Gaurav Kumar

JUNIOR UNDERGRADUATE · INDIAN INSTITUTE OF TECHNOLOGY KANPUR

(+91) 8927935045 | ✉ grvk@iitk.ac.in | ⌂ home.iitk.ac.in/ grvk | grvk02 | in grvk

Education

Exp. 2023	**Bachelor of Technology**, , Department of Aerospace Engineering, IIT Kanpur, India	*GPA: 8.8/10*
May 2019	**Grade XII (CBSE)**, , Kendriya Vidyalaya, Asansol	*Percentage: 95.4%*
May 2017	**Grade X (CBSE)**, , Kendriya Vidyalaya, Asansol	*CGPA: 10/10*

Research Interests

Astrodynamics, Control and Autonomous Navigation using Reinforcement Learning

Publication

Optimal Control Design using Krotov conditions for Spacecraft Docking *[Report]*

PROF. DIPAK KUMAR GIRI *Dec. 2019 - May. 2021*

- Designed control algorithm using Krotov conditions overcoming non-differentiability constraint of cost function issue in Hamilton-Jacobi-Bellman (HJB) equation solution.
- Improved robustness of existing algorithm by developing global optimum solutions for mission scenarios under various parametric constraints in terminal docking phase.
- Simulated and tested derived algorithms on MATLAB to confirm results.
- Designed control algorithm using Krotov conditions overcoming non-differentiability constraint of cost function issue in Hamilton-Jacobi-Bellman (HJB) equation solution.
- Designed control algorithm using Krotov conditions overcoming non-differentiability constraint of cost function issue in Hamilton-Jacobi-Bellman (HJB) equation solution.

Experience

SURGE'21 *IIT Kanpur, India*

RESEARCH INTERN *Jun. 2021 - Aug. 2021*

- Developed dynamics for on-track docking of Coulomb satellites using Gravity-gradient torque stabilisation.
- Implemented and evaluated LQR control for guidance using Voltage Control, significantly improving charge control.
- Derived non-linear control law using Lyapunov Direct method
- Simulated and tested developed docking system with derived control law in **basilisk framework**

Research Projects

Optimal Control Design using Krotov conditions for Spacecraft Docking *[Report]*

PROF. DIPAK KUMAR GIRI *Dec. 2019 - May. 2021*

- Designed control algorithm using Krotov conditions overcoming non-differentiability constraint of cost function issue in Hamilton-Jacobi-Bellman (HJB) equation solution.
- Improved robustness of existing algorithm by developing global optimum solutions for mission scenarios under various parametric constraints in terminal docking phase.
- Simulated and tested derived algorithms on MATLAB to confirm results.

Technical Projects

PetCAT *[Github]*

ROBOTICS CLUB, IIT KANPUR *Apr. 2020 - Jul. 2020*

- Developed biologically inspired robot that mimics structure and behaviour of Cats under obstacle-avoidance team.
- Implemented and tested a new method of Advanced Fuzzy Potential Field Method (AFPMF) which solved the problem of local minimum field disturbances at low computation.

Autonomous Navigation in Rough Mars Terrain Environment *[Github]*

Robotics Club, IIT Kanpur *May. 2020 - Jul. 2020*

- Developed and tested GPS and ArUco-marker based navigation on Mars environment in Gazebo using OpenCv and ROS.
- Developed a new and efficient algorithm of combining Depth maps and A* algorithm for obstacle avoidance.

Skills

Programming Languages	C/C++, Python, Bash
Robotics	ROS, basilisk, OpenCV, Gazebo, Rviz
Utilities	MATLAB, LabView, Linux, Git, Autocad, Arduino IDE, LaTeX
Frameworks	PyTorch, OpenCV, NumPy,MatPlotLib

Coursework

Aerospace Engineering	Rigid Body Dynamics (ESO209) | Flight Mechanics (AE321)^i
	Incompressible Aerodynamics (AE211)* | Compressible Aerodynamics^i
	Aerospace Structures (AE311)^i | Thermodynamics (ESO 201)
Control Systems	Classical Control System (EE250)^i | Basics of Modern Control Systems (EE650)^g
	Optimal Control and Reinforcement Learning (AE691A)^g
Mathematics & Statistics	Partial Differential Equations (MSO203)* | Linear Algebra & ODE (MTH102)
	Real Analysis & Multivariate Calculus (MTH101)* | Complex Analysis (MSO202)
Miscellaneous	Introduction to Economics (ECO101)| Sociology (SOC171)
	Life Sciences (LIF101)

: Awarded A grade for outstanding performance
^{i}: Ongoing Course
^{g}: Graduate level Course

Positions of Responsibility

Coordinator — Anime Club, IITK *Apr. 2021 - Current*

- Motivated campus students in appreciating Anime and Manga as an art style.
- Promoted cross cultural understanding in campus.
- Organized Anime quiz, Discussions and OST challenges in online mode.

Secretary — Research Wing, IITK *July 2020 - July 2021*

- Increased awareness about the variety of research going on in the campus through Departmental Orientation
- Promoted research among the campus community in the form of Research News letter and sessions.
- Organized Students' Research Convention (SRC'21) with participation from 50+ researchers across the nation.

Honors & Awards

2019	**National top 1%** , JEE Advanced 2019 among the 2.3 lakhs shortlisted candidates	*India*
2017	**1th Place**, National Science Congress'17 under KVS	*Delhi, India*
2017	**Scholarship**, MHRD, Government of India for exceptional school academics	*India*
2015	**National Rank 84**, National Science Talent Search Examination conducted by Unified Council	*India*