Ramchander Bhaskara

PhD Student · Aerospace Engineering

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Education

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

PhD in Aerospace Engineering — *Jun 2021 - Present*

- Dissertation: On-board sensor data processing and state estimation using FPGA embedded systems
- Advisor: Dr. Manoranjan Majji

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

Jun 2023 - Aug 2023	**Visiting Student Research Intern (JVSRP)**, Robotics, Jet Propulsion Lab, Caltech Perception for sampling autonomy of Europa/Enceladus Lander. Empirically-valid sampling site rendering and multi-sensor modeling for passive and active machine vision [paper].
Jun 2022 - Aug 2022	**Student Researcher**, Robotics, Jet Propulsion Lab, Caltech Velocity benchmarking, IMU noise cancellation, RADAR odometry for vehicle velocity state estimation.
Sept 2019 - Dec 2024	**Graduate Research Assistant**, Land, Air, and Space Robotics Lab, Texas A&M University Research on computer vision, graphics, FPGA embedded solutions for sensing and navigation.
Jun 2017- Jun 2019	**Associate of Intellectual Property**, iRunway India Patent analyst as a subject matter specialist on computer architecture and 5G infrastructure.

Publications

Published

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.

Ramchander Bhaskara, David van Wijk, Roshan T Eapen, Davis Adams, Caleb Peck, and Manoranjan Majji. 2024. Development and Validation of Velocimeter Lidar Simulator. AAS GNC Conference. [Poster]

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

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**).

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

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.

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

In Review

Ramchander Bhaskara, Manoranjan Majji, and Felipe Guzman. Quantized State Estimation for Linear Dynamical Systems. Sensors Journal.

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

In Prep

Ramchander Bhaskara, Manoranjan Majji, and Felipe Guzman. All Digital Phase Detection for the Optomechanical Accelerometer Sensor.

Awards, Fellowships, Grants & Committees

2024	**AIAA**, Guidance, Navigation, and Control Graduate Award
2024	**Member of AIAA technical committee**, Sensor Systems and Information Fusion
2023	**Graduate Mentoring Academy Fellow**, Texas A&M University
2023	**Finalist, GNC Conference Graduate student papers**, SciTech Forum 2023
2021-24	**Graduate Excellence Fellowship**, Dept. of Aerospace Engineering, Texas A&M University
2024, 23	**Travel Award**, 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
2022	**Travel Award**, Office of Graduate and Professional Studies, Texas A&M University
2021	**NASA TechLeap Prize Winners**, Control systems lead for autonomous sub-orbital plume tracking experiment, NASA Flight Opportunities Program
2016	**IIT Madras Summer Research Fellowship**, Dept. of Aerospace Engineering, IIT Madras
2015 - 17	**RECT Silver 72 Scholarship**, National Institute of Technology, Trichy

Presentations

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. 2022. FPGA hardware acceleration for interferometric-vision based navigation. Poster at DASC Conference, Virginia.

Ramchander Rao Bhaskara, Roshan T Eapen, and Manoranjan Majji. 2022. Texas A&M ScORE: Space Object Rendering Engine. Pathways Research Symposium, Texas A&M University.

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 Experience

Spring, Fall'24	**AERO 423: Orbital Mechanics**, Teaching Assistant
Fall'23	**Digital Signal Processing**, Seminar lecture

Mentoring

2023-2024	**Nathan Long**, PhD student, Texas A&M University
2024	**Kaitlyn Moore**, undergraduate student, Texas A&M University
2024	**Omar Mohmand**, undergraduate student, Texas A&M University
2024	**Marco Peredo**, undergraduate student, Texas A&M University

Projects

Vision-based gimbal control for object tracking *Jan 2022 - Jun 2022*

- 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 *Dec 2021*

- Dataset: Automated generation of custom synthetic images with ISS, using the Mitsuba ray-tracing engine.
- Pipelined pose estimation in three stages: object localization (YOLOv3), keypoint detection (ResNet50), and perspective projection (PnP).

Hardware design *Dec 2019 - present*

- 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.

Others

- Optimal control: iLQR based tensegrity structure control using MuJoCo physics simulator, spacecraft vertical landing problem.
- Terrain relative navigation: Synthetic velocimetry using ray-tracing based Lidar, camera simulation., point-cloud registration, and pose estimation.

Service

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

2020-23 **Texas A&M University Science Festival**, Volunteer

2017 - 2019 **Bhumi (NGO)**, Volunteer Teacher of Physics *Bangalore*