G., “Mathematical programming-based design structure matrix clustering for modular architecture design,” under review.
- [J4] Ko, J., Kim, J., Choi, J., and Ahn, J.<sup>\*</sup>, “Simultaneous optimization of launch vehicle stage and trajectory considering flight-requirement constraints,” *International Journal of Aeronautical and Space Sciences*, vol. 1, no. 11, 2024.  
doi: <https://doi.org/10.1007/s42405-024-00737-1>

### Conference

- [C1] 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.
- [C2] Kim, J. and Ahn, J., “An integrated inventory management model for maintenance of multiple satellite constellations,” in *Proceedings of the Korean Society for Aeronautical and Space Sciences, Space Conference*, Changwon, Korea, Jun. 26-28, 2024.
- [C3] Kim, J., Ko, J., Choi, J., Ahn, J., Yoon, N., and Kim, H., “Conceptual design of launch vehicle considering axial acceleration constraints,” in *Proceedings of the Korean Society for Aeronautical and Space Sciences, Space Conference*, Changwon, Korea, Jun. 26-28, 2024.
- [C4] Ko, J., Kim, J., Choi, J., Ahn, J., Yoon, N., and Kim, H., “Development of conceptual design software for space launch vehicle,” in *Proceedings of the Korean Society for Aeronautical and Space Sciences, Spring Conference*, Jeju, Korea, Apr. 3-5, 2024.
- [C5] Kim, J., and Ahn, J., “Multiobjective design optimization of commercial satellite considering on-orbit refueling policy,” in *Proceedings of the Korean Society for Aeronautical and Space Sciences, Spring Conference*, Jeju, Korea, Apr. 19-21, 2023.
- [C6] Kim, J., Lee, D. U., and Ahn, J., “Research on the overseas on-orbit servicing trends and implications,” in *Proceedings of the Korean Society for Aeronautical and Space Sciences, Fall Conference*, Jeju, Korea, Nov. 16-18, 2022.

## AWARDS & HONORS

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### 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

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### Teaching Assistant | *KAIST*

Fall 2023 - Present

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

## EXTRACURRICULAR EXPERIENCES

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### 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

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### 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)

### 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