Jaewoo Kim

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Research Interests

Strategic Issues in Space Systems Design & Operations

- Designing space systems considering their lifecycle and various stakeholders
- Strategically planning and managing operations for economically efficient and sustainable space utilization

Engineering Decision-Making Problems

- Simplifying real-world problems under dynamic and uncertain environments by identifying key factors
- Developing decision-making frameworks grounded in quantitative reasoning
- Bridging analytical results with intuitive understanding to achieve explainable and actionable conclusions

Education

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

Ph.D. in Aerospace Engineering *Feb. 2027 (Expected)*

- Thesis Title (in progress): Maintenance Strategies for Satellite Mega-Constellations
- 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

Publications

Journal Articles (Corresponding Author Underlined)

[J1] **Kim, J.** and Ahn, J., "System Architecting for GEO Communication Satellite Considering On-Orbit Refueling," accepted by *AIAA Journal of Spacecraft and Rockets*, 2025, published online.
http://doi.org/10.2514/1.A36403

[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 Optimal Modular Architecture Design," *ASME Journal of Mechanical Design*, Vol. 147, No. 10, 2025, pp. 101401.
https://doi.org/10.1115/1.4068100

[J3] **Kim, J.**, Ahn, J., and Sung, T., "Replenishment Strategy for Satellite Constellation with Dual Supply Modes," *AIAA Journal of Spacecraft and Rockets*, Vol. 62, No. 5, 2025, pp. 1576–1583.
https://doi.org/10.2514/1.A36281

[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. 25, 2024, pp. 1563–1573.
https://doi.org/10.1007/s42405-024-00737-1

Papers Written in Korean

[K1] **Kim J.**, Lee, J., Choi, E. J., Choi, J., Yu, J., Jo, J., Kam, H., and Ahn, J., "Development of 3D Cell Model for Collision Risk Assessment of Space Assets," *Journal of Space Technology and Applications*, Vol. 25, No. 2, 2025, pp. 114–124.
https://doi.org/10.52912/jsta.2025.5.2.114

Preprint & Work in Progress

[P1] **Kim, J.**, Sung, T., Hwang, W., and Ahn, J., "Joint Replenishment Strategy for Multiple Satellite Constellations with Shared Launch Opportunities,"
https://doi.org/10.48550/arXiv.2503.23666

[P2] **Kim, J.**, Sung, T., Hwang, W., and Ahn, J., "On-Orbit Servicing-Integrated Maintenance Strategy for Satellite Constellation," in preparation.

[P3] **Kim, J.**, Choi, E., Suh, E. S., and Kim, J.-H., Ahn, J., "Optimal Clustering of Design Structure Matrix for Modular Architecture Design Considering Product Assembly," in preparation.

[P4] Park, B., Howell, K. C., **Kim, J.**, and Ahn, J., "Families of Optimal Two-Impulse Rendezvous Transfer Between Elliptic Orbits," in preparation.

[P5] Choi, E., **Kim, J.**, Ahn, J., and Kim, J.-H., "Optimal Design Structure Matrix Clustering with Constraint Selection for Modular Architecture Design," in preparation.

[P6] **Kim, J.**, Yu, J., Choi, E. J., Kam, H., Jo, J., and Ahn, J., "Analysis of Risk Scenarios for Korean Space Assets Using Korean 3D-Cell Engineering Software," in preparation.

Proceedings of Refereed Conferences

[C1] **Kim, J.**, Sung, T., Hwang, W., and Ahn, J., "Integration of On-Orbit Servicing into Constellation Maintenance with Spare Inventory Management," in *2026 AIAA SciTech Forum*, Orlando, Florida, US, Jan. 12–16, 2026. (to appear)

[C2] Song, M., **Kim, J.**, Nam, Y., and Ahn, J., "Low Earth Orbit Space Debris Remediation Program for Maximizing Stakeholders' Utility," in *2025 Asia-Pacific International Symposium on Aerospace Technology (APISAT)*, Seoul, Korea, Oct. 27–29, 2025.

[C3] **Kim, J.**, Sung, T., and Ahn, J., "Joint Replenishment Strategy for Multiple Satellite Constellations," in *2025 AIAA SciTech Forum*, Orlando, Florida, US, Jan. 6–10, 2025.
https://doi.org/10.2514/6.2025-1757

[C4] **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.
https://doi.org/10.52202/078360-0161

Proceedings Written in Korean

[C5] **Kim, J.**, Sung, T., Song, M., and Ahn, J., "Integrated Inventory Model for Constellation Maintenance via Spare Satellites and On-Orbit Servicing," in *Korean Society for Aeronautical and Space Sciences (KSAS) Fall Conference*, Goseong, Korea, Nov. 11–14, 2025.

[C6] **Kim, J.**, Song, M., and Ahn, J., "Optimal Design Lifetime and Propellant Loading of GEO Communication Satellites Considering On-Orbit Refueling," in *Korean Society for Aeronautical and Space Sciences (KSAS) Fall Conference*, Goseong, Korea, Nov. 11–14, 2025.

[C7] **Kim, J.**, Choi, E. J., Choi, J., Yu, J., Jo, J., Kam, H., and Ahn, J., "Survey of Risk Indices for Space Objects and Implications," in *Korean Space Science Society (KSSS) Fall Conference*, Jeju, Korea, Oct. 29–Nov. 1, 2025.

[C8] Lee, J., Lee, J., Jang, E., Jeon, H., **Kim, J.**, Lee, C., Scheeres, D. J., and Han, J., "Asteroid Accessibility Searching Algorithm," in *Korean Society for Aeronautical and Space Sciences (KSAS) Space Conference*, Yeosu, Korea, Jun. 25–27, 2025.

