

EDUCATION

- **Doctor of Philosophy (Ph.D.), Aeronautics and Astronautics** Jan 2018 – Aug 2021
Purdue University, West Lafayette, Indiana, USA
 - Majors: Astrodynamics and Space Applications
 - GPA: 4.00 / 4.00
- **Master of Science, Aeronautics and Astronautics** Aug 2015 - Dec 2017
Purdue University, West Lafayette, Indiana, USA
 - Majors: Astrodynamics and Space Applications
 - GPA: 4.00 / 4.00
- **Bachelor of Technology, Mechanical Engineering** Jul 2011 - May 2015
National Institute of Technology Karnataka, INDIA
 - CGPA: 9.08 / 10

EXPERIENCES

- **Research Associate** Jul 2021 – Present
Interdisciplinary Centre for Security, Reliability and Trust (SnT), LUXEMBOURG
 - Design and validate control algorithm for rendezvous in near-Earth orbits as well as cislunar orbits.
 - Determine optimal rendezvous path using coupled attitude and orbit dynamics.
 - Filter pose estimation data from vision based navigation systems to calculate control maneuvers for compensating deviations from the predicted path.
 - Collaborate with startups to validate their navigation apparatus by conducting laboratory experiments.
 - Conduct hardware-in-the-loop validation tests by simulating satellite motion using robotic manipulators.
- **Research and Development Intern** May 2019 – Aug 2019
Mitsubishi Electric Research Laboratories Inc., Cambridge, Massachusetts, USA
 - Developed coupled satellite orbit control and state estimation strategies for Earth-Moon halo orbits and Mars-Phobos quasi-satellite orbits using the non-Keplerian circular restricted three-body flight dynamics.
 - Optimal station-keeping maneuver and path planning using Linear Quadratic Regulator, and orbit determination using sequential Kalman filter for signal processing.
 - Performed satellite control on high-fidelity ephemeris trajectory using Systems Tool Kit (STK) software.
 - Contingency operations for extended satellite life. Performance monitoring and failure mode analysis.
- **Graduate Assistant** May 2017 – Jul 2021
Purdue University Minority Engineering Program, Indiana, USA
 - Ensure high retention rate of under-represented minority students in engineering.
 - Evaluate tutor performance to assure quality academic assistance to undergraduate students.
 - Taught MATLAB programming, microkart robot design and engineering skills to undergraduate students.
- **Research Intern** May 2016 – Jul 2016
Indian Institute of Space Science and Technology, INDIA
 - Enhanced Differential Evolution (DE) technique (derivative of Genetic Algorithm) for Halo orbit design and satellite trajectory optimization to manage large unexpected orbit perturbations.
 - Executed Fortran code for rapid computation of optimal solutions.
 - Investigated the performance of Differential Evolution technique vs traditional methods.

- **Captain, NITK Racing** May 2014 – Apr 2015
National Institute of Technology Karnataka, INDIA
 - Lead group of 36 students at Formula Student global competitions and supervised different subsystems.
 - Optimized car performance by reduction in chassis and body weight.
 - Proposed and fabricated aerodynamic package for increased traction and braking.
 - Event participated: **Formula Student China, Xiangyang, Hubei, China | October 2014**

PROJECTS

- **PhD Dissertation** Jan 2018 – Jul 2021
Purdue University, USA
 - Information based parameter selection for impulsive station-keeping control algorithm for Earth-Moon Near Rectilinear Halo Orbits in lieu of NASA's Lunar Gateway mission.
 - Device spacecraft orbit maintenance strategies to minimize propellant consumption for cis-lunar missions.
 - Augmented graphical user interface to incorporate station-keeping capabilities to Adaptive Trajectory Design (ATD) software using the MATLAB platform.
 - Formulated innovative Guidance, Navigation and Control techniques in nonlinear astrodynamical regimes.
- **Master's Thesis** Aug 2015 - Dec 2017
Purdue University, USA
 - Enhanced applicability of Cauchy-Green tensor and Target point station-keeping strategies for the Sun-Earth/Moon Libration point missions.
 - Generated Monte Carlo simulations using blended MATLAB and C/C++ codes to detect low cost maneuvers.
 - Simulated spacecraft attitude dynamics and control cases and performed anomaly investigations.
 - Performed satellite orbit tracking from stochastic data.
- **Undergraduate Thesis** Jul 2014 – Apr 2015
National Institute of Technology Karnataka (NITK), INDIA
 - Devised and installed Aerodynamic Drag Brake system to decrease effective braking time.
 - Optimized aero wings for a Formula Student Race Car using Catia and ANSYS software.
 - Analysed flow structure using ANSYS CFX and Structural Analysis using ANSYS Workbench.

PATENT

- Uros Kalabic, **Vivek Muralidharan**, and Avishai Weiss, "Tracking neighboring quasi-satellite orbits around Mars's moon Phobos," U.S. Patent US20210206517A1, published July 8, 2021.

AWARDS

- Featured in list of top **20 under 35** by Space & Satellite Professionals International (SSPI), 2022.
- **Finalist, Luigi G. Napolitano Award** at the 73rd International Astronautical Congress, 2022.

