Koya Yamamoto

Aerospace Engineer • PhD Candidate, Texas A&M University

College Station, TX • koyayamamoto123@gmail.com • Google Scholar • koyayamamoto123.github.io

Summary

PhD candidate in Aerospace Engineering with a strong foundation in control theory, state estimation, trajectory optimization, uncertainty propagation and hardware-in-the-loop validation. Experienced in developing and validating advanced guidance, navigation, and control algorithms — from rigorous modeling to flight-ready software — with methods that transfer also to automotive, robotics, and drone systems.

Experience

Graduate Research Assistant
Aug 2022 – Present

Texas A&M University, College Station, TX

- Developed high-order complex-step state-transition tensors to propagate orbital uncertainty under J_2 and atmospheric drag, reproducing 10^4-sample Monte-Carlo covariance at 1–2 orders of magnitude lower cost across five state representations (submitted to JGCD)
- Extended complex-step differentiation to multivariable higher-order partial derivatives, reaching 15-digit first-order, 10–13 second-order, and 5–8 third-order precision without operator overloading (published, J. Astronaut. Sci.)
- Applied Jacobian coloring to multi-impulse cislunar trajectory optimization, cutting per-iteration constraint-Jacobian evaluations from 52 to 14 for a 2$\times$ solver speed-up (published Aero Sci $\&$ Tech)
- Designed nonlinear MPC for cislunar trajectory correction in the CR3BP under impulsive-maneuver uncertainty, achieving sub-kilometer tracking at $\sim$315 m/s Δv
- Benchmarked NLP solvers (IPOPT vs. fmincon) with finite-difference, complex-step, and analytical derivatives for multi-impulse cislunar trajectory optimization
- Developed gyro-free angular-velocity and attitude estimation from triaxial-accelerometer arrays via linear least squares, with linearized covariance validated against Monte Carlo
- Validated trajectory-optimization algorithms in hardware-in-the-loop testing on Arduino and Raspberry Pi

Navigation Engineer Intern
May – Aug 2023

VectorNav Technologies, Dallas, TX

- Developed smoothing algorithms for post-Kalman filtering, achieving a 2$\times$ improvement in state-estimation accuracy for real-time navigation systems
- Created high-precision geoid-undulation algorithms using the EGM2008 model, deriving recursive formulas for Legendre polynomials

Technical Trainee
Summer 2021

JAXA / ISAS, Kanagawa, Japan

- Modeled liquid-sloshing effects on spacecraft lunar-landing dynamics with physics-based mass-spring-damper models
- Determined system stability boundaries and failure modes via simulation, and proposed control laws for landing-gear systems to prevent overturn

Undergraduate Research Project
2020 – 2021

Waseda University, Tokyo, Japan

- Designed stratospheric-balloon experiments to validate an alignment-monitoring system, with structural analysis (Femap, Nastran) and physical prototyping

Education

Ph.D., Aerospace Engineering 2022 – Present

Texas A&M University • GPA 4.0/4.0

Random Dynamical Systems, Space Domain Awareness, Celestial Mechanics, Spacecraft Dynamics, Optimal Spacecraft Attitude & Orbital Maneuvers, Estimation of Dynamic Systems

B.S., Mechanical Engineering 2018 – 2022

Waseda University, Tokyo • GPA 3.6/4.0

Mechatronics, Fluid Dynamics, Satellite Design, C Programming

Publications

1. **K. Yamamoto**, J. L. Junkins, S. Shrivastava. "Uncertainty Propagation with Complex-Step State Transition Tensors for Perturbed Orbital Dynamics." *Journal of Guidance, Control, and Dynamics*, 2026. (Under review)
2. **K. Yamamoto**, E. Taheri, J. L. Junkins. "Nonlinear MPC for Cislunar Trajectory Correction Under Impulsive Maneuver Uncertainties: A Computational Performance Analysis." *2026 American Control Conference (ACC)*, IEEE, 2026. [IEEE Xplore]
3. **K. Yamamoto**, J. L. Junkins. "Advances in High-Precision Partial Derivative Approximation for Functions of n Variables." *The Journal of the Astronautical Sciences*, 73(3), 2026. [Springer]
4. **K. Yamamoto**, E. Taheri, J. L. Junkins. "Jacobian Coloring for Multi-Impulse Cislunar Trajectory Optimization." *Aerospace Science and Technology*, 180:113985, 2027. [ScienceDirect]
5. **K. Yamamoto**, E. Taheri, J. L. Junkins. "Comparison of NLP Solvers and Derivative Accuracy for Solving Multi-Impulse Cislunar Trajectory Optimization Problems." *2025 American Control Conference (ACC)*, IEEE, 2025, pp. 3807–3812. [IEEE Xplore]
6. **K. Yamamoto**, P. Kelly, J. L. Junkins. "Advancing Complex Differentiation: Applications to the State Transition Matrix." *AAS/AIAA Astrodynamics Specialist Conference*, 2024.
7. **K. Yamamoto**, P. Kelly, M. Majji, F. Guzmán. "Covariance Analysis of Attitude and Angular Rate Estimation Using Accelerometers." *AAS/AIAA Astrodynamics Specialist Conference*, 2023.

Technical Skills

Programming: MATLAB, Simulink, Python, C++

Control & Estimation: Model Predictive Control (MPC), PID, optimal control, Kalman filtering (EKF/UKF), least-squares estimation

Optimization: IPOPT, SNOPT, fmincon, CasADi

CAD & Analysis: SolidWorks, AutoCAD, Femap, Nastran

Hardware: Arduino, Raspberry Pi

Languages: Japanese (Native), English (Fluent), Italian (Advanced), Spanish (Beginner)