Keidai Iiyama

CONTACT INFORMATION

Graduate Student (Master's Program)
Intelligent Space Systems Laboratory (ISSL)
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EDUCATION

M.E. in Aeronautics and Astronautics   Mar, 2021 (expected)
The University of Tokyo, Japan
Department of Aeronautics and Astronautics, School of Engineering
GPA: 4.00/4.00
Thesis: Optimization of configuration and development strategy for Lunar Navigation Satellite System

B.E. in Aeronautics and Astronautics   Mar, 2019
The University of Tokyo, Japan
Department of Aeronautics and Astronautics, School of Engineering
GPA: 3.53/4.00
Thesis: Navigation Satellite Constellation and Monitoring Station Arrangement for Lunar Global Navigation Satellite System (LGNSS) (Advisor: Prof. Ryu Funase)

FELLOWSHIPS and AWARDS

- **Nakajima Foundation Study Abroad Fellowship**   Sep, 2021 - Sep,2023
  Two-year full funding (tuition + stipend) for Ph.D. study abroad. Maximum 5 year for monthly stipend.
  Agency: Nakajima Foundation, Japan
- **Study Abroad Musha Shugyo Program Fellowship**   Jan, 2020 – Feb, 2020
  Travel expense to conduct research at Georgia Institute of Technology as a visiting researcher.
  Agency: School of Engineering, The University of Tokyo, Japan
- **WINGS CFS Fellowship**   Sep, 2019 - Present
  Two-year stipend funding for graduate study
  Agency: WINGS CFS program, The University of Tokyo, Japan
- **32nd ISTS conference student paper competition finalist**   Jun, 2019
  For the paper "Optimization of the Navigation satellite constellation and Lunar Monitoring Station for Lunar Global Navigation Satellite System"
- **ARLISS 2017 Overall Winner & Accuracy Award**   Sep, 2017
  Overall winner of the international CanSat competition ARLISS.

RESEACH INTERESTS

- Autonomous spacecraft guidance, navigation, and control with reinforcement learning.
- Lunar Navigation Satellite System
- Spacecraft trajectory design
- Small satellite system design

RESEARCH EXPERIENCE

Intelligent Space Systems Laboratory, The University of Tokyo   Apr, 2018 - Present
- Role: Graduate Student
- Advisor: Prof. Ryu Funase & Prof. Shinichi Nakasuka
- Research Topic: Optimization of navigation satellite arrangement pattern and staged development strategy of Lunar Navigation Satellite System (LNSS)

- ➢ Implemented a Multi-Objective Monte-Carlo Tree Search algorithm to obtain staged development strategy that could flexibly adjust to uncertainties and changes in area of interest.
- ➢ Implemented a user positioning simulator for LNSS. Conducted positioning performance analysis for several constellation and lunar monitoring station arrangement patterns.
- ➢ Related Publications: (C2) (C3)

Space Systems Optimization Group, Georgia Institute of Technology   Jan, 2020 – Feb, 2020
- Role: Visiting Researcher
- Advisor: Prof. Koki Ho
- Research Topic: Landing site selection and divert maneuver planning with deep reinforcement learning
  - ➢ Developed a deep reinforcement learning framework that autonomous selects safe landing sites and plan divert maneuver from Lidar DEM observations during powered descent to planetary bodies.
  - ➢ Related Publications: (C1) (C4)

ACADEMIC APPOINTMENTS
- **Assistant researcher at ISAS/JAXA**   Apr, 2019 - Present
  JAXA Institute of Space and Astronautical Science (ISAS), worked on EQUULEUS project

TEACHING EXPERIENCE
- **Graduate Teaching Assistant** – to Assoc.Prof Ryu Funase in "Astrodynamics"   Sep, 2019 – Feb, 2020
  Created report assignments, sample codes. Ex: perturbation methods, orbit transfers, flybys, DVEGA

PROJECTS
EQUULEUS: Equilibrium Lunar-Earth point 6U Spacecraft   Sep 2017 - Present
- EQUULEUS is a 6U cubesat lunar mission jointly proposed by JAXA and the University of Tokyo to NASA. It was selected as the secondary payload of the EM-1 Mission (First flight of the NASA's new rocket, SLS).
- Contribution:
  - ➢ Thermal analysis with MATLAB and Thermal Desktop
  - ➢ Heater control and FDIR algorithm design, flight software development and implementation with C
  - ➢ Simulator design and implementation with C++
  - ➢ Eclipse analysis and halo orbit escape analysis with MATLAB.
- Related Publications: (J1) (C5) (C6) (C7)

ARLISS (A Rocket Launch for International Student Satellites)   Apr 2017 – Sep 2017
- ARLISS is a cansat competition in Black Rock, Nevada. Cansats developed by the participants are launched by rockets, going up high to 4km. In the comeback competition, the participating teams integrate autonomous system (including cases, parachutes and rovers) to direct the cansat to designated location.
- Our team won the overall winner and best accuracy award (0 m), which is given to the team that successfully navigated the rover closest to the goal. I contributed in the algorithm design and on-board software implementation for the flight sequence.

PUBLICATIONS and PRESENTATIONS
Journal Publications
Co-Author

(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
First Author

(C1) **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 Maneuvers", 2020 AAS/AIAA Astrodynamics Specialist Conference, USA, August, 2020

(C2) **Iiyama, K.**, Ozaki, N., Kawabata, Y., Funase, R., and Nakasuka, S. "The Optimization of Staged

Development of Lunar Navigation Satellite System", Space Sciences and Technology Conference, Tokushima, Japan, November, 2019 (Written in Japanese).

(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, Japan, j-20s, June, 2019 **{Student session finalist}**

Co-Author

(C4) Tomita, K., Jagatia, B.A., Nakagawa, T., **Iiyama, K.,** and Ho, K., "Real-Time Terrain Mapping and Processing for Safe Landing via Deep Neural Networks", ASCEND, Las Vegas, Nevada, The United States, November, 2020

(C5) Dei Tos, D.A., Baresi, N., Chikazawa, T., Campagnola, S., Kawabata, Y., **Iiyama, K.,** Kakihara, K., Ozaki, N., Funase, R., and Kawakatsu. Y., "Challenges and Solutions for the Trajectory Design of EQUULEUS", 29th Workshop on Astrodynamics and Flight Mechanics, Kanagawa, Japan, July, 2019

(C6) 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, USA, July, 2019.

(C7) 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.

MISCELLANEOUS

- **Language:** English (Professional proficiency), Japanese (Native)
- **Test Scores:**
  - GRE V: 155/170 (67%), Q: 169/170 (94%), A/W: 4.0 (55%)
  - TOFEL iBT 105/120
- **Programming:** MATLAB, Python, C, C++, Javascript
- **Software, Frameworks, Tools:**
  - Trajectory Design: SPICE Toolbox (celestial body ephemeris), jTOP (spacecraft trajectory design software)
  - Engineering: Thermal Desktop, CAD(Autodesk Inventor)
  - Reinforcement learning: Pytorch, OpenAI Gym
  - Web: React
  - Others: Subversion, Git

Last Updated: November 14, 2020