

# Jaewoo Kim

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## RESEARCH INTERESTS

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### Design Optimization of Space Systems

- Mathematical modeling of various space systems
- System design considering the lifecycle, from inception to retirement
- Considering various stakeholders and deriving solutions from a holistic viewpoint
- Exploring potentials of emerging technologies

### Decision Making Under Uncertainties

- Defining real-world problems related to highly uncertain nature and identifying key factors
- Developing decision-making framework based on fundamentals of mathematical reasoning

## 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 🌐 | Research Assistance

*Feb. 2022 – Present*

1. Modular Architecting Based on Multi-Criteria Decision Making
  - Surveyed general multi-criteria decision making methods and their applications to concept selection in the system design process
2. Development of Risk Analysis Framework for Korea Space Situational Awareness
  - 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]
3. Spare 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]
4. A Study on the Principle of Modular Architecture Engineering to Improve Level of Completion for Vehicle Architecture
  - 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
5. Research on ADR/OOS Applications for National Security Space Assets

- Reviewed on-orbit servicing technologies and related projects [C6]

#### 6. Development of Launch Vehicle Mission & Conceptual Design Software

- Developed analysis tools for the propulsion module and the staging module
- Contributed to developing all-at-once design optimization framework of launch vehicles [J4][C3, C4]

#### 7. Optimal Satellite System Architecting Considering On-Orbit Servicing

- Developed an optimal satellite system architecting framework based on a lifecycle simulation [J2][C5]

**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

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### Journal Articles

- [J1] Sung, T.<sup>†</sup>, Kim, J.<sup>†</sup>, and Ahn, J.\*, “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.\*, “Optimal satellite system architecting considering on-orbit refueling,” in preparation.
- [J3] 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.
- [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*, 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, 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, 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, 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, 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, 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