

Keidai Iiyama

PHD STUDENT · STANFORD AERONAUTICS AND ASTRONAUTICS

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Education

Stanford University

PHD STUDENT - AERONAUTICS AND ASTRONAUTICS

- Advisor: Prof.Gao

Stanford, CA

2021.9 - present

The University of Tokyo

ME - AERONAUTICS AND ASTRONAUTICS

- Advisor: Prof.Funase
- Thesis: System Design and Autonomous Orbit Determination Strategy for Lunar Navigation Satellite System

Tokyo, Japan

2019.4 - 2021.3

The University of Tokyo

BE - AERONAUTICS AND ASTRONAUTICS

- Advisor: Prof.Funase
- Thesis: Navigation Satellite Constellation and Monitoring Station Arrangement for Lunar Global Navigation Satellite System

Tokyo, Japan

2015.4 - 2019.3

Awards, Fellowships, & Grants

AWARDS

2019.6 **Student Paper Competition Finalist**, 32nd International Symposium on Space Technology and Science

2017.9 **ARLIS 2017 Cansat Competition Overall Winner and Accuracy Award**, UNISEC

FELLOWSHIPS & GRANTS

2022.1 **Student Registration Grant**, 2022 ION ITM Conference

2021.9 - 2022.8 **Ph.D. Student Fellowship**, Stanford Aero/Astro Department \$101,856

2021.9 - 2023.8 **Nakajima Foundation Study Abroad Fellowship**, Nakajima Foundation 10,800,000 yen

2020.1 - 2021.2 **Study Abroad Musha Shugyo Program Travel Award**, School of Engineering, The University of Tokyo 400,000 yen

2019.9 - 2021.8 **WINGS CFS Fellowship**, WINGS CFS, The University of Tokyo 4,320,000 yen

Research Experience

Navigation and Autonomous Vehicles (NAV) Lab, Stanford University

ADVISOR: PROF. GRACE GAO

- Developed Diffusion Kalman Filter for time transfer from GPS to lunar communication networks.
- Developed a autonomous lunar navigation algorithm using GPS carrier phase measurements (in-progress)
- Related Publications: (C1)

Stanford, CA

Sep, 2021 - Present

Space Rendezvous Lab, Stanford University

Stanford, CA

ADVISOR: PROF. SIMONE D'AMICO

Sep,2021 - May, 2022

- Developed an angles-only navigation framework for spacecraft swarms in lunar orbits.
- Developed an angles-only batch-orbit determination algorithm using factor graphs (in-progress)
- Related Publications: (C2)

Space Systems Optimization Group, Georgia Institute of Technology

Atlanta, GA

ADVISOR: PROF.KOKI HO

Jan,2021-Feb,2021

- Developed an autoencoder + deep reinforcement learning + feedback controller framework that autonomously selects safe landing target site and plans divert maneuver from Lidar DEM observations during powered descent to planetary bodies.
- Related Publications: (C4), (C5)

Intelligent Space Systems Laboratory, The University of Tokyo

Bunkyo-Ku, Tokyo, Japan

ADVISOR: PROF. RYU FUNASE

Apr,2018 - Aug,2021

- Developed an autonomous and decentralized autonomous orbit determination and clock offset estimation strategy for LNSS navigation satellites equipped with chip-scale atomic clocks.
- Implemented a user positioning simulator for LNSS. Conducted positioning performance analysis for several constellations and lunar monitoring station arrangement patterns.
- Related Publications: (C3), (C7)

EQUULEUS Project Team

ADVISOR: PROF.RYU FUNASE

Oct,2017 - Present

- EQUULEUS is a 6U cubesat lunar mission jointly proposed by JAXA and the University of Tokyo to NASA. It is selected as the secondary payload of the EM-1 Mission (First flight of the NASA's new rocket, SLS)
- Designed and Implemented flight software for heater control and FDIR of the thermal sub-system.
- Contributed on environment tests and result analysis with MATLAB and Thermal Desktop.
- Related Publications: (J1), (C6), (C8)

Publications

JOURNAL PAPERS

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| 2020 | (J1) Funase, R., Ikari, S., Miyoshi, K., et al., (as 20th author) "Mission to Earth-Moon Lagrange Point by a 6U CubeSat: EQUULEUS", IEEE Aerospace & Electro. Systems Magazine, Vol.35, No.3, pp.30-44, 2020 |
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CONFERENCE PROCEEDINGS

