

YOUNGIL KO

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West Lafayette, USA

RESEARCH INTERESTS

Non-Equilibrium flow, Rarefied flow, Multi-scale modeling, Gas-surface interactions (GSI)

EDUCATION

Purdue University

Ph.D. in School of Aeronautics and Astronautics | Advisor: Prof. Kazuki Maeda

Aug 2025 — Present

West Lafayette, USA

Korea Advanced Institute of Science and Technology (KAIST)

M.S. in Aerospace Engineering | Advisor: Prof. Eunji Jun

Aug 2023 — Aug 2025

Daejeon, Republic of Korea

4.15 / 4.3

Korea Advanced Institute of Science and Technology (KAIST)

B.S. in Aerospace Engineering

Aug 2017 — Aug 2023

Daejeon, Republic of Korea

3.86 / 4.3 | Magna Cum Laude

PUBLICATIONS

Journal Articles

- [J3] **Ko, Y.**, & Jun, E. (2026). Radiative equilibrium boundary condition and correlation analysis on catalytic surfaces in DSMC. *International Journal of Heat and Mass Transfer*, 255, 127693.
- [J2] **Ko, Y.**, & Jun, E. (2024). Mechanism-specific chemical energy accommodation with finite-rate surface chemistry in non-equilibrium flow. *Physics of Fluids*, 36(9), 096115.
- [J1] **Ko, Y.**, Kim, S., Moon, G., Yi, M., Park, K., Kim, Y., & Jun, E. (2023). Parametric study on the flight envelope of a radio-frequency ion thruster based atmosphere-breathing electric propulsion system. *Acta Astronautica*, 212, 198-212.

Manuscripts Under Review

- [U1] Moon, G., **Ko, Y.**, Yi, M., & Jun, E. (n.d.). *Operational feasibility analysis of a cryogenic active intake device for atmosphere-breathing electric propulsion*. Manuscript submitted for publication.

Conference Presentations

- [C13] **Ko, Y.**, Moon, G., & Jun, E. (2025, June). *Effect of surface recombination reaction on performance of intake device*. The Korean Society for Aeronautical & Space Sciences (KSAS) Conference, Yeosu, Korea.
- [C12] Park, W., **Ko, Y.**, & Jun, E. (2025, April). *Advanced gas-surface interaction model considering atomic oxygen in very low Earth orbit*. Korean Society for Computational Fluids Engineering (KSCFE) Conference, Iksan, Korea.
- [C11] Ma, S., **Ko, Y.**, & Jun, E. (2025, April). *Validation of air-carbon ablation model of carbon-based ablation TPS using DSMC*. The Korean Society for Aeronautical & Space Sciences (KSAS) Conference, Jeju, Korea.
- [C10] **Ko, Y.**, & Jun, E. (2025, April). *Re-entry flow analysis considering surface reaction and radiation equilibrium*. The Korean Society for Aeronautical & Space Sciences (KSAS) Conference, Jeju, Korea.
- [C9] Moon, G., **Ko, Y.**, & Jun, E. (2024, November). *Numerical analysis of the operational concept of a cryogenic active intake device for atmosphere-breathing electric propulsion*. The Korean Society of Propulsion Engineers (KSPE) Conference, Busan, Korea.
- [C8] **Ko, Y.**, & Jun, E. (2024, July). *Reaction mechanism-specific chemical energy accommodation in Direct Simulation Monte Carlo*. 33rd International Symposium on Rarefied Gas Dynamics (RGD33), Göttingen, Germany.
- [C7] Moon, G., **Ko, Y.**, & Jun, E. (2024, July). *Feasibility analysis of a cryogenic active intake device for atmosphere-breathing electric propulsion*. 33rd International Symposium on Rarefied Gas Dynamics (RGD33), Göttingen, Germany.

- [C6] **Ko, Y., & Jun, E.** (2024, June). *Surface reaction chemical energy accommodation model for re-entry flows*. The Korean Society for Aeronautical & Space Sciences (KSAS) Conference, Changwon, Korea.
- [C5] **Ko, Y., & Jun, E.** (2024, April). *Surface catalytic effect on chemical heat flux using Direct Simulation Monte Carlo*. The 3rd International Conference on High-Speed Vehicle Science and Technology (HiSST), Busan, Korea.
- [C4] Moon, G., **Ko, Y.**, Kim, S., Yi, M., Kim, Y., & Jun, E. (2023, June). *Conceptual system analysis of atmosphere-breathing electric propulsion for very-low-Earth-orbit operation*. The Korean Society for Aeronautical & Space Sciences (KSAS) Conference, Yeosu, Korea.
- [C3] Jun, E., Moon, G., **Ko, Y.**, & Kim, S. (2023, March). *Conceptual system analysis of very-low-Earth-orbit satellites with atmosphere-breathing electric propulsion*. The 11th Asian Joint Conference on Propulsion and Power (AJCPP), Kanazawa, Japan.
- [C2] **Ko, Y.**, Kim, S., Moon, G., & Jun, E. (2023, March). *Flight envelope determination of atmosphere-breathing electric propulsion system*. The Korean Society of Propulsion Engineers (KSPE) Conference, Jeju, Korea.
- [C1] **Ko, Y.**, Kim, S., Moon, G., & Jun, E. (2022, November). *Drag compensation feasibility of an atmosphere-breathing electric propulsion system*. The Korean Society of Propulsion Engineers (KSPE) Conference, Busan, Korea.

