

Ashutosh Mukherjee

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[Projects Website](#)

Education

10/2021 – Ongoing	M.Sc. Computer-Aided Conception of Machines in Mechanical Engineering <i>RWTH Aachen</i>	CGPA : 1,8
8/2016 – 6/2020	B.Tech in Mechanical Engineering <i>Punjab Engineering College, Chandigarh</i>	CGPA : 8.3/10
4/2014 – 3/2016	High School (10+2) <i>Bhavan Vidyalaya, Chandigarh</i>	Percent : 94.4%

Work Experience

Master Thesis Student

October 2023 - March 2024

Rheinmetall Technology Centre - New Technologies, Rheinmetall AG, Neuss, Germany

Distributed Data-Fusion and Control over a network of Unmanned Aerial Vehicles

- Development of a simulation model of an integrated flight control system for a single UAV, including a flight controller, 6 degree-of-freedom UAV dynamic model, IMU, Magnetometer and GPS sensor models and an Extended Kalman Filter for attitude estimation.
- Implementation of inertial strapdown equations to propagate the attitude and other states of the UAV in time.
- Design of an attitude estimation filter based on the attitude error rotation vector dynamics, also known as *Multiplicative Extended Kalman Filter*
- Implementation of waypoint navigation algorithms for the UAV flight controller
- Design of a vector measurement model for a network of UAVs as a *multilateration problem*.

Werkstudent (Working Student)

June 2022 - September 2023

Rheinmetall Technology Centre - New Technologies, Rheinmetall AG, Neuss, Germany

- Involved in a project about a novel electrostatic synchronous actuator for flexible exoskeletons
- Developing a mathematical model for the force analysis of the actuator based on the concept of *Method of Moments*, a discretization technique for electric fields.
- Validation of the simulation models against real-time testing of the actuator prototype
- Maintenance of the developed mathematical model, for using it as an in-house solver, making use of software engineering principles like object orientation, version control and comprehensive code documentation

Project Assistant

October 2022 - April 2023

Institut für Getriebetechnik, Maschinendynamik und Robotik, RWTH Aachen

- Scripting Multi-Body simulation models of a standard mountain bike in Simpack using the *Semi-Analytical Approach* where the multibody model partly depends on real-time sensing of loads on the actual bike.
- Setting up co-simulation between Simpack and Simulink for a closed loop simulation for stabilizing the multibody model of the bike excited by the measured loads.

- Testing various control techniques like *Position Feedback* and *Force pre-control* in order to achieve disturbance rejection so that the actual loads on the real bike can be reproduced in the multi-body model.
- The work in this project culminated in a mini-thesis worth 9 ECTS, which can be accessed [here](#).

Research Associate

September 2020 - July 2021

Thapar Institute of Engineering and Technology, Patiala, India

- Dynamic modeling of a strength augmentation exoskeleton designed by *Defence Bio-Engineering and Electro-Medical Laboratory (DEBEL)*, a branch of *Defence Research and Development Organization (DRDO)*, India
- Modeling of Human and Lower Extremity Exoskeleton in the form of coupled multi-body systems in which the Human is the master and the exoskeleton is the slave.
- Development of a Computed Torque Control algorithm based on control partitioning for Strength Augmentation of the Pilot wearing the Lower Extremity Exoskeleton.
- Various sections of the work done for this project are being submitted in various journals and conferences related to Biomechanics and Multi-Body Dynamics, and all published work can be referred from *Conference Presentations and Publications* section.

Intern, Order Management and Assembly Department

January 2019 - June 2019

Siemens Ltd., Vadodara, India

- Developed a solver in C for allocation of jobs (processes) to different machines present in the shop floor in order to optimize the aggregate machining lead times
- Designed an induction heating apparatus for heating of rotor wheel discs of steam turbines
- Increased robustness of fixtures for machining of stator guide blade carriers of steam turbines
- Redesigned and fabricated a machining and blading stand for rotor wheel discs of steam turbines

Other Relevant Experience

Undergraduate Thesis Project

September 2019 - May 2020

1. Development of a Test Rig for measuring propeller thrust

- Built a test stand acting as an alternative to the wind tunnel for measuring the thrust produced by a propeller mounted on it.
- Implemented Arduino Uno controlled circuits for driving the propeller motor using a brushless DC motor and capturing and displaying the speed of the propeller using an IR sensor-based tachometer.

2. Design and Analysis of a propeller for slow-flying Quad-copters

- Generated and modified propeller designs iteratively based on required flying conditions and propeller thrust using QMIL, a first-order propeller design tool
- Used QPROP, a solver for calculating propeller performance to generate propeller efficiency and thrust curves for the designed propellers and reiterated the designing process until a design giving desirable propeller performance was achieved.
- Assisted in second-order design validation using computational fluid dynamics (CFD) once the propeller design showed better performance than a market standard propeller.
- Developed a solver acting as an alternative to QPROP in MATLAB for calculating the performance characteristics of a propeller based on Blade Element Momentum Theory.

Technical Skills

Programming	Computational Techniques
<div>1. Scripting Languages<ul style="list-style-type: none">• MATLAB & Simulink• Python</div> <div>2. Programming Languages<ul style="list-style-type: none">• C++• Java</div> <div>3. Markup Languages<ul style="list-style-type: none">• HTML• LaTeX</div> <div>4. General<ul style="list-style-type: none">• Object-Oriented Programming• Version Control using Git</div>	<div>1. Multi-Body Dynamics</div> <div>2. Finite Element Analysis (Static and Dynamic)</div> <div>3. Regression and Classification using Neural Networks</div> <div>4. Boundary Element Method in Electrostatics (Method of Moments)</div> <div>5. Strapdown Algorithms for Inertial Navigation</div> <div>6. State Estimation using Kalman and Extended-Kalman Filters</div> <div>7. Numerical Integration and Differentiation using implicit and explicit schemes and stability analysis of explicit techniques</div>

Conference Presentations and Publications

1. Chander, S., Mukherjee, A., & Singla, A. (2023, July). *Estimation of Ground Reaction Force for Coupled Dynamic Modelling and Control of the Lower-Limb Exoskeleton*, AIR 2023: Proceedings of the 2023 6th International Conference on Advances in Robotics, July 2023, Article No.: 37, Pages 1-8, [DOI](#)

2. Chander, S., Mukherjee, A., Shivling, V., & Singla, A. (2022, October 16-20). *Modelling and Validation of Human Gait Dynamics using Modified Euler-Lagrange Approach* [Paper Presentation], 6th Joint International Conference on Multibody System Dynamics and 10th Asian Conference on Multibody Dynamics, New Dehli, India, [URL](#)