# PRAVEEN KUMAR RANJAN

Graduate Research Fellow
Unmanned Systems Laboratory,
University of Texas at San Antonio.

Email : praveenkranjan97@gmail.com
praveen.ranjan@my.utsa.edu
Website : praveenkranjan.github.io

## 📚 Education

| Year | Degree | Major (Concentration) | Institute |
|---|---|---|---|
| 2021 - 2024(Dec) | Ph.D. | Electrical Eng. (Systems & Controls) | University Of Texas at San Antonio, USA (UTSA) |
| 2018 - 2019 | M.tech | Aerospace Eng.(Structures and dynamics) | Indian Institute of Technology, Kanpur, India (IITK) |
| 2014 - 2019 | B.tech | Aerospace Engineering | Indian Institute of Technology, Kanpur, India (IITK) |

## 🧑‍💼 Work and Teaching Experience

▪ **Graduate Research Fellow|** Unmanned Systems Laboratory, UTSA  (JAN 2021- present)
- Led research initiatives to develop flexible aircraft maneuvering tactics for the Air Force Research Lab (AFRL).
- Conducted flight experiments on a fixed-wing VTOL UAV, working closely with the flight experiment team.
- Organized and led meetings to produce detailed research reports ensuring effective communication among groups.
- Authored and presented technical papers at conferences, contributing to a journal publication and preparing a patent proposal.

▪ **Graduate Teaching Assistant|** Department of Electrical Engineering, UTSA  (JAN 2021- MAY 2021)
- Managed course development for "Senior Design I," including tutoring, grading, and providing feedback on project planning.
- Guided 10 teams in creating engineering solutions to enhance student's technical problem-solving and teamwork skills.
- Coordinated team presentations and facilitated peer review sessions, helping students improve communication and leadership skills.

▪ **Project Engineer|** Helicopter and VTOL laboratory, IITK.  (JUL 2019- Dec 2020)
- Supervised development of an autonomous helicopter UAV, leading a team in executing wind tunnel and flight tests.
- Collaborated with cross-functional teams to create data-driven models and advance the project's goals.
- Presented findings to stakeholders and authored project reports to document progress and outcomes.

▪ **Teaching Assistant |** Department of Aerospace Engineering, IITK  ( AUG 2018- JUN 2019)
- Tutored weekly lab sessions, graded assignments, and provided one-on-one mentoring for the "Engineering Drawing" course.
- Designed and conducted an AutoCAD workshop for 100 students, developing the curriculum and leading hands-on training sessions.

## 🛠️ Skills and Interests

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|---|---|
| **Programming Languages** | C++, Python (libraries such as pytorch, tensorflow, openAI-gym, scikit-learn, openCV ), LATEX |
| **Software Tools** | Matlab/Simulink, Robot Operating System (ROS), CIFER, Solidworks, Autocad, Gazebo, Flightgear |
| **Hardware** | Pixhawk autopilot board and Raspberry Pi. |
| **Areas of Expertise** | Guidance Navigation and Control, Multi-agent Systems, Flight Dynamics Modelling, System Identification. |
| **Other Interests** | Non-linear Control, UAV design (rotary-wing, fixed-wing, hybrid), Reinforcement Learning, Deep Learning, Robust and adaptive state estimation, Optimal Control, path-planning, motion-planning |

## ⚙️ Relevant Research Projects

▪ **Integrated guidance and control of mobile manipulator in GPS-denied environment**
- Constructed a full-stack 3-DOF armed tracked robot capable of autonomously picking and placing objects
- Designed nonlinear guidance laws to steer the robot based on the manipulator's reachable regions.
- Utilized color-based object identification and disturbance-observer angle estimator for robot localization and navigation.
- Implement the guidance algorithm on Raspberry Pi equipped on armed robot with only a low-cost camera sensor.

