

# Dhruv Kool Rajamani

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/DhruvKoolRajamani



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**2015 - 2019 BTech., Graduation** Mechatronics Engineering, Manipal Institute of Technology, KA 8.83/<sup>10</sup>  
**2012 - 2014 AISSCE, CBSE Delhi** Vasant Valley School, Delhi 95.00%

## INTERESTS

Legged Locomotion, Mobile Robots, Rehabilitative and Assistive Devices, Nonlinear Control, Robot Dynamics

## ACHIEVEMENTS

- Best Rover team from Asia, 8th out of 82 teams at the University Rover Challenge, Utah, 2017 (URC). ([link](#))
- Offered INSPIRE scholarship by DST, Government of India for top 1% score in AISSCE 2014 – Declined
- Best paper presentation at the iACT-2017 conference, ISA Bangalore.

## INTERNSHIPS

- **BioRob ([link](#))** Prof. Auke Jan Ijspeert, Dr.Hamed Razavi, Jonathan Arreguit  
École polytechnique fédérale de Lausanne (EPFL) January 2018 - Present
  - **Implementation of novel walking controller COMAN Robot(Compliant HuMANoid Platform) <sup>1</sup>:**  
**Objective:** Design a simulator to validate experiments conducted on the COMAN for a continuum of gaits using a single control structure.
    - \* Developed simulators for OROCOS-RTT and ROS along with the appropriate analysis tools. ([Simulation Packages](#))
    - \* Tested continuum of gaits (stepping, active balance, and walking) with a single controller. ([Video](#))**Outcome:** Worked with various robotics frameworks (ROS, OROCOS, YARP), performed gait analysis, conducted extensive reviews on postural control and benefits of the emerging gait controller used, to traditional ZMP methods.
  - **Development of a Neuromechanical framework to study animal locomotion <sup>2</sup>:**  
**Objective:** Develop a simulator along with appropriate analysis tools to conduct extensive gait analysis of modular tetrapoda models, such as lesion studies, evolutionary studies, etc.
    - \* Developed a simulator on ROS and Gazebo with custom real time analysis tools (PyQt, NetworkX, etc) with custom GUI.
    - \* Implemented a neuromechanical controller using Central Pattern Generators (CPGs) on a centipede and a salamander.
    - \* Conducting lesion studies on a centipede and analysed gait characteristics.**Outcome:** Gained proficiency in Subversion Control and Project Management, implemented a novel closed loop controller for modular tetrapods (single controller for varying body parts).
- **Autonomous Robotics Lab ([link](#))** Dr.Sudipto Mukherjee  
Indian Institute of Technology, Delhi 2017 – 2018
  - **Development of an Underactuated Flexible Manipulator using Differential Flatness:**  
**Objective:** Design a flexible manipulator on MATLAB with just 2 non-colinear forces acting as input.
    - \* Successfully flattened a 4-link planar manipulator and implemented a differentially flat controller.
    - \* Implemented trajectory tracking. ([video](#))**Outcome:** Conducted extensive research on Differential Flatness, comparative analysis of holonomic and non-holonomic constraints, performed a detailed review on differentially flat orthotic and prosthetic devices.

## EXPERIENCE

- **BioRobotics Group ([link](#))** Manipal Institute of Technology, KA  
Co-Founder 2018 - Present  
The Biorobotics Group is a community of mixed researchers from EPFL and Manipal, collaborating on projects on bioinspired robotics.
  - **Neuromechanical model of a Humanoid:**  
Leading a team of 8 researchers on developing a neuromechanical controller for the COMAN using Central Pattern Generators.
  - **ROS Package for the Pleurobot:**  
Leading a team of 6 researchers on developing a ROS Package for the Pluerobot (BioRob, EPFL) with CPGs.
  - **Tutorials for ROS and Robotics:**  
Created tutorials to learn ROS, Gazebo, and Robot Dynamics and Control using a linear inverted pendulum model.

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<sup>1</sup>This work is supported by the Horizon 2020 Work Programme. (<https://cogimon.eu/>)

<sup>2</sup>This work is supported by the Human Frontier Science Program (HFSP) for the Robotics-Inspired Biology project. ([Gain access to this repo](#))

- **Teaching Assistant** Manipal Institute of Technology, KA  
*MTE-3003, MTE-2211* 2018 - Present
  - **Robot Dynamics and Control (MTE-3003):**  
Teaching Junior and Senior Undergraduates Robot Dynamics through ROS and evaluating final research project.
  - **CAD & Kinematics Lab (MTE-2211):**  
Teaching and evaluating 3D kinematic models on CATIA V6.
- **Mars Rover Manipal ([link](#))** Manipal Institute of Technology, KA  
*Robotic Arm Lead, Research Lead, Mechanical Member* 2015 - 2017
  - **Development of a Mars Rover Prototype:**  
Developed a Mars Rover prototype that can traverse harsh Martian like terrain and steep gradients of approximately 1m height.
    - \* Participated at the University Rover Challenge, UT - 2017 and stood 8th. ([URC-2017](#))
    - \* Presented the Rover at various conferences. ([Critical Design Review](#)) [2]
  - **Robotic Arm Lead:**  
Supervised a team of 6 interdisciplinary researchers to develop an detachable 6DOF Manipulator module for the Rover.
    - \* The arm has a 6kg payload and a 1.5m reach.
    - \* Self adapting gripper to perform screwing, grasping, retrieving, etc tasks, published. [1, 3-4]

## PROJECTS

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- Obstacle detection and Path planning for an autonomous robot using computer vision and fuzzy logic. <sup>3</sup>
- Traffic Detection using a Kalman Filter and Feature detection. <sup>4</sup>
- LQR based control of a 3-link Linear Inverted Pendulum on a cart (LIP). <sup>5</sup>

## TECHNICAL SKILLS

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<b>Programming</b>	C++, Python, C#, MATLAB, Simulink, Embedded C, $\text{\LaTeX}$ , Arduino, HTML, CSS, JS
<b>Robotics Software</b>	ROS, OROCOS, GazeboSim, RViz
<b>CAD &amp; CAM</b>	ANSYS Mechanical Workbench, ADAMS, Solidworks, CATIA V6, AutoCAD, Blender

## PUBLICATIONS & PRESENTATIONS

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1. **Rajamani, D. K.** , et al. **Design and development of a linear jawed gripper for unstructured environments.** Manipal Journal of Science and Technology 3, no. 1 (June 2018). [\[link\]](#)
2. **Rajamani, D. K.**, et al. **Design Overview of a Planetary Exploration Rover for Unstructured Terrain.** 3rd International and 18th National Conference on Machines & Mechanisms.
3. **Rajamani, D. K.**, et. all. **Design and Development of a Linear Jawed Gripper for Unstructured Environments.** International Conference on Applied Sciences, Engineering & Technology.(ISBN: 978-93-5279-058-6)
4. **Rajamani, D. K.**, et. all. **A comparative Analysis of Industrial Grade Parallel Gripper and Linear Grippers.** ISAB Industrial Automation and Control TechEvent Day, ISA Bangalore. ([Best Paper Award](#))

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<sup>3</sup>C++, Python, MATLAB

<sup>4</sup>MATLAB

<sup>5</sup>ROS (C++, Python), MATLAB