# AYUSH SINHA

Senior Undergraduate
Mechanical Engineering
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## EDUCATION

| Qualification | Institute | Year | Performance |
|---|---|---|---|
| **BTech Mechanical Engineering** | Indian Institute of Technology, Kanpur | 2013-2017 | 9.3/10 |
| **Intermediate (12th CBSE)** | Delhi Public School, Indira Nagar, Lucknow | 2013 | 92.4% |
| **High School (10th CBSE)** | Delhi Public School, Indira Nagar, Lucknow | 2011 | CGPA 10 |

## RESEARCH INTERESTS

Robotics, Mechanical Design, Bioinspiration

## PUBLICATION

A. Spröwitz, K. Petersen, C. Göttler, **A. Sinha**, C. Caer, M. U. Öztekin, and M. Sitti, "Scalable Pneumatic and Tendon Driven Robotic Joint Inspired by Jumping Spiders", manuscript submitted for publication

## INTERNSHIPS

- **MAX PLANCK INSTITUTE FOR INTELLIGENT SYSTEMS, STUTTGART**
  **GUEST SCIENTIST** (May 2016 – July 2016)
  **Project Title:** *"Scalable Pneumatic and Tendon Driven Robotic Joint Inspired by Jumping Spiders"*
  **Project Supervisors:** Dr. Metin Sitti, Dr. Alexander Spröwitz, Dr. Kirstin Petersen
  - Developed a novel leg-joint mechanism employing both pneumatics and electrically-actuated tendons with its implementation closely inspired by joints seen in real spiders
  - Designed and fabricated mechanical analogues of spider-leg joints using inferences drawn from scanning-electron microscope images of real spiders developed by another collaborator
  - Built cam-based cable-driven quick release mechanism to mimic the flexor muscles in spiders
  - Designed and molded soft rubbery joints for their comparison against proposed spider-inspired joints
  - Built two experimental setups for characterization of the system under static and dynamic conditions

- **TATA MOTORS LIMITED LUCKNOW**
  **SUMMER INTERN** (May 2015 – June 2015)
  **Project Title: "***Problem resolution and Root Cause Analysis for specified part belonging to vehicle's chassis"*
  **Project Supervisor:** Mr. Naveen Agnihotri
  - Operated in Supplier Quality department to resolve a recurring fitment issue for a particular cross-member
  - Identified possible causes of defect in its complete manufacturing process which led to the fitment issue
  - Altered the riveting fixture and replaced the worn out punch of bending press to eliminate the defect

## PROJECTS

- **ROBOCON 2015 – ROBOMINTON**
  **NATIONAL ROBOTICS CONTEST** (Centre for Mechatronics, IITK) (September 2014 – March 2015)
  - Designed and built two badminton playing robots for doubles match on an actual size court
  - Synthesized mechanisms for racket actuation to implement various badminton strokes
  - Devised a pneumatically powered double actuation mechanism which replicates the combined motion of the elbow and wrist joints while playing a badminton stroke
  - Selected suitable pneumatic pistons and motors for driving the mechanisms with required speed and force
  - Implemented holonomic drive using omni wheels to provide three degrees of freedom to the chassis
  - Finished Eleventh in eighty-five teams representing different universities from all over India

- **MECHANICALLY ACTUATED GARBAGE COMPACTOR**
  **DEPARTMENTAL PROJECT** (Dr. Bishakh Bhattacharya, Mechanical Engineering, IITK) (August 2016 – Ongoing)
  - Aim at developing inexpensive and robust garbage compressing solution for Indian circumstances
  - Constructed mechanism for amplifying user input force without using electronics or hydraulics
  - Current design generates 1635N output for an input of 300N and achieves compression factor of five

- **DEVELOPMENT OF PENNATE MUSCLE INSPIRED ACTUATOR USING SHAPE MEMORY ALLOY WIRES**

**COURSE TERM PAPER** (Smart Materials and Structures) (January 2016 – April 2016)

- Conceptualised Shape Memory Alloy (SMA) based actuator inspired by the functioning of pennate muscles
- Established kinematic and force formulations for the SMA based actuator
- Determined relations between actuator characteristics like resultant force, displacement and actuation time