CERTIFICATIONS

- **Graduate Certificate in Applied Statistics**, Purdue University, USA (2020)
- **Foundational Artificial Intelligence**, Skillup Online & NASSCOM FutureSkills (2020)

SKILLS

- **Programming Languages:** MATLAB, Python, C/C++, Fortran, R, SAS, Simulink
- **Utilities:** Systems Tool Kit (STK), Robot Operating System (ROS), SPSS, Microsoft Office, Latex
- **Engineering Design Analysis:** Catia, AutoCad, Creo, ANSYS

AREAS OF EXPERTISE

- Astrodynamics / Orbit Mechanics
- Station-keeping Strategies
- Optimization
- Guidance Navigation & Control (GNC)
- Classical Mechanics
- Stochastic Process and Data Analysis
- Orbit Determination
- Rendezvous

PUBLICATIONS

- i. **Vivek Muralidharan**, Mohatahem R. Makhdoomi, Kuldeep R. Barad, Lina M. Amaya-Mejia, Kathleen C. Howell, Carol Martinez Luna, and Miguel A. Olivares Mendez. "Rendezvous in cislunar halo orbits: Hardware-in-the-loop simulation with coupled orbit and attitude dynamics", Under Review, Aerospace Science and Tech., January 2023.
- ii. Mohatahem R. Makhdoomi, **Vivek Muralidharan**, Juan Sandoval, Miguel A. Olivares-Mendez, Carol Martinez Luna. "Evaluation of Position and Velocity Based Forward Dynamics Compliance Control (FDCC) for Robotic Interactions in Position Controlled Robots", arXiv:2210.13421, October 2022. [\[Link\]](#)
- iii. **Vivek Muralidharan** and Kathleen C. Howell. "Stretching directions in cislunar space: Applications for departures and transfer design", Astrodynamics, Springer, September 2022. [\[Link\]](#)
- iv. Mohatahem R. Makhdoomi, **Vivek Muralidharan**, Kuldeep R. Barad, Juan Sandoval, Miguel A. Olivares-Mendez, Carol Martinez Luna. "Emulating On-Orbit Interactions Using Forward Dynamics Based Cartesian Motion", Submitted to ICRA2023, arXiv:2209.15406, September 2022. [\[Link\]](#)
- v. **Vivek Muralidharan**, Mohatahem R. Makhdoomi, Kuldeep R. Barad, Lina M. Amaya-Mejia, Kathleen C. Howell, Carol Martinez Luna, and Miguel Angel Olivares Mendez. "Hardware-in-the-loop Proximity Operations in Cislunar Space", International Astronautical Congress, September 2022. [\[Link\]](#)
- vi. **Vivek Muralidharan**, Carol Martinez Luna, Augustinas Zinys, Marius Klimavicius and Miguel Angel Olivares Mendez. "Autonomous control for satellite rendezvous in near-Earth orbits", IEEE International Conference on Control, Automation and Diagnosis, July 2022. [\[Link\]](#)
- vii. **Vivek Muralidharan** and Kathleen C. Howell. "Leveraging stretching directions for stationkeeping in Earth-Moon halo orbits", Advances in Space Research, Volume 69, Issue 1, January 2022. [\[Link\]](#)
- viii. **Vivek Muralidharan** and Kathleen C. Howell. "Departure and Trajectory Design Applications using Stretching Directions", AAS/AIAA Astrodynamics Specialist Conference, August 2021. [\[Link\]](#)
- ix. **Vivek Muralidharan**. "Stretching Directions in Cislunar Space: Stationkeeping and an Application to Transfer Trajectory Design", Ph.D. Dissertation, Purdue University, August 2021. [\[Link\]](#)
- x. **Vivek Muralidharan** and Kathleen C. Howell. "Orbit Maintenance Strategy for Earth-Moon Halo Orbits", AAS/AIAA Space Flight Mechanics Meeting, February 2021. [\[Link\]](#)
- xi. **Vivek Muralidharan** and Kathleen C. Howell. "Stationkeeping in Earth-Moon Near Rectilinear Halo Orbits", AAS/AIAA Astrodynamics Specialist Conference, August 2020. [\[Link\]](#)
- xii. **Vivek Muralidharan**, Avishai Weiss, and Uros V. Kalabic. "Tracking neighboring quasi-satellite orbits around Phobos", World Congress of the International Federation of Automatic Control (IFAC), July 2020. [\[Link\]](#)
- xiii. **Vivek Muralidharan**, Avishai Weiss, and Uros V. Kalabic. "Control Strategy for Long-Term Station-Keeping on Near-Rectilinear Halo Orbits", AIAA Scitech 2020 Forum, January 2020. [\[Link\]](#)
- xiv. **Vivek Muralidharan**. "Orbit Maintenance Strategies for Sun-Earth/Moon Libration Point Missions: Parameter Selection for Target Point and Cauchy-Green Tensor Approaches", M.S. Thesis, Purdue University, December 2017. [\[Link\]](#)
- xv. **Vivek Muralidharan**, Abhijith Balakrishnan, Vinit K Vardhan, Nikita Meena, Suresh Kumar Y, "Design of Mechanically Actuated Aerodynamic Braking System on a Formula Student race car", Journal of the Institution of Engineers (India): Series C, Springer Inc., 99 (2), 247-253. [\[Link\]](#)
- xvi. **Vivek Muralidharan**, Abhijith Balakrishnan, Suresh Kumar Y, "Design Optimization of Front and Rear Aerodynamic wings of a high performance race car with modified airfoil structure", International Conference on Nascent Technology in Engineering Fields (ICNTE), Mumbai, India, 9-10 January, 2015, IEEE Xplore digital library. [\[Link\]](#)
- xvii. Prajwal Kumar M. P., **Vivek Muralidharan**, G. Madhusudhana, "Design and Analysis of a Tubular Space Frame Chassis of a High Performance Race Car", International Journal of Research in Engineering and Technology, Volume: 03 Issue: 02, Page No. 497-501. [\[Link\]](#)