IRENE GRACE KAROT POLSON

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EDUCATION

Indian Institute of Technology, Kanpur *July 2018 - May 2022*
Bachelor of Technology in Aerospace Engineering CPI: 8.8/10.0
Member of Society of Aerospace Engineers | Aquatics Team

RESEARCH EXPERIENCE

Derivative-free Adaptive Satellite Attitude Control April 2021 – Present
Advisor: Dr. Dipak Kumar Giri, ACC Paper *Indian Institute of Technology, Kanpur*

- Developed adaptive controllers with derivative free weight update laws to make an attitude controller for satellite systems using MRP representations.
- Working on applications of machine learning and evolutionary optimisation techniques on adaptive laws and control as a part of my undergraduate research project.

Autonomous Multi-Drone Systems to Large Structure Inspections March 2021 – Present
Advisor: Dr. Debasish Ghose, ACC Paper *Indian Institute of Science, Bangalore*

- One amongst 60 students selected from across the country as a candidate for the Indian National Academy of Engineering Mentorship Program 2021-22
- Developing a 3D coverage path planning algorithm using Lissajous curves where the drone's controller carries out trajectory tracking using desktop prototyping of ROS/Gazebo system into MATLAB.

Control System Design using Bond graph Representation March - June 2021
Advisor: Dr. N. Selvaganesan, ICC7 Paper *Indian Institute of Space Science and Technology*

- Developed a power-based graphical representation of system and its controller using bond graph approach. Reduced model is derived and is used to obtain feedback.
- The entire closed-loop MIMO system is represented using 20SIM software and the simulations were performed to meet satisfactory stable responses under tracking and disturbance conditions.

Wingtip Vortices Parameter Estimation to Analyze Instabilities Nov 2019 – Dec 2020
Advisor: Dr. Navrose, Report *Indian Institute of Technology, Kanpur*

- Analyzed the instability in wingtip vortices and the formation of vortices using Parameter estimation.
- Verified Batchelor and Lamb-Oseen Models at low Reynolds using curve fitting of simulation data for Re=1000 using MATLAB curve fitting tools and VisIT flow visualization.

TECHNICAL EXPERIENCE

Airbus Internship April - Sept 2021
Aircraft and Flight Analytics Group | Airbus India Pvt Ltd *Bangalore, India*

- Developed an algorithm to automatically identify and classify commercial aircrafts into training, delivery, test flights. It was developed in Java using flight parameters and black-box data.

Controls System Development Intern Sept 2020 - Feb 2021
Range Aerospace Pvt Ltd | Start Up Team *Bangalore, India*

- Employed system identification techniques using in-flight data to find best-fit model of helicopter.
- Automated the process of control gains tuning using Genetic algorithm and MAVLink connections.

- Optimization and parameter setting was carried out using MATLAB. Simulations were conducted using JMAVsim and prototype testing through serial connections to Pixhawk.

Zeus Numerix Summer Intern May – Sept 2020
Target Flight Recognition from Satellite Data *Pune, India*

- Implemented of Kalman Filter over Neural Networks to perform target tracking on passive Radar signal bearing angles. Using the bearing angles and timestamps, we predict the target trajectory.
- Classified satellite images into classes of military targets using PyTorch and Sci-Kit learn libraries using data-sets (25000+ images) of planes.

PUBLICATIONS

[1] **I. G. Karot**, M. Kumar and N. Selvaganesan, "Control System Design for MIMO System using Bond graph Representation - Quadcopter as a Case Study," Indian Control Conference 7, accepted, invited for presentation Dec 20-22, IIT Bombay. Paper
[2] **I. G. Karot**, S. Nath and D. Ghose, "Autonomous Drone Systems for Large Structure Inspections using Lissajous Curves," manuscript 686 submitted to 2022 American Control Conference. Paper
[3] **I. G. Karot** and D.K. Giri, "Spacecraft Attitude Control using Derivative-free Purely Adaptive Controller," manuscript 633 submitted to 2022 American Control Conference. Paper

SELECTED PROJECTS

Vehicle Shape Optimisation For Minimization Of Sonic Boom July - Dec 2020
AE311- Compressible Aerodynamics, Report *Indian Institute of Technology, Kanpur*

- Optimized super-sonic flight by minimizing pressure perturbations generated by the aircraft during supersonic flight using a simplified sonic-boom prediction method.
- Leveraged a linearized analysis with some corrections built-in so that non-linear effects can also be modeled in terms of F-function, as defined by Whitman with the help of numerical methods.

