

# HEEKUN ROH

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Associate GNC Engineer at Satrec Initiative Co., Ltd., Republic of Korea

## EDUCATION

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**Korea Advanced Institute of Science and Technology (KAIST)** Mar 2017 - Feb 2019

M. S. in Aerospace Engineering

Thesis: *Impact Time and Angle Control Guidance*

*for Homing Missiles Using Sequential Convex Programming*

Advisor : Prof. Min-Jea Tahk (Flight Dynamics and Control Laboratory)

GPA : 4.17/4.3

**Korea Advanced Institute of Science and Technology (KAIST)** Mar 2013 - Feb 2017

B.S. in Aerospace Engineering

B.S. in Electrical Engineering (Double Major)

Summa Cum Laude, KAIST Presidential Fellow, Honor Student, Dean's List

GPA : 4.13/4.3

**Korea Science Academy of KAIST** Mar 2010 - Feb 2013

Specialized secondary education institute for gifted students in mathematics and science

## PROFESSIONAL EXPERIENCE

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**Satrec Initiative** Feb 2019 - Present

Associate GNC Engineer (Satellite Attitude Determination and Control)

- Development and Early Operation of SpaceEye-X System

Served as a lead developer of Flight Control Software(FCS) for SpaceEye-X EO Satellite. Experienced the end-to-end system engineering process starting from PDR. Developed and implemented several novel attitude control and determination algorithms. Developed and refactored the onboard software in C. Introduced Test-Driven Development / Continuous Integration scheme to the legacy FCS. To be launched in 2022.

- Preliminary Design of Satellite Constellation Systems

Served as an Attitude Determination and Control System(ADCS) performance analyst for multiple constellation satellite systems, including a sub-100kg small satellites system to > 300kg medium satellites system, both in EO and SAR. Delivered several ADCS performance measures corresponding to multiple design iterations.

- Development of Lightweight Satellite Simulator

Served as a lead developer of a highly-versatile in-house satellite ADCS simulator in Python. The developed simulator supplied several satellite attitude profiles and performance measures for official design documents.

- Image Collection Performance Analysis

Served as an analyst for orbit and image collection analysis. Developed a novel optimal image collection scheduling method for minimum-time area coverage.

## RESEARCH EXPERIENCE

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### KAIST, Flight Dynamics and Control Lab (FDCL)

Dec 2016 - Feb 2019

Department of Aerospace Engineering, Master's Student

- Trajectory Optimization of Aerodynamically Controlled Objects
- Fast Trajectory Optimization using Sequential Convex Methods
- Optimal allocation of assets using mixed integer linear programming
- Target Tracking Filter using angle-only measurements
- Published 3 first-authored journal papers, and 9 first-authored conference papers

## PUBLICATIONS

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### Journal Papers

- [1] H. Roh, Y.J. Oh, M.J. Tahk, K.J. Kwon, and H.H. Kwon, "L1 Penalized Sequential Convex Programming for Fast Trajectory Optimization: With Application to Optimal Missile Guidance," *International Journal of Aeronautical and Space Sciences(IJASS)*, Vol. 21, pp. 493-503, Jun. 2020.
- [2] H. Roh, Y.J. Oh, M.J. Tahk, and Y.R. Jung "Optimal Weapon-Target Assignment of Multiple Dissimilar Closed-In Weapon Systems Using Mixed Integer Linear Programming", *Journal of Korean Society for Aeronautical and Space Sciences*, Vol. 47, No. 11, pp.787-794, Nov. 2019.
- [3] H. Roh, S.W. Shim, and M.J. Tahk, "Maneuver Algorithm for Bearings-Only Target Tracking with Acceleration and Field of View Constraints," *International Journal of Aeronautical and Space Sciences(IJASS)*, Vol. 19, No. 2, pp. 423-432, Jun. 2018.
- [4] S.Y. Han, J.H. Bai, S.M. Hong, H. Roh, M.J. Tahk, J.S. Yun, S.H. Park, "Control law for agile turn of air-to- air missile during boost phase," *International Journal of Aeronautical and Space Sciences(IJASS)*, Vol.18, No.4, Dec. 2017

### International Conference Papers

- [1] Y.J. Oh, H. Roh, and M.J. Tahk, "Fast Trajectory Optimization using Sequential Convex Programming with No-Fly Zone Constraints", 21st IFAC Symposium on Automatic Control in Aerospace (ACA), Cranfield, United Kingdom, Aug. 2019.
- [2] H. Roh, Y.J. Oh, M.J. Tahk, and C.H. Lee, "Fast Trajectory Optimization Using Sequential Convex Method for Guided Missiles," *The 5th CEAS Conference on Guidance, Navigation and Control (EuroGNC)*, Milano, Italy, Apr. 2019.
- [3] Y.J. Oh, H. Roh, M.J. Tahk, "A Lattice Path Following Algorithm for Guided Missiles," *2018 Asia-Pacific International Symposium on Aerospace Technology (APISAT)*, Chengdu, China, Oct. 2018.
- [4] H. Roh, M.H. Cho and M.J. Tahk, "Trajectory Optimization Using Cramer-Rao Lower Bound for Bearings-Only Target Tracking," *AIAA Scitech Forum 2018*, Kissimmee, Florida, USA, Jan. 2018.
- [5] H. Roh, B.Y. Lee, and M.J. Tahk, "Automatic Maneuver Generation for Suppression of Enemy Air Defense Using Scoring Function Matrix," *Asia-Pacific International Symposium on Aerospace Technology (APISAT)*, pp.1087-1093, Seoul, Korea, Oct. 2017.
- [6] J.M. Park, S.M. Hong, H. Roh, M.J. Tahk, Y.Y. Kim, J.S. Yun, "Optimal control of roll-pitch seeker with singularity avoidance," *The 26th Mediterranean Conference on Control and Automation (MED)*, Zadar, Croatia, Jun. 2018.

