YOUNGIL KO

youngil.ko@kaist.ac.kr youngil.ko17@gmail.com youngilko.github.io
Daejeon, Republic of Korea | +82 10-7200-4012

RESEARCH INTERESTS

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

EDUCATION

Korea Advanced Institute of Science and Technology (KAIST) Aug 2023 — Aug 2025
M.S. in Aerospace Engineering | Advisor: Prof. Eunji Jun *Daejeon, Republic of Korea*
4.15 / 4.3 (Cumulative) | 4.22 / 4.3 (Major)
Full Tuition Scholarship

Korea Advanced Institute of Science and Technology (KAIST) Aug 2017 — Aug 2023
B.S. in Aerospace Engineering *Daejeon, Republic of Korea*
Magna Cum Laude | 3.86/4.3 (Cumulative) | 4.06/4.3 (Major)
Full Tuition Scholarship | Leadership Mileage Award

PUBLICATIONS

[J2] **Youngil Ko**, Eunji Jun. "Mechanism-specific chemical energy accommodation with finite-rate surface chemistry in non-equilibrium flow." *Physics of Fluids* 36 no.9 (2024): 096115 | DOI: 10.1063/5.0222518

[J1] **Youngil Ko**, Sangwon Kim, Geonwoong Moon, Minwoo Yi, Kangmin Park, Younho Kim, Eunji Jun. "Parametric study on the flight envelope of a radio-frequency ion thruster based atmosphere-breathing electric propulsion system." *Acta Astronautica* 212 (2023): 198-212. | DOI: 10.1016/j.actaastro.2023.07.043

MANUSCRIPTS UNDER REVIEW

[U2] **Youngil Ko**, Eunji Jun. "Radiative equilibrium boundary condition and correlation analysis on catalytic surfaces in DSMC." *International Journal of Heat and Mass Transfer*

[U1] Geonwoong Moon, **Youngil Ko**, Minwoo Yi, Eunji Jun. "Operational Feasibility Analysis of a Cryogenic Active Intake Device for Atmosphere-Breathing Electric Propulsion."

CONFERENCE

[C13] **Youngil Ko**, Geonwoong Moon, Eunji Jun. "Effect of Surface Recombination Reaction on Performance of Intake Device." *The Korean Society for Aeronautical & Space Sciences KSAS* (Yeosu, Korea, Jun 2025)

[C12] Woonghwi Park, **Youngil Ko**, Eunji Jun. "Advanced Gas-Surface Interaction Model Considering Atomic Oxygen in Very Low Earth Orbit." *Korean Society for Computational Fluids Engineering KSCFE* (Iksan, Korea, Apr 2025)

[C11] Suyeon Ma, **Youngil Ko**, Eunji Jun. "Validation of Air-Carbon Ablation Model of Carbon-based Ablation TPS using DSMC." *The Korean Society for Aeronautical & Space Sciences KSAS* (Jeju, Korea, Apr 2025)

[C10] **Youngil Ko**, Eunji Jun. "Re-entry Flow Analysis Considering Surface Reaction and Radiation Equilibrium." *The Korean Society for Aeronautical & Space Sciences KSAS* (Jeju, Korea, Apr 2025)

[C9] Geonwoong Moon, **Youngil Ko**, Eunji Jun. "Numerical Analysis of the Operational Concept of a Cryogenic Active Intake Device for Atmosphere-Breathing Electric Propulsion." *The Korean Society of Propulsion Engineers KSPE* (Busan, Korea, Nov 2024)

[C8] **Youngil Ko**, Eunji Jun. "Reaction mechanism-specific chemical energy accommodation in Direct Simulation Monte Carlo." *33rd International Symposium on Rarefied Gas Dynamics RGD33* (Göttingen, Germany, Jul 2024)

[C7] Geonwoong Moon, **Youngil Ko**, Eunji Jun. "Feasibility Analysis of a Cryogenic Active Intake Device for Atmosphere-Breathing Electric Propulsion." *33rd International Symposium on Rarefied Gas Dynamics RGD33* (Göttingen, Germany, Jul 2024)

[C6] **Youngil Ko**, Eunji Jun. "Surface Reaction Chemical Energy Accommodation Model for Re-entry Flows." *The Korean Society for Aeronautical & Space Sciences KSAS* (Changwon, Korea, Jun 2024)

[C5] **Youngil Ko**, Eunji Jun. "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, Apr 2024)

[C4] Geonwoong Moon, **Youngil Ko**, Sangwon Kim, Minwoo Yi, Younho Kim, Eunji Jun. "Conceptual system analysis of atmosphere-breathing electric propulsion for very-low-Earth-orbit operation." *The Korean Society for Aeronautical & Space Sciences KSAS* (Yeosu, Korea, Jun 2023)

[C3] Eunji Jun, Geonwoong Moon, **Youngil Ko**, Sangwon Kim. "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, Mar 2023)

[C2] **Youngil Ko**, Sangwon Kim, Geonwoong Moon, Eunji Jun. "Flight Envelope Determination of Atmosphere-Breathing Electric Propulsion System." *The Korean Society of Propulsion Engineers KSPE* (Jeju, Korea, Mar 2023)

[C1] **Youngil Ko**, Sangwon Kim, Geonwoong Moon, Eunji Jun. "Drag Compensation Feasibility of an Atmosphere-Breathing Electric Propulsion System." *The Korean Society of Propulsion Engineers KSPE* (Busan, Korea, Nov 2022)

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 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

Magna Cum Laude | *KAIST* Aug 2023

Excellent Award in Undergraduate Research Participation (URP) Program | *KAIST* Feb 2023
Awarded to the top three teams among URP participants

KAIST-Boeing Scholarship | *KAIST & Boeing* Aug 2022, Mar 2019
Merit-based scholarship awarded by Boeing

Leadership Mileage Award | *KAIST* Mar 2022
Awarded to the top 3% of KAIST undergraduates for outstanding leadership achievements

Best Aircrew of the Quarter Award | *Republic of Korea Army Special Warfare Command* Dec 2021
Recognized for significant contributions to the battalion, on and off the field

Full Tuition Scholarship | *KAIST & Ministry of Science and ICT* Aug 2017 — Aug 2025
Scholarship awarded for both undergraduate and graduate studies

TEACHING & MENTORING

International Student Mentor | *KAIST* Sep 2024 — Dec 2024
Mentored international students in Aerospace Engineering at KAIST

Undergraduate Research Participation (URP) Program Mentor | *KAIST* Dec 2023 — Jul 2024
Guided undergraduate participants of the URP program (Suyoun Ma)

SpaceKids Mentor | *Hanwha Space Hub & KAIST* Mar 2022 — Feb 2024
Co-developed and led a space project and curriculum for grade 6 and 7 students nationwide

Freshman Cultural Activity (FCA) Lecturer | *KAIST* Mar 2019 — Dec 2019
Designed and led two 13-week undergraduate freshman courses as a student lecturer