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| 2023 | (C1) Iiyama, K. , Bhamidipati,S., and Gao,G., "Terrestrial GPS Time-Differenced Carrier-Phase Positioning of Lunar Surface Users", IEEE Aerospace Conference, Big Sky, MT, March, 2023 (Accepted)
(C2) Iiyama, K. , Bhamidipati,S., and Gao,G., "Precise Positioning and Timekeeping in Lunar Orbit via Terrestrial GPS Time-Differenced Carrier-Phase Measurements", ION International Technical Meeting (ITM), Long Beach, CA, January, 2023 (Submitted) |
| 2022 | (C3) Bhamidipati,S., Iiyama, K. *, Mina,T *, and Gao,G., "Time-Transfer from Terrestrial GPS for Distributed Lunar Surface Communication Networks", IEEE Aerospace Conference, Big Sky, MT, March, 2022. (*:Equal Contribution)
(C4) Iiyama, K. , Kruger, J., and D'Amico, S., "Autonomous Distributed Angles-Only Navigation and Timekeeping in Lunar Orbit", ION International Technical Meeting (ITM), Long Beach, CA, January, 2022,
Student Travel Grant |
| 2021 | (C5) Iiyama, K. , and Funase, R., "Autonomous and Decentralized Orbit Determination and Clock Offset Estimation of Lunar Navigation Satellites Using GPS Signals and Inter-satellite Ranging", ION GNSS+ 2021, St.Louis, MO, USA, September, 2021) |

2020	<p>(C6) Tomita, K., Skinner, K., Iiyama, K., Jagatia, B.A., Nakagawa, T., and Ho, K., “Real-Time Terrain Mapping and Processing for Safe Landing via Deep Neural Networks”, ASCEND, Las Vegas, NV, 2020</p> <p>(C7) Iiyama, K., Tomita, K., Jagatia, B.A., Nakagawa, T., and Ho, K., “Deep Reinforcement Learning for Safe Landing Site Selection with Concurrent Consideration of Divert Maneuver”, 2020 AAS/AIAA Astrodynamics Specialist Conference, Online, August, 2020</p> <p>(C8) Shibukawa, T., Matsushita, S., Iiyama, K., Ishikawa, A., Nishii, K., and Funase, R. “Flight Model Thermal Design and Validation for a 6U Deep Space Cubesat EQUULEUS”, 50th International Conference on Environmental Systems, Lisbon, Portugal, July, 2020. (conference postponed)</p>
2019	<p>(C9) Iiyama, K., “Optimization of the Navigation Satellite Constellation and Lunar Monitoring Station for Lunar Global Navigation Satellite System”, 32nd International Symposium on Space Technology and Science, Fukui, Japan, j-20s, June, 2019, Student Session Finalist</p> <p>(C10) Matsushita, S., Shibukawa, T., Iiyama, K., and Funase, R., “Thermal Design and Validation for a 6U Cubesat EQUULEUS under Constraints Tightly Coupled with Orbital Design and Water Propulsion System”, 49th International Conference on Environmental Systems, Boston, MA, The United States, July, 2019.</p> <p>(C11) Shibukawa, T., Matsushita, S., Iiyama, K., and Funase, R., “Reflection and Verification of Thermal Design under Tightly-Coupled Constraints to the 6U Deep Space CubeSat EQUULEUS”, 32nd International Symposium on Space Technology and Science, Fukui, Japan, June, 2019.</p>

Teaching Experience

Fall 2019 **Astrodynamics (Undergraduate course)**, taught by Prof. Ryu Funase, Graduate Teaching Assistant, The University of Tokyo

Miscellaneous

LANGUAGE

English (Fluent), Japanese (Native)

SOFTWARE SKILLS

Programming Language: C, C++, Python, MATLAB

Trajectory Design: SPICE Toolbox, jTOP (spacecraft trajectory design software)

Engineering: Thermal Desktop, Autodesk Inventor

Machine Learning: Pytorch, Open AI Gym

Web: React, Jekyll

Version Control: Git, Subversion

PROFESSIONAL MEMBERSHIPS

AIAA, ION