EXPERIENCE

KAIST Non-equilibrium Gas and Plasma Dynamics Lab (KNGPDL)

Aug 2023 — Present

Graduate Student Researcher | Advisor: Prof. Eunji Jun

Daejeon, Republic of Korea

| **Reusable Unmanned Space Vehicle Research Center** | Korea Research Institute for defense Technology planning and advancement (KRIT)

- Implemented chemical energy accommodation in a gas-surface reaction module within a C++-based Direct Simulation Monte Carlo (DSMC), resulting in a 14.4% reduction in heat flux prediction
- Evaluated gas-phase and gas-surface interaction models for hypersonic flows using DSMC

| **Aerodynamics Analysis of Supersonic Retro-Propulsion (SRP) System** | Korea Aerospace Research Institute (KARI)

- Devised a criterion of mesh generation and refinement for high-enthalpy flow DSMC simulations
- Analyzed DSMC results of SRP flow during atmospheric re-entry and compared them with CFD results

| **Prediction of Gas-Surface Interaction (GSI) in Very Low Earth Orbit (VLEO) Using an Atomic Oxygen-Surface Chemistry Models** | Air Force Office of Scientific Research (AFOSR)

- Integrated a gas-surface reaction model for rarefied atmosphere intake in VLEO in DSMC
- Identified up to 50% mole fraction variations in Atmosphere-Breathing Electric Propulsion (ABEP) intake gas composition with surface reactions in VLEO conditions

KAIST Non-equilibrium Gas and Plasma Dynamics Lab (KNGPDL)

Feb 2022 — Aug 2023

Undergraduate Student Researcher | Advisor: Prof. Eunji Jun

Daejeon, Republic of Korea

| **Undergraduate Research Participation (URP) Program** | KAIST

- Led a study on the ABEP system, predicting its feasibility at 196 - 248 km altitudes during moderate solar activity
- Developed a 0D ABEP discharge charge chamber model with 10% deviation from experiments with MATLAB
- Won Excellent Award in KAIST Undergraduate Research Participation (URP) program

Republic of Korea Army Special Warfare Command

Jul 2020 — Jan 2022

UH-60 Blackhawk Aircrew | Squad Leader | Sergeant

Eumseong, Republic of Korea

- Performed multiple aerial missions with a high level of skill, discipline, and teamwork
- Received the Best Aircrew of the Quarter award for being a valuable asset to the battalion

HONORS AND AWARDS

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| Ross Fellowship <i>Purdue University</i> Recruitment fellowship for outstanding PhD-track students to graduate programs at Purdue | Aug 2023 |
| Magna Cum Laude <i>KAIST</i> | Aug 2023 |
| Excellent Award in Undergraduate Research Participation (URP) Program <i>KAIST</i> Awarded to the top three teams among URP participants | Feb 2023 |
| KAIST-Boeing Scholarship <i>KAIST & Boeing</i> Merit-based scholarship awarded by Boeing | Aug 2022, Mar 2019 |
| Leadership Mileage Award <i>KAIST</i> Awarded to the top 3% of KAIST undergraduates for outstanding leadership achievements | Mar 2022 |
| Best Aircrew of the Quarter Award <i>Republic of Korea Army Special Warfare Command</i> Recognized for significant contributions to the battalion, on and off the field | Dec 2021 |
| Full Tuition Scholarship <i>KAIST & Ministry of Science and ICT</i> Scholarship awarded for both undergraduate and graduate studies | Aug 2017 — Aug 2025 |

TEACHING & MENTORING

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| International Student Mentor <i>KAIST</i> Mentored international students in Aerospace Engineering at KAIST | Sep 2024 — Dec 2024 |
| Undergraduate Research Participation (URP) Program Mentor <i>KAIST</i> Guided undergraduate participants of the URP program (Suyoun Ma) | Dec 2023 — Jul 2024 |
| SpaceKids Mentor <i>Hanwha Space Hub & KAIST</i> Co-developed and led a space project and curriculum for grade 6 and 7 students nationwide | Mar 2022 — Feb 2024 |
| Freshman Cultural Activity (FCA) Lecturer <i>KAIST</i> Designed and led two 13-week undergraduate freshman courses as a student lecturer | Mar 2019 — Dec 2019 |