ADARSH SOMAYAJI

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RESEARCH INTERESTS

Engineering Physiology | Rehabilitation & Assistive Technology | Medical Device Development | Robotics | Manipulation & Grasping | Mechanism Design

EDUCATION

Indian Institute of Technology, Madras (IIT-M) — *Chennai, India*
Bachelor of Technology & Master of Technology – Engineering Design — 2015 – 2020*
Specialization – Biomedical Engineering
CGPA – **8.92**/10 (3rd/27 within specialization)

SKILLS

CAD & FEA	SolidWorks, Autodesk Fusion 360, Autodesk Inventor, Abaqus
Programming	C, Python, VBA
Scientific	MATLAB, Mathematica, SimScape
Hardware	Arduino, Raspberry Pi, 3D Printing, Manufacturing

PROFESSIONAL EXPERIENCE

Medical Device Innovation via Biodesign Process — Dec '18 – May '19

Product Development Intern, Shira MedTech Pvt. Ltd.

- Identified unmet medical needs via a process of clinical immersion, detailed market analysis & interviews with medical professionals
- Developed concepts for assisting care providers in providing lifesaving critical care for patients with Acute Respiratory Distress Syndrome
- Prototyped a device for provision of prone ventilation therapy in any setting with minimal training

Utility Docking Station for a Rural Health Centre — May '18 – Jul '18

Research Intern, Aalto University, Finland | Guide – Prof. Vishal Singh

- Developed SpaCyPhy – a mobile modular ecosystem aiming to boost spatial efficiency of built environment by conceptualizing ideas for affording freedom to users for modifying living spaces
- Designed a utility docking station interface to transfer electricity, water & other critical supplies to mobile units

RESEARCH PROJECTS

Design, Modelling & Analysis of Variable Stiffness Endoscope — Jul '19 – Present

Dual Degree Thesis Project, IIT-Madras | Guide – Prof. Asokan Thondiyath

- Developing a variable stiffness endoscope for enabling traversal of tortuous paths & while providing sufficient force for grasping of tissue
- Performing FEA to model behavior of endoscope under different boundary conditions
- Developing a mathematical model to correlate with FEA models & implement a control scheme

Static Balancing of 6 Degree of Freedom (DoF) Palletizing Robot — Aug '18 – Nov '18

Undergraduate Researcher, IIT-Madras | Guide – Prof. Asokan Thondiyath

- Simulated multibody dynamics of 6 DoF robot master arm used for teleoperation using Simscape
- Used Lagrangian formulation to derive forward & inverse dynamics to validate Simscape model
- Reduced operator load by optimizing counterbalance positions for precise static balancing of robot

Monolithic Remote Centre of Motion Mechanism for Robotic Surgery — Jul '17 – Nov '17

Undergraduate Researcher, IIT-Madras | Guide – Prof. Asokan Thondiyath

- Realized a flexure based compliant remote centre of motion mechanism for robot assisted surgery
- Simulated & fabricated flexural joints for achieving large range of motion(±40°) & low axis drift
- Achieved static balancing of the mechanism through integration of pre-stressed members

Technical Projects

Mars Rover Design Jul '16 – Sep '18

Team Lead, Team Anveshak, Centre For Innovation, IIT Madras

- Led a team of 30 students in showcasing Mars Rover Design at international robotics competitions (**1st**/14 teams at the Indian Rover Challenge '19, **25th**/73 teams at the University Rover Challenge '18)
- Co-headed chassis and digger design, end-to-end analysis & manufacturing of the rover
- Optimized part topologies to achieve 17% reduction in weight of rover without affecting robustness
- Streamlined team finances by initiating an online portal for recording purchases & reimbursements
- Networked with Maxon Motor & Pololu Corp. for sponsorship deals & discounts worth USD $2500

Swimming Pool Lift for Disabled Aug '18 – Nov '18

Course Project, ME6223 – Theory of Mechanisms

- Performed 4 position mechanism synthesis + position, velocity & force analysis of a pool lift
- Reduced torque required for actuating lift by 25 times by using springs to make system energy-free
- Achieved 40% reduction in weight of lift by devising a system of buoys to replace counter masses

Optimization of Robot Parameters Aug '18 – Nov '18

Course Project, ED6002 – Optimization Methods in Engineering Design

- Optimized link lengths of a manipulator for maximizing force isotropy within a prescribed workspace using Global Isotropy Index as metric
- Implemented a variant of a Branch & Bound algorithm to achieve fast optimization of parameters

Robotic Surgical Tooltip Design Aug '18 – Nov '18

Course Project, ED5315 – Introduction to Field & Service Robotics

- Devised a 2 degree of Freedom robotic surgical tooltip for MIS with embedded pneumatic actuation
- Performed non-linear fluid structure interaction simulations on ABAQUS to obtain actuator model

Publications

- [Conf. Paper] Karthik C, **Adarsh S,** Asokan T, "Realization of a Statically Balanced Compliant Remote Centre of Motion Mechanism for Robotic Surgery", ASME Design of Medical Devices Conference 2018. DOI: 10.1115/DMD2018-6911

Teaching & Mentorship

Teaching Assistant, ED5080 – Mechatronic System Design Aug '19 – Present

- Mentoring a team of students in developing a color sensing manipulator for sorting objects

Centre For Innovation, IIT Madras Aug '16 – Mar '18

- Spearheaded *Vistaar*, an initiative to foster a culture of innovation in sister institutes via projects
- Mentored Railroad Crack Detection Robot project that won the James Dyson Innovation Award
- Conducted multiple sessions & workshops on robot design, CAD modelling & Arduino programming

Positions of Responsibility

Club Head, iBot Robotics Club, IIT Madras Mar '17 - Mar '18

- Created awareness & directed club towards impactful applications of robotics in social areas
- Launched publicity events & secured recognition from the Asian Book of Records for the largest number of robots clearing debris from a zone
- Organized Automated Toilet Cleaning Robot event at the Inter IIT Tech Meet 2018

Relevant Coursework

Biomedical Engineering Courses

Medical Equipment Dissection Lab	Human Factors in Design	Biomaterials Engg.
Anatomy, Physiology & Biomechanics	Design of Implantable & Surgical Devices	Medicinal Chemistry
Neuroscience of Human Movement	Design of Monitoring & Diagnostic Systems	Medical Image Analysis

Robotics Courses

Mechanics & Control of Manipulators	Introduction to Field & Service Robotics	Modern Control Theory

Other Relevant Courses

Optimization Methods in Engg. Design	Computational Methods in Design	Theory of Mechanisms