Tanay Kumar

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Profile

I am a Ph.D. student in Aerospace Engineering with a background in Electronics and Communication Engineering. I focused on aerospace robotics, autonomy, and GNC, with hands-on experience across various levels of autonomous UAV development. I am driven by a passion for integrating theoretical insights with experimental validation to address complex, real-world challenges in aerospace systems.

Education

Texas A&M University — College Station, TX
Ph.D. in Aerospace Engineering — *August 2024 – 2028*
Research Focus: Modular Robotics, Optimization, Robust and Fault Tolerance Control

Manipal Institute of Technology — Manipal, India
Bachelor of Technology in Electronics and Communication Engineering (8.39/10 CGPA) — *July 2018 – July 2022*
Minor specialization in Control Systems

Kendriya Vidyalaya, IIT Kanpur — Kanpur, India
AISSCE (91.8%) — *July 2017 – May 2018*

Experience

Department of Aerospace Engineering, TAMU — College Station, USA
Graduate Teaching Assistant — *August 2024 – Present*

- AERO 422: Active Control for Aerospace Vehicles

Department of Aerospace Engineering, IIT Bombay — Mumbai, India
Visiting Researcher — *August 2023 – July 2024*

- Worked on developing satellite-based navigation system for precision guidance of high-spin projectiles.
- Collaborated with various research organizations including the Indian Army, IIT Kanpur, IIT Madras, and SVNIT Surat.

Intelligent Guidance and Control Lab (IGCL), IIT Kanpur — Kanpur, India
Research Associate — *July 2022 – July 2024*

- Contributed to the development of FPGA-based GNSS receiver.
- Designed $\mathcal{H}_\infty$ based robust controller for quadrotor biplane tailsitter UAV.
- Conducted wind tunnel experiments for developing flight dynamics model of quadrotor biplane tailsitter UAV.
- Investigated alternatives to manual PX4 source code modification

Undergraduate Research Intern — *January 2022 – May 2022*

- Developed a robust controller for a quadrotor UAV to handle disturbances and system uncertainties.

National Technical Research Organization Aviation Base — Dehradun, India
UAV Controls and Autopilot Systems Intern — *August 2021 – November 2021*

- Assisted in forensic analysis of malicious UAVs.
- Initiated the development of anti-drone systems.
- Supervised the fabrication, maintenance, sensor integration, and autopilot system design of reconnaissance UAVs.

AeroMIT (University's official aeromodelling and aerial robotics student team) — Manipal, India
Advanced Drone Research Head — *March 2020 – May 2021*

- Administered the team to ensure its efficient operation and the undertaking of projects.
- Represented and managed the team at various national and international competitions.

Advanced Drone Research Member — *May 2019 – February 2020*

- Engineered a hybrid autonomous tilt-rotor drone for numerous applications.
- Designed and fabricated UAVs for research and competitions.
- Participated and won numerous national and international competitions.
- Gave presentations and conducted workshops regarding UAVs.

Publications

- **Kumar, T.**, and Bhattacharya, R., " Sparse Actuation for LPV Systems with Full-State Feedback in $\mathcal{H}_2/\mathcal{H}_\infty$ Framework" Manuscript accepted for publication. https://doi.org/10.48550/arXiv.2410.01118
- Shubham, **Kumar, T.**, and Kothari, M., "SDR-Based NavIC and GPS Receiver." In AIAA SciTech 2025 Forum, p. 2552. 2025. https://arc.aiaa.org/doi/abs/10.2514/6.2025-2552
- **Kumar, T.**, Kothari, M., and Bhattacharya, R., "$\mathcal{H}_\infty$ Robust Control of a Quadrotor Biplane Tailsitter UAV." In AIAA SciTech 2024 Forum, p. 0318. 2024. https://arc.aiaa.org/doi/abs/10.2514/6.2024-0318
- **Kumar, T.**, and Kothari, M., "Insights to the Forensic Investigation of a Custom Built UAV", 2023 doi.org/10.48550/arXiv.2308.14494

Projects

FPGA Based GNSS Receiver Development | *IGCL, IIT Kanpur* September 2022 - Present

- Developed highly configurable GNSS receiver for precise navigation of aerospace vehicles.
- Employed custom algorithms to optimize FPGA core utilization, increasing overall efficiency.
- Spearheaded the utilization of high-level hardware description language as an alternative to VHDL.

$\mathcal{H}_\infty$ Control of Biplane Quadrotor Tailsitter UAV | *IGCL, IIT Kanpur* May 2022 - February 2023

- Designed an $\mathcal{H}_\infty$ robust controller for a novel VTOL UAV to achieve stabilization with guaranteed performance under high disturbances and uncertainties.

Drone for COVID-19 Pandemic | *AeroMIT* April 2020

- Constructed an autonomous UAV to deliver essential medical aid.
- Equiped with 1.5kg payload with 8km range.

Autonomous Tiltrotor | *AeroMIT* October 2019 – April 2020

- Engineered an autonomous tiltrotor bicopter UAV for numerous purposes.
- Analyzed flight dynamics for controller synthesis and performed hardware integration.

Interests

Aerospace GNC, Aerial Robotics, Robust and Fault Tolerance Control, Optimization, Satellite-Based Navigation, Avionics

Technical Skills

Analysis and Simulation: MATLAB, Simulink, Vivado, Arduino IDE, SPICE
Languages: Python, C/C++, VHDL
Technical Writing: LaTeX

Awards and Honors

- Secured 2nd position in AeroDes competition during Techkriti 2021 at IIT Kanpur.
- Rank 2 in Technical Presentation and Rank 5 in Design Report at SAE AeroDesign Knowledge Event 2021.
- Secured 1st position for Application Report SAE ISS 2021.
- Second best Indian team at the BRICS Future Skills Aerial Robotics Competition 2020.
- Rank 4 and best in the technical presentation at the Lockheed Martin SAE AeroDesign East 2020 competition held at Lakeland, Florida.
- Secured 3rd position in Boeing National Aeromodelling Competition and 2nd position in Airbus Drone Challenge during TechFest 2019-20 at IIT Bombay.
- Taekwondo Dan-1 black belt holder.
- Received three gold, one silver, and two bronze medals under various categories in the Taekwondo district championships.

Extracurricular and Volunteer Activities

- Participated in plantation drive on World Environment Day 2023.
- Participated in a 5km marathon aiming to spread awareness against sexual harassment in 2022.
- Conducted a workshop at a local public school to promote higher education in 2021.
- Rendered excellent service for providing all the required support to a freshman under the Student Buddy Program 2019, an initiative to facilitate the holistic development of freshmen.
- Event Head of SkyRush, National UAV design competition at TechTava 2019 (MIT Manipal's annual technical fest).
- Organising volunteer for Manipal Marathon 2019, one of India's largest student-organised marathons.
- Represented the institute contingent in the Indian Republic Day parade 2019.
- Malpe beach cleanup volunteer on World Clean up Day 2018.
- Manipal lake clean up volunteer in 2018.