Numerical Implementation of 2D Panel Methods Jan - March 2020
AE211- Incompressible Aerodynamics, Report *Indian Institute of Technology, Kanpur*

- Formulated and implemented Source-panel and Vortex-panel methods for flow past an Airfoil using MATLAB. The shape of the airfoil is obtained by simulation using traditional airfoil equation and arranged such that that the panels summed up close to zero and created the required flow past airfoil.

Composite Material Aircraft May - July 2019
Aeromodelling Club, Report *Indian Institute of Technology, Kanpur*

- Modelled a Twin-boom pusher aircraft on XFLR5 to analyse stability and design and animated a CAD model of the wings using AutoCAD for laser balsa cutting for wingtip Margins.
- Fabricated a composite material twin-boom pusher aircraft using Vacuum Packing. The model had detachable wings and fuselage. It was successfully flown using a remote control.

RELEVANT COURSEWORK

Controls	Optimal Space Flight Control, Aircraft Control Systems, Automatic Control of Rockets And Spacecrafts, Flight Mechanics
Dynamics	Space Dynamics, Dynamics
Programming	Applied Numerical Methods, Introduction to Computing, Virtual Instrumentation And Sensors, Aircraft Systems Design
Mathematics	Complex Variables, Partial Differential Equations, Ordinary Differential Equations
Coursera	Machine Learning, Control of Nonlinear Spacecraft Attitude Motion, Kinematics: Describing The Motions of Spacecraft

TECHNICAL STRENGTHS

Tools for Controls	PX4 Autopilot, JMAVsim, ROS, MAVLink Protocols, Gazebo
Machine Learning	ANNs, CNNs, Linear & logistic Regression, Regularisation Techniques
Programing Languages	MATLAB/Simulink, C, C++, Python
Scientific Visualization	Tecplot, Paraview Immersive, ViSIT, XFLR5, Curvefitting Toolkit
Libraries	PyTorch, TensorFlow, Sci-Kit Learn, Pandas, Numpy, Matplotlib, PIL
Other Skills	Autocad, Fusion360, NI LabVIEW, Excel, Unity

SCHOLASTIC ACHIEVEMENTS

2018 Joint Entrance Exam Mains: Ranked 2851 in 1.3 million candidates
2018 Computer Science and Physics Top 0.1 % Scorer — CBSE
2017 KVPY Fellowship — All India Rank: 613 — IISc Bangalore
2016 NTSE Scholarship Stage 1 — Tamil Nadu — Government of India

CO-CURRICULAR ACHIEVEMENTS

2019 Bronze in 4x50m Freestyle Relay — 54th Inter-IIT Aquatics Meet
2018 Bronze in 4x50m Medley Relay — 53rd Inter-IIT Aquatics Meet
2018 Best incoming sportsperson — IIT Kanpur
2018 Pushpa Garg Scholarship — IIT Kanpur

POSITIONS OF RESPONSIBILITY

Society of Aerospace Engineers Batch Representative Y18

Acted as a liaison between the committee and fellow batch mates. Conducted multiple workshops for the Aerospace Department students and organised the department Freshers and Farewell.

Aquatics Institute Team Institute Secretary & Summer Camp Captain

Ensured the smooth conduction on Summer Camp Aquatics and organised a 5KM Long swimming event. Organized annual Interhall Sports Competition, Inferno. Also conducted Aaghaaz (Freshers' Interhall sports competition) and some workshops.