Automatic Control & Dynamic Optimization Society and Indian Institute of Science (IISc), Bangalore

Onboard Trajectory Optimization for System Autonomy

Saturday, 07 June 2025, 9.00 AM - 5.30 PM
Auditorium, Department of Aerospace Engineering, IISc-Bangalore

(maps.app.goo.gl/sgSQyo7Cxn75Mgfs6)

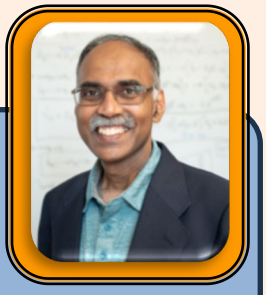
Abstract: Onboard trajectory optimization lies at the heart of true system autonomy, including UAVs, Robots, spacecrafts, launch vehicles, missiles, and so on. Onboard trajectory optimization in real time (optimal guidance) can be generally viewed as a difficult problem. However, it holds great promise for true system autonomy. The complex interplay between autonomy and onboard decision support systems introduces new vulnerabilities that are extremely hard to predict with most existing guidance and control tools. In this tutorial workshop, the basic background behind trajectory optimization and computational guidance will be reviewed first. Next, some recent advances in stabilized continuation techniques for solving two-point boundary value problems with convergence and compute guarantees will be discussed. These concepts further extend for applications to broad classes of trajectory guidance applications for aerospace flight systems including the accommodation of higher-fidelity models through bootstrapping techniques. These technical foundations will be highlighted through illustrative examples for optimal trajectory guidance inside dynamic and uncertain environments. The topics covered will also include an overview of optimal computational guidance with its relevance for challenging aerospace missions.

Lectures:

1. Overview of Trajectory Optimization (Optimal Control)
2. Stabilized Continuation for Onboard Trajectory Optimization
3. Computational Guidance for Aerospace Missions
4. Bootstrapping Techniques for Onboard Trajectory Optimization

Prof. Radhakant Padhi
HAG Professor & Satish Dhawan Chair
Department of Aerospace Engineering
& Center for Cyber-Physical Systems
Indian Institute of Science, Bangalore

Dr. Radhakant Padhi has pioneered the application of Nonlinear, optimal, adaptive and intelligent control for of aerospace vehicles, UAVs and Biomedical applications with the novel MPSP algorithm. He has also contributed to the G&C design of various ISRO missions like RLV and Chandrayaan-3 soft landing. The innovative nonlinear and optimal guidance and control algorithms developed by Dr. Padhi and his team are received very well across the globe. Currently his research group is passionately involved in (i) Soft-landing of spacecrafts and drones on Earth, Moon and Mars, (ii) Station-keeping and attitude control of spacecraft, (iii) High-precision pointing control of laser beams, (iv) Dynamic modelling and optimal management of air-traffic, and (v) Robust and intelligent artificial pancreas and IoT enabled support systems for diabetic patients.



Prof. Maruthi R. Akella
Professor, Department of Aerospace
Engineering and Engineering Mechanics
University of Texas at Austin, USA

Dr. Maruthi R. Akella is founding director for the Center for Autonomous Air Mobility and faculty lead coordinator for the controls, autonomy, and robotics area at UT Austin. His research encompasses coordinated systems, learning, adaptation, and vision-based sensing. His research group contributed for the onboard guidance algorithm for the Intuitive Machines IM-1 mission. His work has been recognized through the AIAA Mechanics and Control of Flight Award, the IEEE-CSS Award for Excellence in Aerospace Control, and the Judith Resnik Space Award from the IEEE Aerospace and Electronic Systems Society. He is being hosted by the Indian Institute of Science through a VAIBHAV fellowship from the Indian Department of Science and Technology as the first ever honoree focusing on aerospace technologies.

Registration (Deadline: 04 Jun 2025)

1) **Students: ₹ 300 (content of the lectures will be at the PG level)**
2) **Professionals: ₹ 500 (Academic / R&D), ₹ 700 (Industry)**

***The fee includes a kit, tea/coffee (two times) and a Pizza lunch.**

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