Karan Jain – Resume

CONTACT INFORMATION

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EDUCATION

University of California - Berkeley August 2018 - Present

MS/PhD program in **Mechanical Engineering**; advisor - Prof. Mark Mueller

- Graduate student researcher at the High Performance Robotics Laboratory (**HiPeRLab**)

Indian Institute of Technology Bombay, Mumbai, India July 2014 - May 2018

Bachelor of Technology with Honors in **Mechanical Engineering**; CGPA: **9.79/10.00**

- **Ranked 1**st in a class of 153 students
- Minor degree in **System and Controls Engineering** with a CGPA of **9.80/10.00**

PUBLICATIONS

Flying batteries: In-flight battery switching to increase multirotor flight time

Karan P. Jain, Mark W. Mueller

- Submitted to RA-L with ICRA 2020 option (currently under review)
- Designed and fabricated a passive mid-air docking mechanism to dock two quadcopters
- Designed a circuit to switch the power source of a quadcopter between two batteries
- Integrated the docking mechanism and battery switching circuit on a custom-built quadcopter and demonstrated a flight time increase by a factor of 4.7

Modeling of aerodynamic disturbances for proximity flight of multirotors

Karan P. Jain, Trey Fortmuller, Jaeseung Byun, Simo A. Mäkiharju, Mark W. Mueller

- Published in the proceedings of ICUAS 2019
- Characterized the velocity field in the downwash of a multirotor using a turbulent-jet model
- Developed a model to predict the aerodynamic force and torque on a multirotor flying in the downwash of another multirotor
- Conducted proximity flight experiments and verified the fidelity of the model

PRODUCT DEVELOPMENT EXPERIENCE

Design and Fabrication of an Electric Vehicle for Formula Student

Student Team Project, IIT Bombay Racing, IIT Bombay August 2015 - May 2017

Faculty Advisor: Prof. Ramesh K. Singh

- Involved in powertrain design, analysis, manufacturing and testing
- Developed a mathematical model in Simulink including dynamics of a racecar such as torque-RPM-efficiency characteristics of motors, traction data of tyres and aerodynamics to **optimize gear ratio**, and **minimize lap times** for dynamic events at Formula Student
- Developed 3D CAD models and carried out Finite Element Analysis in ANSYS of every component of the drivetrain, to check their structural integrity
- Designed a compact, high-efficiency gearbox with a **38% YOY weight reduction**

Design and Prototyping of an Exoskeleton suit for Flight

B.Tech. Project, IIT Bombay July 2017 - July 2018

Guide: Prof. Arindrajit Chowdhury, Mechanical Engg. Dept., IIT Bombay

Involved in the development of an all-electric, compact, quiet single-passenger flying device

- Analyzed motor and propeller data to select the ones with high efficiency and thrust
- Selected Lithium-Polymer batteries based on energy and power density considerations
- Characterized the RPM-power-thrust response of contra-rotating propellers with varying separation on an in-house designed testing rig
- Designed a space-frame chassis to house the components and a passenger upto 90 kg in weight

Professional Experience

R&D Internship at **ideaForge, Navi Mumbai, India** May 2018 - June 2018

Modelled a single-axis gimbal control mechanism for stabilizing a camera using a PID controller

- Built up on existing models of 'ideal' motors, and included non-idealities such as **motor-cogging** and bearing friction, which play a significant role in low speed applications
- Tuned the PID parameters to give a stable and 'tight' control over camera rotation to eliminate high frequency disturbances. Low frequncy disturbances were stabilized using 'electronic stabilization' via video processing

R&D Internship at **Sysmex Corporation, Kobe, Japan** May 2017 - July 2017

*Contributed to the development of **Compact Immunoassay Device** to detect levels of different hormones (TSH, PSA and FT4) in blood using very small blood samples ∼100 μL*

- Developed image processing algorithms for the following purposes:
  - to detect the concentration of a colored reagent (magnetic beads) in a chamber
  - to estimate the volume of a transparent liquid in a chamber
- Designed and teseted micro-channels for our device to homogeneously distribute a 100 μL blood sample into 3 equal volumes, by centrifugation of the cartridge.

Academic Achievements and Awards

- Secured an **All India Rank** of **35** in the Joint Entrance Exam - Advanced 2014 among 1.4 million candidates; ranked 1^{st} in Mumbai and 3^{rd} in Maharashtra state
- Grader and scrutinizer for the International Physics Olympiad (IPhO) - 2015
- Awarded **Institute Technical Citation** 2018 by IIT Bombay for exemplary contribution towards institute technical activities from 2014-18.
- Received the UC Berkeley Graduate Division Block Grant Award for summer 2019 research

Software Skills

Mathematical Analysis and Simulations	: MATLAB, Simulink
Programming Languages	: C++, Python
Robot Operating System (ROS)	
Computer Aided Design (CAD)	: SolidWorks, AutoCAD, Fusion 360
Computer Aided Engineering (CAE)	: ANSYS, MSC ADAMS
Computer Aided Manufacturing (CAM)	: G-code for CNC
General Purposes and Productivity	: MS-Excel, MS-Powerpoint, LaTeX

Language Skills

- Fluent in English and Hindi
- Taking elementary level Chinese course at UC Berkeley (Fall 2019)
- Underwent basic Japanese language training (30 hours)
- Learnt French for 6 years - 5^{th} to 10^{th} grade (2006-2012)

Teaching Experience

Undergraduate Teaching Assistant at IIT Bombay for 5 courses:

Calculus	Autumn 2015-16	Basics of Electromagnetism	Spring 2015-16
Differential Equations	Spring 2016-17	Biology	Autumn 2017-18
Numerical Analysis	Spring 2017-18		

- Organized weekly tutorial sessions for about 50 freshmen on different topics pertaining to the course for making their concepts crystal clear
- Assisted the instructors in comprehensive and timely evaluation of the students

Extra-Curricular Activities

- Completed Special Personality Development Course (SPDC) under Dr. Tushar Guha at Nrityanjali Institute in 2015
- Volunteered to teach underprivileged high school students near our campus through LCCWA (a non-profit organization associated with IIT Bombay) (May - June 2016)
- Hiking. Two of my favorites are Mt. Fuji (Japan) and Half Dome (Yosemite, California)
- Playing soccer, table tennis, ultimate frisbee, chess and video games