Keidai IIYAMA

PhD Candidate · Stanford Aeronautics and Astronautics

✉ kiiyama{at}stanford.edu | ⌂ https://kdricemt.github.io/ | 🔗 https://www.linkedin.com/in/keidai-iiyama/

Education

Stanford University   *Stanford, CA*
PhD Student - Aeronautics and Astronautics   *2021.9 - present*
- Advisor: Prof.Gao

The University of Tokyo   *Tokyo, Japan*
ME - Aeronautics and Astronautics   *2019.4 - 2021.3*
- Advisor: Prof.Funase
- Thesis: System Design and Autonomous Orbit Determination Strategy for Lunar Navigation Satellite System

The University of Tokyo   *Tokyo, Japan*
BE - Aeronautics and Astronautics   *2015.4 - 2019.3*
- Advisor: Prof.Funase
- Thesis: Navigation Satellite Constellation and Monitoring Station Arrangement for Lunar Global Navigation Satellite System

Awards, Fellowships, & Grants

Awards

2023.9	**ION GNSS+ 2023 Best Presentation of the Session (as co-author)**, Institute of Navigation (ION), for the paper (C12)
2017.9	**ARLISS 2017 Cansat Competition Overall Winner and Best Accuracy Award**, UNISEC

Fellowships & Grants

2022.1	**Student Registration Grant**, 2022 ION ITM Conference	*$600*
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   *Stanford, CA*
Advisor: Prof. Grace Gao   *Sep,2021 - Present*
- Developed Diffusion Kalman Filter framework for time transfer from terrestrial GPS to lunar surface communication networks (C9)
- Developed a positioning and timing algorithm of lunar rovers and satellites using terrestrial GPS time-differenced carrier phase (TDCP) measurements (J2), (C10), (C11), (C13)
- Developed an open-source simulator for lunar positioning, navigation, and timing (C14)
- Developed Ephemeris optimization framework for lunar navigation satellites (C12)
- Developed Distributed orbit determination and timing framework for satellite networks using covariance intersection (C16)

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
- Related Publications: (C8)

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: (C5), (C6)

Intelligent Space Systems Laboratory, The University of Tokyo
Bunkyo-Ku, Tokyo, Japan

ADVISOR: PROF. RYU FUNASE   *Apr,2018 - Aug,2021*

- Developed decentralized autonomous orbit determination and clock offset estimation algorithm for LNSS navigation satellites connected by crosslinks using a Schmidt Kalman Filter.
- 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 NASA's Space Launch System (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), (C1), (C2), (C4)

Publications

JOURNAL PAPERS

2023	(J2) **Iiyama, K**., Bhamidipati,S., and Gao,G., "Precise Positioning and Timekeeping in Lunar Orbit via Terrestrial GPS Time-Differenced Carrier-Phase Measurements", Navigation: Journal of the Institute of Navigation, 2023 (Under Review)
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

CONFERENCE PROCEEDINGS *: Equal Contribution

2024	(C16) ***Iiyama, K**., *Vila, G.C., and Gao,G., "Contact Plan Optimization and Distributed State Estimation for Delay Tolerant Satellite Networks", Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Big Sky, MT, March 2024
2023	(C15) *Shimane, Y., and ***Iiyama, K**., "Methods for Dual-Objective High Energy Tour Design", 2023 IEEE Aerospace Conference (AERO), Big Sky, MT, 2023
	(C14) ***Iiyama, K**., *Vila, G.C., and Gao,G., "LuPNT: Open-Source Simulator for Lunar Positioning, Navigation, and Timing", Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, September 2023
	(C13) **Iiyama, K**., and Gao,G., "Positioning and Timing of Distributed Lunar Satellites via Terrestrial GPS Differential Carrier Phase Measurements", Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, September, 2023

(C12) Cortinovis,M., **Iiyama,K**., and Gao,G., "Satellite Ephemeris Approximation Methods to Support Lunar Positioning, Navigation, and Timing Services", Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2023), Denver, CO, September, 2023, **Best Presentation of the Session**

(C11) **Iiyama, K.**, Bhamidipati,S., and Gao,G., "Terrestrial GPS Time-Differenced Carrier-Phase Positioning of Lunar Surface Users", 2023 IEEE Aerospace Conference (AERO), Big Sky, MT, March, 2023

(C10) **Iiyama, K.**, Bhamidipati,S., and Gao,G., "Precise Positioning and Timekeeping in Lunar Orbit via Terrestrial GPS Time-Differenced Carrier-Phase Measurements", Proceedings of the 2023 International Technical Meeting of The Institute of Navigation, Long Beach, CA, January, 2023

2022

(C9) Bhamidipati,S., *__Iiyama, K.__, *Mina,T ., and Gao,G., "Time-Transfer from Terrestrial GPS for Distributed Lunar Surface Communication Networks", 2022 IEEE Aerospace Conference (AERO), Big Sky, MT, March, 2022.

(C8) **Iiyama, K**, Kruger, J., and D'Amico, S.,"Autonomous Distributed Angles-Only Navigation and Timekeeping in Lunar Orbit", Proceedings of the 2023 International Technical Meeting of The Institute of Navigation, Long Beach, CA, January, 2022, **Student Travel Grant**

2021

(C7) **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", Proceedings of the Institute of Navigation GNSS+ conference (ION GNSS+ 2021), St.Louis, MO, USA, September, 2021)

2020

(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

(C5) **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

(C4) 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)

2019

(C3) **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

(C2) 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, Bostion, MA, The United States, July, 2019.

(C1) 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.

Teaching Experience

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

Mentoring

2023.1-Current	**Guillem Casadesus Vila**, Master Student, Stanford University
2023.1-Current	**Marta Cortinovis**, Ph.D. Student, Stanford University
2022.9-2023.3	**Guillem Rueda Oller**, Ph.D. Student, Stanford University

Miscellaneous

LANGUAGE

English (Fluent), Japanese (Native)

SOFTWARE SKILLS

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

Astrodynamics: GMAT, SPICE Toolbox, jTOP (spacecraft trajectory design software)

Optimization: CVXPY, SNOPT

Engineering: Thermal Desktop, Autodesk Inventor

Machine Learning: Pytorch, Open AI Gym

Web: React, Jekyll

Version Control: Git, Subversion

PROFESSIONAL MEMBERSHIPS

AIAA, ION