Ramchander Bhaskara

PhD Candidate · Aerospace Engineering · Texas A&M University

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Education

Texas A&M University — *College Station, TX*

PhD in Aerospace Engineering — *Jun 2021 - Aug 2025*

- Dissertation (Defended): Real-time Signal Processing and State Estimation for Spaceflight Applications.
- Committee: Drs. Manoranjan Majji (advisor), Felipe Guzman (Arizona), John Junkins, Tim Davis (TAMU).

Texas A&M University — *College Station, TX*

MS in Aerospace Engineering — *Aug 2019 - May 2021*

- Thesis: Hardware implementation of navigation filters for automation of dynamical systems
- Advisors: Drs. Manoranjan Majji & Robert Skelton

National Institute of Technology — *Trichy, India*

BTech in Instrumentation and Control Engineering — *Aug 2013 - Apr 2017*

- Thesis: Physics-based modeling of selective catalytic reduction system
- Advisor: Dr. Umapathy Mangalanathan

Professional Experience

2019 - 2025 — **Graduate Teaching & Research Assistant**, Land, Air, and Space Robotics Lab, Texas A&M University

- Lead researcher of signal processing architecture for interferometric phase measurement system.
  Project: Optomechanical accelerometers for space geodesy. Funding: JPL SURP (FY 2019-22).
  Focus: Real-time signal processing, frequency stabilization using FPGAs, multi-rate filtering, and state estimation.
- Developer of simulation and validation architecture for optical space-scene modeling software.
  Project: Hardware-in-the-loop testbeds for robust landing navigation systems. Funding: JPL SURP (FY 2021-24).
  Focus: Navigation filters, space-borne simulations, ray-tracing, FMCW LiDARs, and computer vision.

Jun - Aug 2023 — **Research Intern**, Robotics, NASA Jet Propulsion Lab
Perception for sampling autonomy of Europa Lander. Multi-sensor modeling for passive and active machine vision for lander arm mobility.
Focus: Digital image processing, sensor modeling, machine learning. [paper].

Jun - Aug 2022 — **Student Researcher**, Robotics, NASA Jet Propulsion Lab
IMU adaptive noise cancellation, Radar odometry for vehicle velocity state estimation.
Focus: Adaptive filtering.

Publications

Published

Ramchander Bhaskara, Roshan T Eapen, and Manoranjan Majji. 2025. Development and Validation of Velocimeter Lidar Simulator. Accepted to AIAA SciTech. [Poster][Paper]

Ramchander Bhaskara, Manoranjan Majji, and Felipe Guzman. Quantized State Estimation for Linear Dynamical Systems. Sensors 2024. [Paper]

Ramchander Bhaskara, G Georgakis, J Nash, J Bowkett, M Cameron, A Ansar, P backes, and M Majji. 2024. Icy Moon Surface Simulation and Stereo Depth Estimation for Sampling Autonomy. IEEE Aerospace Conference. [Paper] [Software]

Ramchander Bhaskara, Roshan T Eapen, and Manoranjan Majji. 2023. Differentiable Rendering for Pose Estimation in Proximity Operations. (**Finalist, graduate student papers**) AIAA Scitech Forum. [Paper]

Ramchander Bhaskara, Kookjin Sung, and Manoranjan Majji. 2022. An FPGA framework for Interferometric Vision-Based Navigation (iVisNav). 41^{st} Digital Avionics and Systems Conference. (**Best student research paper**). [Paper]

Ramchander Bhaskara, and Manoranjan Majji. 2022. FPGA Hardware Acceleration for Feature-Based Relative Navigation Applications. 2022 AAS/AIAA Astrodynamics Specialist Conference. [Paper]

Andrew Verras, Roshan T Eapen, Andrew Simon, Manoranjan Majji, **Ramchander Bhaskara**, Carolina I Restrepo, and Ronney Lovelace. 2021. Vision and Inertial Sensor Fusion for Terrain Relative Navigation. AIAA 2021 Scitech Forum. [Paper]

Kookjin Sung, **Ramchander Bhaskara**, and Manoranjan Majji. 2020. Interferometric Vision-Based Navigation Sensor for Autonomous Proximity Operation. 39^{th} Digital Avionics and Systems Conference. [Paper]

In Review

Ramchander Bhaskara, Roshan T Eapen, Manoranjan Majji, and Davis Adams. On applications of high-fidelity visual data synthesis in space mission designs. Journal of Advances in Space Research.

In Preparation

Ramchander Bhaskara, Manoranjan Majji, and Felipe Guzman. All Digital Phase Locked Loop for the Optomechanical Phase measurement System.

Ramchander Bhaskara, and Manoranjan Majji. Estimation of Linear System States from Quantized Inputs and Measurements.

