# HARSHIT KHURANA

harshit.khurana@epfl.ch, +41 766759896
Chemin du Bochet 29, 1025, St. Sulpice
https://harshitk95.github.io/

## EDUCATION

***EPFL*** (August, 2020 - Present) - Machine Learning and Robotics
PhD in Electrical Engineering (Expected 2024)
**Learning Algorithms and Systems Laboratory** - *Prof. Aude Billard*

***ETH Zurich*** (Sept, 2016 - Sept, 2019)
M.Sc. Robotics, Systems and Control (**Excellence Scholarship and Opportunity Program**)

## PUBLICATIONS

### Journals

- **H. Khurana** and A. Billard. Learning hitting with different joints of a robotic manipulator. In *preparation for IEEE RA-L*, 2024
- **H. Khurana** and A. Billard. Learning inverse hitting problem. In *preparation for IEEE RA-L*, 2024
- **H. Khurana** and A. Billard. Motion planning and inertia based control for impact aware manipulation. *IEEE Transactions on Robotics*, 2023 - *paper*
- A. S. Vempati, **H. Khurana**, V. Kabelka, S. Flueckiger, R. Siegwart, and P. Beardsley. A virtual reality interface for an autonomous spray painting uav. *IEEE Robotics and Automation Letters*, 4(3):2870–2877, July 2019 - *paper*

### Conferences

- S. Birjandi, **H. Khurana**, A. Billard, and S. Haddadin. Stable adaptive extended kalman filter for estimating robot link velocity and acceleration. *IEEE/RSJ IROS*, 2023
- **H. Khurana**, M. Bombile, and A. Billard. Learning to hit: A statistical dynamical system based approach. *IEEE/RSJ IROS*, 2021 - *paper*

### Workshops

- **H. Khurana** and A. Billard. Hitting with different joints of a robotic manipulator. In *ICRA 2024 Workshop on Agile Robotics: From Perception to Dynamic Action*, 2024

## TALKS

- **Keynote speaker** - Control and learning for industrial applications (adaptive polishing and robotic package handling) 'The lab of the future, today' – Laboratory Automation Workshop 2022 - EPFL

## RESEARCH EXPERIENCE

**Impact Aware Manipulation** Aug, 2020 - Present
*Learning Algorithms and Systems Laboratory, EPFL* *Lausanne*

- Working on manipulation algorithms for robotic arms using dynamical systems for applications involving high speed robot environment contact. - *I.AM EU PROJECT*
- Research on physics inspired learning methods, physically based simulation, multi-task and collaborative learning of dynamical systems to leverage intentional impacts - Robot object high speed contact with predictable outcome.

**3D painting simulator** June, 2018 - Dec, 2018
*Internship, Disney Research Zurich* *Zurich*

· Developed a real time 3D world painting simulator from the gound up using open source software
· Worked on a virtual reality setup to enable a user to paint rockworks in real time in Virtual reality - *published in IEEE RAL 2019*

**Model Predictive Control for Morphing Quadrotor** Feb 2019 - August 2019
*Masters' Thesis (Prof. Davide Scaramuzza)* *Robotics and Perception Group, University of Zurich*

· Developed a nonlinear model predictive control scheme to optimize shape and trajectory tracking of a morphing quadrotor

**Human Interaction with a path following Quadrotor** March 2017 - August 2017
*Semester Project (Prof. Raffaelo D'Andrea)* *Institute of Dynamic Systems and Controls, ETH Zurich*

· Developed a **path following control** system with admittance controllers to make quadrotors force compliant, thus enabling human interaction through different force estimation techniques - **implemented and demo-able** in the *Flying Machine Arena (FMA), ETH Zurich.*

## STUDENT SUPERVISION

- Geometrical Dynamical System based obstacle avoidance, Baudouin Bosc (EPFL)
- Impact Aware Kalman Filtering for object trajectory prediction, Julien Mollard (EPFL)
- Validation of numerical simulations for planning robot motions with impacts, Daan Stokbroekx (TU/e)
- Impact Aware object placement through principles of golf, Andre Schakkal (EPFL)
- Kalman filter v/s Particle filter for impacts, Amine Tourki, Emna Tourki (EPFL)
- Development of AirHockey setup to understand object behaviour upon impact, Daan Stokbroekx (TU/e)

## TEACHING EXPERIENCE

**Teaching Assistant**
*EPFL* *Lausanne*

· Applied Machine Learning (Fall 2021), Machine Learning Programming (Fall 2022, Fall 2023), Learning and adaptive control for robots (Spring 2022, Spring 2023)

**Teaching Assistant**
*ETH Zurich* *Zurich*

· Linear System Theory (Fall 2017), Game Theory And Control, Autonomous Mobility on Demand (Spring 2018), Dynamics I (Fall 2016)

**Teaching Assistant**
*IIT Delhi* *Delhi*

· Kinematics and Dynamics of machines, Mechanical Engineering Drawing

## ROBOTICS COMMUNITY SERVICE

- Reviewer for ICRA, IROS, RA-L, T-RO, IJRR

## TECHNICAL STRENGTHS

| | |
|---|---|
| **Analysis packages and languages** | MATLAB, C++, ROS, python, OpenGL |
| **Design-Analysis, Simulation Packages** | Gazebo, pybullet, Algoryx Dynamics, SolidWorks, Blender |
| **Robotic Platforms** | Quadrotors, KUKA iiwa lbr, FE Research 3 |

## AWARDS

- **2016: ETH Excellence Scholar (ESOP)**: Awarded to **53** incoming masters students at ETH Zurich
- **2016: IIT DELHI Institute Silver Medal** (Mechanical Engineering), for class standing: **1/102**
- **2016: Rhodes Scholarship Indian Finalist**
- **2014, 2015: O.P. Jindal Engineering and Management Scholar**
- **2014: University of British Columbia Go Global International Learning Programs Awardee**
- **2013: Singapore Technologies Engineering Indian Scholar**
- **2012: CBSE District Rank 1**: Awarded INSPIRE fellowship from Central Board of Secondary Education.
- **2010: KVPY** (Kishore Vaigyanik Protsahan Yojana) / **Young Scientist** fellow

## DESIGN THINKING

- ETH Week 2019 participation - "**Rethinking Mobility**"

## NON-ACADEMIC INTERESTS

- *Music*: Indian Classical Music - Bansuri (Indian Classical Flute)
- *Dancing*: Argentine Tango, Swing, Latin, Tap.
- *Sports*: Ultimate frisbee (Club: Flyhigh Lausanne), Table tennis, Badminton