

Rajnish Bhusal

Arlington, TX | 469-664-3723 | rajnish.bhusal@mavs.uta.edu | [linkedin.com/in/rajnish-bhusal-766ba931](https://www.linkedin.com/in/rajnish-bhusal-766ba931) | rajnishbhusal.com

SUMMARY

Extensive experience with applying analytical and computational methods to model and control a broad class of dynamical systems. Strong research experience with novel contributions in the field of robust and optimal nonlinear control design, nonlinear state estimation and filtering algorithms, sensor fusion, and distributed control and optimization. Proven ability to collaborate and work in a team environment on multi-disciplinary projects.

EDUCATION

- The University of Texas at Arlington (UTA), Arlington, TX, USA** Jan 2017 – Aug 2021
Ph.D. in Aerospace Engineering
- Thesis: “Uncertainty Propagation, Control, and Estimation of Stochastic Dynamic Systems Using Generalized Polynomial Chaos Expansion” under the supervision of Prof. Kamesh Subbarao
 - GPA: 4.0/4.0
- Visvesvaraya Technological University, Bangalore, India** Aug. 2011 – June 2015
Bachelor of Engineering in Mechanical Engineering
- Grade: 4.0/4.0

EXPERIENCE

- Post-doctoral Research Associate** Oct 2021 – Present
Mechanical and Aerospace Engineering, UTA **Arlington, TX**
- Lead of the project entitled “Quantification of Uncertainty and Risk Sensitivity for Safety of Emerging Operations”.
 - Characterized uncertainties in the real-time flight of a group of unmanned aerial vehicles for unmanned traffic management (UTM) in National Airspace.
 - Developed software toolbox to predict risk and safety hazards in the UTM due to loss of control, severe weather conditions (wind shear), uncertain model parameters (related to drag, lift, and actuator specifications), and degraded positioning system.
 - Quantified the sensitivity of the safety metrics (for separation assurance in UTM) to the underlying uncertain parameters and inputs.
 - **Funding Agency:** National Aeronautics and Space Administration (NASA)
- Graduate Research Assistant** April 2018 – Aug 2021
Aerospace Systems Laboratory, UTA **Arlington, TX**
- Worked under the supervision of Prof. Kamesh Subbarao with three other team-mates in the project titled “Cooperative Assessment of Multibody-Control-Systems”
 - Prepared literature for reports, presentations, and submissions to peer-reviewed journals and conferences.
 - **Funding Agency:** Office of Naval Research (ONR)
- Graduate Teaching Assistant** Jan 2017 – May 2018
Department of Mechanical and Aerospace Engineering, UTA **Arlington, TX**
- Presented lectures and recitations, helped students with course materials, and graded homeworks.
 - Courses assisted: Introduction to Automatic Control, Experimental Methods & Measurements, Engineering Analysis.
- Mechanical Engineer** July 2015 – April 2016
Department of Engineering Services, Bata India Ltd. **Kolkata, India**
- Coordinated technical requirements, scheduling and solution development for engineering design and test issues.
 - Designed blueprints of machinery using CATIA while coordinating with subcontractors to meet project milestones.
 - Worked in collaboration with R&D department to design, build and overhaul heavy equipment machinery.

PUBLICATIONS and CONFERENCES

Journal Publications

- Rajnish Bhusal and Kamesh Subbarao, “Uncertainty Quantification Using Generalized Polynomial Chaos Expansion for Nonlinear Dynamical systems with Mixed State and Parameter Uncertainties,” *ASME Journal of Computational and Nonlinear Dynamics*, 2019
- Rajnish Bhusal and Kamesh Subbarao, “Generalized Polynomial Chaos Expansion Approach for Uncertainty Quantification in Small Satellite Orbital Debris Problems,” *The Journal of the Astronautical Sciences*, 2020
- Baris Taner, Rajnish Bhusal, and Kamesh Subbarao, “A Nested Robust Controller Design for Interconnected Linear Parameter Varying Aerial Vehicles,” *AIAA Journal of Guidance, Control, and Dynamics*, 2021
- Rajnish Bhusal and Kamesh Subbarao, “Robust Stability Margin of Continuous-Time Cooperative Unmanned Systems,” *AIAA Journal of Guidance, Control, and Dynamics*, 2021