Awards, Fellowships, Grants & Committees

2024	**AIAA**, Guidance, Navigation, and Control Graduate Award
2024	**Member of AIAA technical committee**, Sensor Systems and Information Fusion
2023	**Finalist, GNC Conference Graduate student papers**, SciTech Forum 2023
2021-24	**Graduate Excellence Fellowship**, Dept. of Aerospace Engineering, Texas A&M University
2022	**2nd place, Best student research papers**, Digital Avionics Systems Conference (DASC)
2022	**ASIE Scholarship**, American Society of Indian Engineers and Architects, Houston
2021	**NASA TechLeap Prize**, Control systems lead for autonomous sub-orbital plume tracking experiment, NASA Flight Opportunities Program

Talks

Ramchander Rao Bhaskara. 2025 (upcoming). High-fidelity space scene modeling for planetary exploration. University of Wisconsin-Madison.

Ramchander Rao Bhaskara. 2023. Scratching the Surface of Europa and Enceladus. Jet Propulsion Laboratory, Caltech.

Ramchander Rao Bhaskara. 2023. Study of Topology of Icy Moons. Jet Propulsion Laboratory, Caltech.

Ramchander Rao Bhaskara, Roshan T Eapen, Andrew Verras and Manoranjan Majji. 2021. Texas A&M ScORE: Space Object Rendering Engine. Lunar Surface Innovation Consortium, Applied Physics Laboratory, John Hopkins University.

Teaching

2024	**AERO 423:Orbital Mechanics**, Teaching Assistant [Course work]	*Spring & Fall*
2023	**Digital Signal Processing**, Seminar talk	*Fall*

Mentoring

2024-25	**Team Lunatyx**, 2 graduate & 2 undergraduate students, Lunar Autonomy challenge 2025	*TAMU*
2024	**Omar Mohmand**, undergraduate student, Trajectory Design for Mars rendezvous	*TAMU*
2024	**Marco Peredo**, undergraduate student, Trajectory Design for Jupiter rendezvous	*TAMU*

Select Projects

FPGA-Based All Digital Phase Locked Loop

Research: Phasemeter for optomechanical accelerometer

- Developed the mathematical framework for digital phase readout of high-frequency optical interferometric signals.
- Designed and implemented FPGA-based signal processing front-end for optical phase detection. Built Kalman filter on FPGA for state estimation pipeline.
- Built and tested a low-TRL breadboard prototype, demonstrating real-time signal processing [Demo].
- Implemented HDMI display controller for visualization, pipelined architecture for real-time implementation of the Fast Fourier Transform (FFT) algorithm on Digilent Zybo Z7020 FPGA.

Fast Fourier Transform on FPGA

Research: Interferometric visual navigation sensors

- Implemented digital IIR filters for signal processing, HDMI display controller for video output, pipelined architecture for real-time implementation of the Fast Fourier Transform (FFT) algorithm on Digilent Zybo Z7020 FPGA.

Optimal Kalman Filtering with Finite-Precision Measurements

Research: Robust Filtering on Embedded Hardware

- Formulated Kalman filter algorithms incorporating quantization noise in state and measurement updates. Improved sensor fusion performance through precision-aware filtering, optimizing for low-latency FPGA deployment.

Vision-based gimbal control for object tracking

Prof. Daniel Selva, TAMU

- Prototype: Kernelized Correlation Filters (KCF) and PID control for pan-tilt object tracking.
- NASA flight experiment: Implemented 3U gimbal payload for tracking plumes from 100,000 ft.

Spacecraft pose estimation aided by neural networks

Research: Robust pose estimation framework

- Pipelined pose estimation in stages of: object classification, keypoint detection, and pose optimization.

Service

2024 - 26 **American Institute of Aeronautics and Astronautics**, Member of technical committee

2023-24 **Aerospace Engineering Graduate Student Association**, Professional Development Chair

2020-25 **Texas A&M University Science Festival**, Volunteer

2017 - 19 **Bhumi (NGO)**, Volunteer Teacher of Physics *Bangalore*

REVIEWED: Transactions on Computers, IEEE Control Systems Letters, American Control Conference, AIAA SciTech Forum, Journal of Astronautical Sciences (JAS), Journal of Guidance, Control, and Navigation (JGCD).

References

Prof. Manoranjan Majji — Texas A&M University
Professor, Dept. of Aerospace Engineering — mmajji@tamu.edu

Prof. Felipe Guzman — University of Arizona
Professor of Optical Sciences — felipeguzman@arizona.edu

Prof. John Junkins — Texas A&M University
Professor, Dept. of Aerospace Engineering — junkins@tamu.edu

Prof. Roshan Eapen — Penn State University
Assistant Professor, Dept. of Aerospace Engineering — reapen@psu.edu

Dr. Georgios Georgakis — Jet Propulsion Laboratory
Robotics Technologist — georgios.georgakis@jpl.nasa.gov

Skills

Programming	MATLAB/Simulink, C++, C, Python, Verilog.
Focus Areas	Optical and RF sensors, Software-Defined Radio, Digital filters and communication, Audio.
Platforms	FPGA - Xilinx Vivado, Microprocessors, GNU Radio, Breadboard prototyping (analog front-end).