▪ **System Identification and Hardware-In-The-Loop (HITL) simulation framework for helicopter UAV.**
- Frequency domain identification of the linear model to rapidly simulate aerial vehicle and prototype control laws.
- Augmented the linear identified model with deep learning to develop a stable plant model for continuous time simulations.
- Developed HITL framework, integrating plant/visualizer(gazebo), autopilot(pixhawk) & communication(mavros) in Simulink.
- Designed robust guidance laws using sliding mode control for helicopter operation in gusty environments.

## 🏆 Awards

- KCEID Scholarship (Fall 2022, Spring 2023).
- GREAT Tuition Award (Summer 2022).
- KCEID Competitive Scholarship (Spring 2021).
- MHRD Postgraduate GATE Fellowship (Fall 2018, Spring 2019).

## 👤 Professional Services

### ▪ Reviewer Of Peer Reviewed Journals

- IEEE Transactions on Cybernetics
- Automatica
- Journal of Process Control
- ASME Journal of Dynamic Systems, Measurement, and Control

### ▪ Reviewer Of Peer Reviewed Conferences

- Americal Control Conference (ACC)
- AIAA SciTech Forum

## 📖 Publications

### ▪ Patent

- **Praveen Kumar Ranjan**, A. Sinha, Y. Cao, D. Tran, D. Casbeer, and I. Weintraub **"Relational Maneuvering of Leader-Follower Unmanned Aerial Vehicles for Flexible Formation**" (Provisional Application Filed: 07/25/2024)

### ▪ Journals articles

- **Praveen Kumar Ranjan**, A. Sinha and Y. Cao, "Self-organizing multiagent target enclosing under limited information and safety guarantees.", IEEE Transactions on Aerospace and Electronic Systems, 2024.
- **Praveen Kumar Ranjan**, A. Sinha and Y. Cao, "3D Guidance Law for Maximal Coverage and Target Enclosing with Inherent Safety." IEEE Robotics and Automation Letters (Under review), 2024.
- **Praveen Kumar Ranjan**, A. Sinha, Y. Cao, D. Tran, D. Casbeer, and I. Weintraub, "Relational Maneuvering of Leader-Follower Unmanned Aerial Vehicles for Flexible Formation." in *IEEE Transactions on Cybernetics*, vol. 54, no. 10, pp. 5598-5609, Oct. 2024, doi: 10.1109/TCYB.2024.3435029.
- **Praveen Kumar Ranjan**, A Sinha, Y. Cao, D. Tran, D. Casbeer, and I. Weintraub, "Energy-Efficient Ring Formation Control with Constrained Inputs ", AIAA Journal of Guidance, Control, and Dynamics, vol. 46, no. 7, pp. 1397–1407, 2023 and in Proc., Guidance, Navigation, and Control Conference (AIAA SciTech Forum), National Harbor, USA, 23rd-27th Jan 2023.

### ▪ Conference articles

- **Praveen Kumar Ranjan**, A. Sinha, and Y. Cao, "Three-Dimensional Relational Maneuvering Guidance law for Flexible Leader-Follower Formation.", in Proc., Guidance, Navigation, and Control Conference (AIAA SciTech Forum), Orlando, FL, Jan. 2025.
- **Praveen Kumar Ranjan**, A. Sinha and Y. Cao, "Robust uav guidance law for safe target circumnavigation with limited information and autopilot lag considerations.", Guidance, Navigation, and Control Conference (AIAA SciTech Forum), Orlando, FL, Jan. 2024.
- **Praveen Kumar Ranjan**, J. Votion, Y. Cao, D. Tran, D. Casbeer, I. Weintraub "Energy-aware 3D Leader-Follower Flight Trajectory Optimization for Fixed-Wing Aircraft.", in Proc., Guidance, Navigation, and Control Conference (AIAA SciTech Forum), San Diego, USA, 3rd-7th Jan 2022.

### ▪ Thesis

- "Motion Planning for Relational Maneuvering of Unmanned Aerial Vehicles with Limited Information." (**PhD Thesis**), University of Texas at San Antonio.
- "Development of High-Fidelity Flight Dynamics model for Rotary-UAV using Deep Learning." (**Master's Thesis**), Indian Institute of Technology, Kanpur.