Ramchander Bhaskara

Department of Aerospace Engineering
Texas A&M University

✉ bhaskara@tamu.edu (979) 739-6675

EDUCATION

Texas A&M University, *College Station, TX*
Ph.D. in Aerospace Engineering *Jun. 2021 – May. 2024*
Research: Navigation, signal processing, and sensor modeling

Texas A&M University, *College Station, TX*
Master of Science in Aerospace Engineering *Aug. 2019 – May. 2021*
Thesis: Hardware implementation of navigation filters for automation of dynamical systems

National Institute of Technology, *Tiruchirappalli, India*
Bachelor of Technology in Instrumentation and Control Engineering *Aug. 2013 – Apr. 2017*
Thesis: Physics-based modeling of selective catalytic reduction system

RESEARCH

Land, Air and Space Robotics Lab (LASR)
Guide: Drs. Manoranjan Majji & Robert Skelton *Sep. 2019 – Oct. 2021*

Hardware design for navigation filters (M.S. Thesis)

- Developed FPGA based hardware/software codesign architecture for 6-DoF real-time motion rate estimation using interferometric vision based navigation sensor (iVisNav).
- Designed FPGA based custom hardware architecture to solve point cloud registration problem for 6-DoF pose estimation using synthetic LiDAR measurements.
- Designed hardware/software framework to deploy Kalman filter for state estimation on FPGA computing system. The codesign is applied to single and dual oscillator models based accelerometer sensors for acceleration estimation.

Terrain Relative Navigation and Machine Vision

- Implemented a software framework for generation of ground-based and space-based synthetic image data and depth maps.
- Developed a LIDAR simulation pipeline that captures LIDAR parameters and computes 3D point cloud and velocimetry with in-house developed software. Implemented the simulation pipeline to include earth's atmospheric model for ground-based and space-borne imaging.
- Developed a terrain relative navigation sim for feature 3D coordinates extraction using stereo vision techniques. Developed pixel averaging and pixel masking techniques to pick image coordinates that accurately capture an estimated set of 3D terrain coordinates.
- Programmed MATLAB and Python environments for automated and parallel rendering of large image data sets on the Mitsuba rendering system.
- Executed a differential rendering algorithm to match the pose of a captured image from any statistically unrelated starting pose.

Modeling of Selective Catalytic Reduction system - Vehicle Exhaust Control
Guide: Dr. M Umapathy, NIT Trichy *Jan. 2017 – May. 2017*

- Developed a linear state-space model, with reduced order steady-state dynamics, to accurately capture the NOx reduction from diesel engine exhaust.

INDUSTRY EXPERIENCE

iRunway, *Bangalore, India*
Associate of Intellectual Property *Jul. 2017 – Jun. 2019*

- Performed research-based analysis of patents in areas of high-speed clock circuits, micro-controller architectures, LTE and 5G infrastructures, and Lidar sensors.

- Performed chip-level reverse engineering analysis and reports for RF transceivers in Google Pixel 3 and Samsung Galaxy Note 9 smartphones.
- Co-authored a technological overview report on 4G LTE landscape in 2018.

Reliance Industries Limited, *Dahej, India*
Intern *May. 2016 – Jul. 2016*

- Worked on design, development, testing, and maintenance of motor control circuit relays employed in process plants.
- Developed digital logic implementation for high-pressure, high-temperature detection using ladder logic for execution in Programmable Logic Controllers.

PROJECTS

Vision-based gimbal control for object tracking
Prototype developed for NASA Techleap challenge *Jan. 2022*

- Implemented Kernelized Correlation Filters (KCF) for pan-tilt object tracking
- Deployed PID control law for real-time tracking via a Raspberry Pi 4 SBC.

Spacecraft pose estimation aided by neural networks
Course: Pattern Recognition *Dec. 2021*

- Generated a synthetic imageset with ISS in a free-space environment, using the Mitsuba rendering system.
- Achieved pose estimation in three stages: object localization, keypoint detection, and perspective projection.
- Implemented transfer learning techniques using YOLOv3 (localization), ResNet50 (keypoint detection) deep learning models for training (PyTorch). 6D pose is inferred using a modified gradient descent approach in a perspective projection model.

iLQR based tensegrity structure control
Tensegrity Systems Lab *Aug. 2021 – current.*

- Investigating control of tensegrity based bi-pedal support structures using LQG/iLQR techniques.
- Built models of multi-state tensegrity robotic structures in MuJoCo physics simulator.
- Experimented control policies for sample models on MuJoCo, integrated with robotic simulation on MATLAB.

Hardware design
Land, Air and Space Robotics Lab *Nov. 2019 – Dec. 2020*

- Implemented digital IIR filters for signal processing, HDMI display controller for video output.
- Developed a pipelined architecture for real-time implementation of the Fast Fourier Transform (FFT) algorithm on Digilent Zybo Z7020 FPGA. The FFT architecture is implemented and tested as an embedded system package to receive analog signals and evaluate frequency components on the fly.
- Designed a digital synthesizer simulation framework for hardware testing and validation of the FFT algorithm.

HONORS

- Winning team of NASA TechLeap Prize - Autonomous Observation Challenge 2021
- Graduate Excellence Fellowship (2021), Aerospace Engineering, Texas A&M University
- RECT Silver 72 scholarship for academic and extra-curricular excellence (NIT Trichy)
- IIT Madras Summer Research Fellowship
- State 9^{th} position with 97.5% in 10^{th} grade
- Silver medal in National Science Olympiad'10 with an All India Rank of 87.

SKILLS & OTHERS

Leadership: Vice President at the Entrepreneurship Cell of NIT Trichy, 2016-17
Volunteering: Volunteer - TAMU Science festival, Physics tutor at Bhumi (NGO), Bangalore chapter, 2017-19
Microcontrollers: Raspberry Pi, Arduino UNO, MSP430, TI CC3200
Hardware: Verilog, embedded C for SDK application development
Programming: C++, MATLAB, Python
Interests: Books, Piano, Chess, Hockey.