- [7] J.M. Park, H. Roh, M.J. Tahk, “Co-evolutionary Method For Dynamic Weapon-Target Assignment,” *Advances in Control and Optimization of Dynamic Systems(ACODS)*, Hyderabad, India, Feb. 2018.
- [8] S.Y. Han, J.H. Bai, H. Roh, S.M. Hong, M.J. Tahk, J.S. Yun, S.H. Park, “Three-Dimensional Velocity Maximizing Agile Turn of Air-to-Air Missile with Collision Triangle Constraint,” *25th Mediterranean Conference on Control and Automation (MED)*, Valletta, Malta, Jul. 2017.

### Domestic Conference Papers

- [1] H. Roh, M.J. Tahk, K.B. Kim, and H.H. Kwon, “Trajectory Optimization for Missile Impact Time Control Problem Using L1 Penalty Method and Sequential Convex Programming,” *The Korean Society for Aeronautical and Space Sciences(KSAS): 2018 Fall Conference*, Jeju, Korea, Nov. 2018.
- [2] H. Roh, and M.J. Tahk, “Comparison Study on Bearings-Only Target Tracking Filters,” *The Society for Aerospace System Engineering(SASE): 2018 Fall Conference*, Gyeongju, Korea, Nov. 2018.
- [3] H. Roh, S.M. Hong, M.J. Tahk, K.B. Kim, K.J. Kwon, and H.H. Kwon, “Optimal Impact Time Control Guidance Using Convex Optimization ,” *Korean Institute of Military Science and Technology(KIMST): 2018 General Conference*, Jeju, Korea, Jun. 2018.
- [4] H. Roh, and M.J. Tahk, “Optimization of Closed-In Weapon System Target Assignment Using Mixed Integer Linear Programming,” *The Korean Society for Aeronautical and Space Sciences(KSAS): 2018 Spring Conference*, Gyeongju, Korea, Apr. 2018.
- [5] H. Roh, B.Y. Lee, and M.J. Tahk, “Maneuver Generation for Moving Obstacle Avoidance Using Scoring Function Matrix,” *The Korean Society for Aeronautical and Space Sciences(KSAS): 2017 Fall Conference*, Jeju, Korea, pp. 561-562, Nov. 2017.
- [6] H. Roh, J.M. Park, and M.J. Tahk, “Modeling and Formulation for Return-to-Launch-Site Trajectory Optimization of Reusable Launch Vehicle,” *The 17th Symposium on Space Launch Vehicle Technology*, Gyeongju, Korea, Aug. 2017
- [7] K. Kim, H. Kim, H. Roh, and H.L. Choi, “Flying BioLab : A CanSat platform for sampling and monitoring air bacteria in bio-hazardous area” *The Korean Society for Aeronautical and Space Sciences(KSAS): 2014 Fall Conference*, Jeju, Korea, Nov. 2014.

### HONOR & AWARDS

<b>Graduation with Highest Honors, Summa Cum Laude</b>	Feb 2017
<b>Dean’s List, College of Engineering</b>	Mar 2015
<b>The World Embedded Software Contest 2014, 1st Place</b> in 'Medical Services' section Organized by Ministry of Trade, Industry and Energy	Dec 2014
<b>Samsung SDS Software Club Championship 2014, 1st Place</b> Organized by Samsung SDS	Nov 2014
<b>Cansat Competition Korea 2014, 2nd Place</b> Organized by KAIST Satellite Technology Research Center (SATREC)	Aug 2014
<b>Cansat Competition Korea 2012, 1st Place</b> Organized by KAIST Satellite Technology Research Center (SATREC)	Aug 2012
<b>Boeing Scholarship</b> Selected students in Department of Aerospace Engineering, KAIST	Mar 2014 - Dec 2016

## KAIST Presidential Fellowship

Mar 2013 - Feb 2017

Selected 20 students who show academic excellence and leadership

### LANGUAGE PROFICIENCY

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#### **Korean**

First Language

#### **English**

Proficient

TOEFL: (TBA, 102 in 2012)

GRE: (V 165 / Q 170 / AW TBA, 2022)

#### **French**

Fluent

DELFB2 (2016)

### TECHNICAL SKILLS

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#### **Programming Languages**

Fluent in C, Python, MATLAB

Experiences with Java, Julia, and many others

#### **Optimization Softwares**

Fluent in MOSEK, GPOPS II, Gurobi

#### **Miscellaneous**

L<sup>A</sup>T<sub>E</sub>X, Git, STK, Simulink, Linux Applications