Conference Publications

- Rajnish Bhusal and Kamesh Subbarao, “Uncertainty Quantification Using Non-Intrusive Generalized Polynomial Chaos Expansion for Orbital Debris Studies,” *AAS/AIAA Astrodynamics Specialist Conference*, AAS-18-438, Snowbird, UT, August 2018.
- Rajnish Bhusal and Kamesh Subbarao, “Sensitivity Analysis of Cooperating Multi-agent Systems with Uncertain Connection Weights,” *American Control Conference (ACC)*, IEEE, Philadelphia, PA, July 2019.
- Rajnish Bhusal, Baris Taner, and Kamesh Subbarao, “Performance Analysis of a Team of Highly Capable Individual Unmanned Aerial Systems,” *AIAA Scitech Forum*, Orlando, FL, January 2020.
- Baris Taner, Rajnish Bhusal, and Kamesh Subbarao, “A Nested Robust Controller Design for Interconnected Vehicles,” *AIAA Scitech Forum*, Orlando, FL, January 2020.
- Rajnish Bhusal, Baris Taner, and Kamesh Subbarao, “On the Phase Margin of Networked Dynamical Systems and Fabricated Attacks of an Intruder,” *American Control Conference (ACC)*, IEEE, Denver, CO, July 2020.
- Rajnish Bhusal and Kamesh Subbarao, “Nonlinear State Estimation of Reentry Vehicle using Polynomial Chaos-based Ensemble Filtering,” *AAS/AIAA Astrodynamics Specialist Conference*, AAS-18-438, South Lake Tahoe, CA, August 2020.
- Rajnish Bhusal, Baris Taner, and Kamesh Subbarao, “Generalized Polynomial Chaos Expansion-based Stochastic Linear Quadratic Regulator for Multi-agent Systems,” *AIAA Scitech Forum*, Nashville, TN, January 2021.
- Rajnish Bhusal and Kamesh Subbarao, “Generalized Polynomial Chaos-based Ensemble Kalman Filtering for Orbit Estimation,” *American Control Conference (ACC)*, IEEE, New Orleans, LA, May 2021.
- Rajnish Bhusal and Kamesh Subbarao, “Robust Stability Margin of Continuous-Time Cooperative Unmanned Systems,” *AIAA Scitech Forum*, San Diego, CA, January 2022.
- Rajnish Bhusal, Diganta Bhattacharjee, and Kamesh Subbarao, “Stochastic Model Predictive Control of Discrete-time Cooperative Unmanned System,” *AIAA Scitech Forum*, San Diego, CA, January 2022.
- Rajnish Bhusal and Kamesh Subbarao, “Consensus of Cooperative Unmanned Systems with Non-uniform Time-varying Delays,” *AIAA Scitech Forum*, San Diego, CA, January 2022.

Honors and Awards

- **AIAA SciTech GNC Graduate Student Paper Competition 2022:** Finalist in the Student Paper Competition, awarded by the AIAA Guidance, Navigation and Control (GNC) Technical Committee. (January 2022)
- **Excellent Reviewer for Journal of Guidance, Control, and Dynamics (JGCD):** Awarded by the Associate Editors of *AIAA Journal of Guidance, Control, and Guidance*. (2021)
- **Dissertation Fellowship:** Awarded by the Office of Graduate Studies upon nomination by the Department of Mechanical and Aerospace Engineering and College of Engineering, UTA. (Summer 2021)
- **Lawrence W. Stephens Endowment Award:** Awarded by the College of Engineering, UTA for outstanding students in aerospace systems, aerospace engineering, systems engineering, and autonomous systems. (2018 and 2020)
- **Visvesvaraya Technological University Gold Medalist:** Awarded with **5 gold medals** for securing first rank (Bachelor of Engineering) in Mechanical Engineering: Murty’s Medal of Excellence, Sri Sanjay Keshavrao Agarkhed Memorial Gold Medal, Jain University Gold Medal, Jyothi Gold Medal, VTU Gold Medal. (2015)
- **COMPEX Scholarship:** Awarded with full-waiver scholarship for top-ranked students from Nepal to study Bachelor of Engineering (2011-2015)

PROJECTS

- Cooperative Assessment of Multibody-Control-Systems** | *Distributed consensus* March 2018 – Aug 2021
- Designed robust, distributed-cooperative consensus control protocols for F-16 like multiple aircraft.
 - Characterized stability margins and time delay margins for state synchronization in multi-agent systems, and studied vulnerability and sensitivity of multi-agent systems to injection attacks from intruders.
 - Developed stochastic linear quadratic regulators (LQR) and stochastic model predictive controllers (MPC) for guaranteed consensus in multi-agent systems with parametric uncertainties.

- Localization and Object Tracking** | *State and parameter estimation* Aug 2018 – Aug 2021
- Developed a computationally efficient novel filtering algorithm for the state estimation of nonlinear systems with parametric uncertainties and noisy measurements.
 - Implemented the proposed filtering algorithm for the state and parameter estimation in hypersonic reentry of spacecrafts in Martian atmosphere using IMU and spacecraft-to-spacecraft radiometric navigation data from Mars orbiters using the Electra ultrahigh frequency (UHF) transceiver.
 - Implemented the filtering algorithm to localize the position of a spacecraft entering the Earth's atmosphere and CubeSats in low-Earth orbits using data from IMU, GPS receiver, and ground-based Radar.

- Guidance, Navigation and Control of UAV, Missile, and UGV** Aug 2019 – Aug 2020
- Modeled GNC subsystem for an F-16 like UAV to carry out trajectory optimization with GPS and IMU for localization.
 - Modeled GNC subsystem for an unmanned ground vehicle (UGV) in MATLAB/Simulink using dead-reckoning with encoders for localization, homing guidance strategy for way-point navigation, and PID control design.
 - Worked with the standard augmented proportional navigation (APN) and true proportional navigation (TPN) guidance laws for missile-target interception in the scenarios with both maneuvering and non-maneuvering targets.
 - Implemented Extended Kalman filter (EKF), Particle filter (PF), and Unscented Kalman filter (UKF) for simultaneous localization and mapping (SLAM), and RRT* algorithm for the path-planning of UAVs and UGVs.

TECHNICAL SKILLS

Analytical: dynamic system modeling, optimal and robust control, nonlinear control, distributed control and optimization, stochastic control, probabilistic modeling and uncertainty quantification, structural dynamics

Development Skills: C++, MATLAB/Simulink, Python, ROS, HTML/CSS, Javascript

Systems: Windows, Linux

Version Control: GIT