Ashutosh Mukherjee

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Projects Website

Education

10/2021 – *Ongoing*	M.Sc. Computer-Aided Conception of Machines in Mechanical Engineering *RWTH Aachen*	CGPA : 1, 8
8/2016 – 6/2020	B.Tech in Mechanical Engineering *Punjab Engineering College, Chandigarh*	CGPA : 8.3/10
4/2014 – 3/2016	High School (10+2) *Bhavan Vidyalaya, Chandigarh*	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
Thesis Advisor - *Priv. Doz. Dr. -Ing. habil. Berno J.E. Misgeld*

- 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 algorithms to propogate the attitude in time and compliment the attitude filter.
- Design of an attitude estimation filter based on the attitude error rotation vector dynamics.
- Design of a vector measurement model for a network of UAVs using Ultra-wideband (UWB) sensors.

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
- Maintainance 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.

Technical Skills

Programming	**Computational Techniques**
1. **Scripting Languages** • MATLAB & Simulink • Python 2. **Programming Languages** • C++ • Java 3. **Markup Languages** • HTML • LaTeX 4. **General** • Object-Oriented Programming • Version Control using Git	1. Multi-Body Dynamics 2. Finite Element Analysis (Static and Dynamic) 3. Regression and Classification using Neural Networks 4. Boundary Element Method in Electrostatics (Method of Moments) 5. Strapdown Algorithms for Inertial Navigation 6. State Estimation using Kalman and Extended-Kalman Filters 7. Numerical Integration and Differentiation using implicit and explicit schemes and stability analysis of explicit techniques

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 6^{th} 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], 6^{th} Joint International Conference on Multibody System Dynamics and 10^{th} Asian Conference on Multibody Dynamics, New Dehli, India, URL