[C9] **Kim, J.**, Song, M., and Ahn, J., "Survey of Research on Economic and Performance Analysis of On-Orbit Servicing and Implications," in *Korean Society for Aeronautical and Space Sciences (KSAS) Space Conference*, Yeosu, Korea, Jun. 25–27, 2025.

[C10] **Kim, J.**, Ahn, J., Choi, E. J., Choi, J., Yu, J., and Jo, J., "Development of Integrated Space Collision Risk Response System," in *Korean Academy of Space Security (KASS) Spring Conference*, Seoul, Korea, May 9, 2025.

[C11] **Kim, J.**, Choi, E. J., Choi, J., Yu, J., Jo, J., and Ahn, J., "Progress of Space Debris Environment and Risk Analysis Framework Development," in *Korean Space Science Society (KSSS) Spring Conference*, Seoul, Korea, Apr. 22–24, 2025.

[C12] **Kim, J.**, Sung, T., and Ahn, J., "Application of Space Logistics: Maintenance Strategy of Satellite Mega-Constellation," in *Korean Society for Aeronautical and Space Sciences (KSAS) Spring Conference*, Jeju, Korea, Apr. 2–4, 2025.

[C13] **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 (KSSS) Fall Conference*, Sacheon, Korea, Oct. 28–30, 2024.

[C14] **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.

[C15] **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.

[C16] 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.

[C17] **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.

[C18] **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.

RESEARCH EXPERIENCE

Graduate Research Assistant | *Strategic Aerospace Initiative, KAIST* *Mar. 2022 – Present*

- **In-Space Servicing and Manufacturing Research Center** (**ISMRC**)
  (Duration: 2025-2035, Sponsor: National Research Foundation of Korea)
  - Proposed an on-orbit servicing-integrated maintenance strategy of satellite constellation [C1]
- **Space Logistics Modeling and Demand Fulfillment Strategy Evaluation Framework**
  (Duration: 2025–2028, Sponsor: National Research Foundation of Korea)
  - Proposed a framework for assessing the value of on-orbit servicing and explored potential architectural changes in GEO communication satellite [J1, C6, C9]
  - Proposed maintenance strategies for maintenance of satellite mega-constellations [P1, C1, C3, C5, C12]

- **Multi-Criteria Decision Making for Optimal Modular System Architecture Selection**
  (Duration: 2024–2026, Sponsor: Hyundai Motor Company)
  - Surveyed multi-criteria decision-making methods and their applications to system architecting
- **Development of Risk Analysis Framework for Korea Space Situational Awareness**
  (Duration: 2024–2026, Sponsor: Korea Astronomy and Space Science Institute)
  - Surveyed models for space object environment and collision risk analysis techniques
  - Developed Korea orbital debris engineering model [K1, C4, C7, C10, C11, C13]
- **A Study on the Principle of Modular Architecture Engineering to Improve Level of Completion for Vehicle Architecture**
  (Duration: 2022–2023, Sponsor: Hyundai Motor Company)
  - Developed an integer programming approach to design structure matrix-based modular architecting [J2]
  - Performed case studies of automobile subsystems and obtained improved design solutions
- **Research on ADR/OOS Applications for National Security Space Assets**
  (Duration: 2022, Sponsor: Korean Society for Aeronautical and Space Sciences)
  - Reviewed on-orbit servicing technologies and related projects [C18]
  - Designed ConOps of ADR/OOS
- **Development of Launch Vehicle Mission & Conceptual Design Software**
  (Duration: 2022–2023, Sponsor: Hanwha Aerospace)
  - Developed the propulsion and the staging modules for multi-disciplinary design optimization
  - Contributed to developing all-at-once design optimization framework considering flight requirements [J4, C15, C16]

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

- **Deep Space Navigation with Optical Sensor Data**
  - Reviewed non-inertial deep space navigation algorithms
  - Analyzed the performance of the selected algorithm with numerical simulations

TEACHING EXPERIENCE

Teaching Assistant | *KAIST* *Sep. 2023 – Present*

- AE551 Introduction to Optimal Control, Fall 2025
- AE280 Software Application in Aerospace Engineering, Spring 2025
- AE450 Flight Dynamics and Control, Fall 2024
- AE210 Aerospace Thermodynamics, Spring 2024
- AE401 Aerospace System Design II, Fall 2023

Part-Time Lecturer | *Humaiin 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 AI Foundation

AWARD & HONORS

2025 Korean Space Science Society Spring Conference | *Best Oral Presentation Award* *Apr. 2025*

- Presentation Title: Progress of space debris environment and risk analysis framework development

Optimization Grand Challenge 2024 | *Top 10% of Participants* *Oct. 2024*

- Competition to develop an optimization algorithm for pickup-and-delivery problems, sponsored by LG CNS
- Team Name: J2Opt

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

- Competition for innovative space systems, technologies, and mission concepts, sponsored by Hanhwa Aerospace
- Team Name: LETA (Lunar Exploration Trajectory Analytics)
- Topic: Lunar exploration trajectory design with low-thrust propulsion and multiple gravity assist
- Prize: 3,000,000 KRW (2,050 USD)

Extracurricular Experience

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

- Supported educational programs for military officers in DSC
- Served as a squad leader
- Received commendation from DSC School Head (Brigadier General)

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

- Interviewed diverse members of the SNU community and discovered insightful and interesting stories

Volunteer | *People to People International* *Mar. 2016 – Feb. 2018*

- Supported underprivileged members in Seoul City
- Student chapter union president (2017); SNU chapter president (2016)

Other Skills

Programming

- Python, MATLAB, Julia, C, C++, Java for quantitative analysis, including optimization, simulation, and statistical reasoning

Language

- Korean (native), English