ADARSH SOMAYAJI

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RESEARCH INTERESTS

Robotics in Healthcare | 3D Printing | Controls | Modelling of Human Physiology | Biomaterials

EDUCATION

University of Minnesota, Twin Cities — *Twin Cities, USA*
Doctoral Student – Mechanical Engineering — 2020 – present
Research – 3D Printing Tissue Simulants

Indian Institute of Technology, Madras (IIT-Madras) — *Chennai, India*
Bachelor of Technology & Master of Technology – Engineering Design — 2015 – 2020
Specialization – Biomedical Engineering
CGPA – **9.07**/10 (2nd/27 within specialization)

AWARDS & HONORS

Recipient of Indian National Academy of Engineering (INAE) Innovative Student Project Award	2020
Recipient of Prof. R Singaperumal Endowment Award for best thesis project in Engineering Design	2020
Winner of Indian Rover Challenge	2019
Recipient of Kishore Vaigyanik Protsahan Yojana (KVPY) – young scientist fellowship award	2014
Recipient of National Talent Scholar award	2013

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 & Analysis of a Compliant Mechanism-based Variable Stiffness Grasper — Jul '19 – May '20

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

- Designed a compact, completely self-contained variable stiffness grasper with fine, rapid and continuous control of stiffness with a simple mechanical input
- Conceptualized a novel method of varying stiffness using principle of stability of truss structures
- Performed extensive bench testing to validate FEA models & verify grasping capabilities

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
- 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

Publications & Patents

- Chandrasekaran, K., **Somayaji, A.** and Thondiyath, A., 2018, April. Realization of a statically balanced compliant planar remote center of motion mechanism for robotic surgery. In Frontiers in Biomedical Devices (Vol. 40789, p. V001T07A011). American Society of Mechanical Engineers. DOI: 10.1115/DMD2018-6911
- Chandrasekaran, K., **Somayaji, A.** and Thondiyath, A., 2021. A Novel Design for a Compliant Mechanism Based Variable Stiffness Grasper Through Structure Modulation. Journal of Medical Devices, 15(1), p.014501. DOI: 10.1115/1.4049309
- [Chandrasekaran, K., **Somayaji, A.** and Thondiyath, A., 2021, April. Design of a Flexure-Based Compliant Grasper for the Master Arm of a Surgical Robot. In Frontiers in Biomedical Devices (Vol. 84812, p. V001T12A007). American Society of Mechanical Engineers. DOI: 10.1115/DMD2021-1037
- [Provisional Patent] Adarsh S, Karthik C, Asokan T, "A compliant Mechanism-based Variable Stiffness Robotic Grasper", Ref No: 202041027961

Teaching & Mentorship

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

Teaching Assistant, ID6040 – Introduction to Robotics Jan '20 – May '20

Student Leader (Robotics), Centre For Innovation, IIT Madras Aug '16 – Mar '18

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
- Established a collaboration with JIPMER to jointly solve problem statements related to healthcare
- Launched publicity events & secured recognition from the Asian Book of Records for the largest number of robots clearing debris from a zone