

Tomoki Koike

PhD Candidate in Aerospace Engineering

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Research Interests: My research interests encompass model reduction, control theory, scientific machine learning, for large-scale dynamical systems. I am eager to apply these techniques to applications such as digital twins, many-query computations, and AR/VR to construct reliable physics-based efficient surrogate models.

Education

Georgia Institute of Technology, Atlanta, GA AUG 2021 – *Present*
Ph.D. in Aerospace Engineering & **M.S.** in Computational Science and Engineering

Cumulative GPA: 3.92 / 4.0

Advisor: Elizabeth Qian, PhD

Purdue University, West Lafayette, IN AUG 2018 – MAY 2021

B.S. in Aeronautical & Astronautical Engineering

Cumulative GPA: 3.89 / 4.0

Undergrad Research Advisor: Dr. Carolin Frueh

Research Topic: Space Debris Database Scraping & Data Analysis

Research & Work Experience

Graduate Research Assistant

Present

AUG 2022

Aerospace Computational Engineering Laboratory, GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, GA

- Developed physics- and stability-informed surrogate models for multi-query computations across various engineering and scientific disciplines.
- Researched incremental/adaptive model reduction techniques to learn reduced surrogate models in a data streaming fashion. Applications include offshore windfarm simulations, carbon sequestration applications, distributed learning, and data security (**ROME Project**).
- Developed a data-driven Lyapunov function inference method to certify the stability of large-scale nonlinear dynamical systems.

Robotics Summer Intern

AUG 2022

JUN 2022

Nokia Bell Labs, New Providence, NJ

- Validated performance enhancements in ROS2 for simulating multi-agent robots in factory environments using Gazebo.
- Benchmarked the scalability of ROS1 and ROS2, focusing on message drop ratio, latency, and jitter.

UAV Capturing – Aerospace Engineering Masters Research

AUG 2021

MAY 2022

Advised by Dr. Jonathan Rogers, GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, GA

- Developed a fully animated quadcopter simulation in MATLAB & Simulink for UAV chase scenarios.
- Implemented advanced control algorithms (PID, Pure Pursuit) for precise target pursuit and capture, enhancing project performance.

LiDAR Data Processing Software Development Summer Intern

AUG 2021

MAY 2021

TerraDrone Corporation, Tokyo, Japan

- Developed Python software to automate drone point cloud data strip adjustment, reducing manual work from hours to 15 minutes for terabytes of data.
- Created tree detection software with a tree crown delineation algorithm for point cloud data.

Teaching Experience

Graduate Teaching Assistant

2022

AE2220 Dynamics I, lecturer: Dr. Mayuresh Patil (Fall, ~ 60 students)

AE2220 Dynamics I, lecturer: Dr. Mayuresh Patil (Spring, ~ 60 students)

Presentations, Posters, & Seminars

- 2024
 - **SIAM MDS 2024**, Atlanta, GA. Presentation for session MS7 & Poster for PP1 on “LyapInf: Data-Driven Lyapunov Function Inference for Stability Analysis of Nonlinear Dynamical Systems”
 - **MORe24** Model Reduction Conference in San Diego, CA. Presentation on “LyapInf: Data-Driven Lyapunov Function Inference for Stability Analysis of Nonlinear Dynamical Systems”
- 2023
 - **AIAA SciTech 2024 Presentation**, in Orlando, FL, for session MDO-08: Metamodeling, Reduced Order Models, and Approximation Methods I. Presentation on “Energy-Preserving Reduced Operator Inference for Efficient Design and Control.”
 - **Short & Sweet Seminar Series**, Georgia Institute of Technology. Talk on “Discovering Stable Reduced Order Models: Energy-Preserving Operator Inference.” Hosted by the Computational Science and Engineering Department.

Publications

Accepted

- 2024
 - **T. Koike** and E. Qian, “Energy-Preserving Reduced Operator Inference for Efficient Design and Control.” In AIAA SciTech Forum 2024, January 8-12, Orlando, FL, <https://doi.org/10.2514/6.2024-1012>.

Submitted

- 2024
 - **T. Koike** and E. Qian, “LyapInf: Data-Driven Lyapunov Function Inference for Stability Analysis of Nonlinear Dynamical Systems,” 2025 American Control Conference (ACC), IEEE.

Skills

Programming Languages: Julia, Python, MATLAB, C/C++, Bash, Lua
Software: Git, Simulink, GMAT
OS, Libraries, Tools: Linux, ROS1, ROS2, PyTorch, L^AT_EX, Arduino IDE, Raspberry PI
Languages: ENGLISH (fluent), JAPANESE (native)

Awards and Scholarships

AUG 2018 - MAY 2023 Semester Hours & Dean’s list, Purdue University
DEC 2020 [2020 FAA Smart Airport Student Competition](#) Winner.
(Developed trajectory planning algorithm)
DEC 2019 Sigma Gamma Tau, National Honor Society of AAE
MAY 2017 De Anza College (Cupertino, CA) – NIC International Japan Partnership Scholarship

Selected Coursework

Controls

Linear Control, Nonlinear Control, Optimal Control, Kalman Filter, Advanced Dynamics

Mathematics

Optimization, Linear Algebra, Numerical Linear Algebra, Real Analysis, Probability, PDE

Machine Learning

Math foundations of ML, Scientific Machine Learning

References

- **Elizabeth Qian, Ph.D.**
Assistant Professor, Georgia Tech, Aerospace Engineering and Computational Science & Engineering
e-mail: eqian@gatech.edu
- **Benjamin Peherstorfer, Ph.D.**
Associate Professor, New York University, Courant Institute of Mathematical Sciences
email: pehersto@cims.nyu.edu
- **Wassim M. Haddad, Ph.D.**
David S. Lewis Professor in Dynamical Systems and Control, Georgia Tech, Aerospace Engineering
e-mail: wassim.haddad@aerospace.gatech.edu