- **HAND HELD DRY CLEANER (CLEANEASY)**

**DESIGN PROJECT** (New Product Design and Prototyping) (January 2016 – April 2016)

- Identified substantial untapped market needs with subsequent ideation of profitable solutions
- Developed design and prototype of a novel device capable of performing all stages in dry cleaning process
- Performed and analysed market survey to identify potential customer segments and tuned product accordingly
- Pitched idea along with business plan to ME department and won monetary grant for first stage prototyping

- **THERMODYNAMIC ANALYSIS OF SOLAR POWERED CLOSED CIRCUIT VAPOUR TURBINE**

**SUMMER PROJECT** (Dr. Santanu De, Mechanical Engineering, IITK) (June 2015 – July 2015)

- Analysis of solar powered vapour turbine for production of electric power for domestic or small-scale use
- Development of Aspen HYSYS models and their efficiency comparison through simulations

- **MODEL OF AN SEMI AUTOMATIC CAR PARKING SYSTEM**

**COURSE PROJECT** (Manufacturing Processes Laboratory) (January 2015 – April 2015)

- Prepared CAD design and fabricated a small-scale hand-driven model of an automatic car parking system
- Gained hands-on experience with basic machine-shop operations and conventional machining methods

## AWARDS AND ACHIEVEMENTS

- Selected for **Japan-Asia Youth Exchange Program in Science (Sakura)** to visit Kyutech, Japan in December 2016
- Awarded **DAAD WISE 2016 Scholarship** for pursuing summer internship in **Germany at MPI for Intelligent Systems**
- Received **Academic Excellence Award** at Indian Institute of Technology (IIT) Kanpur in 2015
- Ranked among **Top 0.2% of 1.3 million** applicants in Joint Entrance Examination for engineering in India in 2013
- Ranked among the **Top 0.1%** of successful candidates in Physics in All India Senior Secondary Board Examinations
- Secured **City Rank 1** and **State Rank 8** in Science Olympiad Foundation's 14th National Science Olympiad
- Awarded Certificate of Merit for obtaining **highest grade (A1) in all subjects** in AISSE 2011 by CBSE

## KEY COURSES AND SKILLS

- **CORE** : Robot Motion Planning*, Probabilistic Mobile Robotics*, Robot Manipulators, Theory of Mechanisms and Machines, Design of Machine Elements, Finite Element Methods, Smart Materials and Structures, Mechanics of Solids, Vibration and Control
- **BREADTH** : Basics of Modern Control Systems, Fundamentals of Computing, Introduction to Electronics, Complex Variables, Ordinary Differential Equations, Partial Differential Equations, Matrix and Determinants
- **SKILLS** : SolidWorks, Autodesk Inventor, AutoCAD, MATLAB, C, Latex, Web Development, Android Development

Starred (*) courses would be completed by May 2017

## POSITION OF RESPONSIBILITY

**SENIOR MEMBER** – TEAM ROBOCON IITK 2015

- Represented IIT Kanpur in National Robocon 2015 organized by Asia-Pacific Broadcasting Union
- Led a team of fifteen freshers to create two robots for playing doubles badminton matches against other teams
- Arranged exhibitions at IIT's technical festival Techkriti 2015 and annual Science and Technology Day of IIT Kanpur
- Felicitated by Science and Technology Council, IITK for contributions towards science and technical activities of institute

## EXTRA CURRICULAR ACTIVITIES

- Shortlisted among top 25 of 3000 teams for the on-going prototyping round of 'Lab2Moon' contest which challenges teams to construct a useful experiment which will be sent to the Moon by a participant of Google's Lunar XPrize contest
- Participated in Entrepreneur Summit IITK's 'Pitch Your Product' and presented our product 'CleanEasy' in finale round
- Stood 1st in Wild Soccer in Takneek 2015 – the intra-institute technical festival of IIT Kanpur. The contest required the teams to build two robots aimed at playing soccer and destroying the opponent's robots
- Won the Stop-Motion Film making contest in Spectrum 2014 – the intra-institute film festival of IIT Kanpur