

Resume

SREE PRASANNA RAJAGOPAL

website: sprajagopal.github.io

mail: prasanna@pozt.cc

My research motivation is towards building bio-inspired cobots. Particularly, I'm interested in motion and manipulation design with soft actuators for semi-autonomous, human-assisted robots.

PROFESSIONAL EXPERIENCE

Lead Navigation Engineer

Invento Robotics

April 2019 - April 2020

- ROS architecture to bridge cloud containers and embedded platform
- Embedded communication architecture for mobile base and integration with encoders, IMUs, ultrasonic sensors
- Surface modeling to reduce wheel odometry drift
- PID controllers for a differential wheel base

Senior Member of Technical Staff

Tonbo Imaging

June 2015 - March 2019

- Direct dual axis stabilization with cascaded position, rate, and current loop
- Angular velocity estimators from shaft encoder measurements
- Cascaded PID control of rotary motion systems
- BLDC feedforward commutation with current control
- Low-pass filter design for high precision gyros
- Gyro bias correction methods using magnetometer fusion
- Sensor fusion techniques for IMUs, Gyros, encoders

Junior Research Fellow

IIT Bombay,

Systems and Control Department

July 2014 - May 2015

- Worked on nonconvex control problems through a convex relaxation and optimization approach.

JOURNAL PUBLICATIONS

- **S.P. Rajagopal**, S. Jain, S.N. Ramasubramanian, B.V. Johnson, and S.K. Dwivedy "Development of an underactuated 2-DOF wrist joint using McKibben PAMS," *Journal of The Institution of Engineers (India): Series C*, 2014, Volume 95, Issue 4, Pages, 327-334
- **S. P. Rajagopal**, V. Ganesh, A.V. Lanjewar, M. Ravi Sankar "Past and Current Status of Hybrid Electric Discharge Machining (H-EDM) Processes," *International Journal of Advanced Materials Manufacturing and Characterization*, 2013, Volume 3, Issue 1, Pages, 111-118

INVITED PRESENTATIONS AND CONFERENCES

- Invited and presented "Development of an underactuated 2-DOF wrist joint using McKibben Pneumatic Artificial Muscles" in the National Conference on Recent Advances in Mechanical Engineering, November 2013, held at NERIST, Arunachal Pradesh, India.
- Invited to present "Past and Current Status of Hybrid Electric Discharge Machining (H-EDM) Processes", March 2013, GRIET, Hyderabad, India.

EDUCATION

B-Tech, Mechanical Engineering

Indian Institute of Technology Guwahati

2010-14

RESEARCH WORK

Design and Development of a 2-DOF Wrist Joint using Pneumatic Artificial Muscles (PAMs)

Guide: Dr. S. K. Dwivedy

- Designed an underactuated mechanism analogous to the human wrist using a ball and socket joint.
- Compliant McKibben actuators were used for the purpose. The model was aimed to be as similar to the biological arm as possible in terms of form and function.
- Empirical data of static calibration, relating length, pressure and load, was combined with forward kinematic analysis to make a static mathematical model for the wrist orientation-pressure behaviour.
- For the dynamic model, the McKibben muscle was modeled as a spring and damper in parallel. Free vibration experiments were carried out and the acceleration-time graphs proved that this assumption worked.

Convex relaxation techniques for certain nonclassical control problems

Guide: Dr. Ankur Kulkarni,

IIT Bombay, Systems and Control Department.

- Aim was to use convex relaxation technique to solve nonclassical control problems.
- Witsenhausen toy problem was the ultimate objective since it is an open problem.
- Modeled an algorithm to convert the continuous convex programming problem into a discrete programming problem with control over the number of intervals (cuts) in each variable.
- Used MatLab's *fmincon* for preliminary results and corroborated previous attempts at solutions of the same problem.

Solving the Rubik's cube using an adaptive $\mu + \lambda$ evolutionary strategy

Guide: Dr. Deepak Sharma

- Studied various mathematical models of the Rubik's cube and analyzed suitability for an evolutionary computing method.
- Adopted a vector notation model and devised matrix operators to simulate Rubik's cube movements.
- An evolutionary strategy with a $\mu + \lambda$ strategy was devised and implemented in python.
- Results were obtained for varying number of scrambles.

Shape Control of SMA-embedded Antenna

Guide: Dr. Bishakh Bhattacharyya,

IIT Kanpur, Smart Materials, Structures and Systems lab.

- Studied shape memory alloy properties and various empirical models in existing literature to choose appropriate one for said purpose.
- Modeled a space-antenna in ABAQUS and simulated the effect of placing SMA actuators. Wrote custom routines to design the parabolic shape of antenna.
- Optimized the tip extension of antenna over the number and type of actuators.

EMBEDDED PLATFORMS

- **ARM-based:** STM32 boards
- **Fast prototyping:** Arduinos, ESP32s, Raspberry Pis
- **Multicore:** XS-1 based multi-core architectures

ROBOTIC FRAMEWORKS

- ROS: deployed several robots in enterprise environments. In-depth knowledge of architectural blocks and trade-offs. Some open-source projects [here](#).

CODING EXPERTISE

- Python - scipy, numpy, pandas
- C++ - used in conjunction with ROS for time-critical SLAM algos
- MATLAB - used for several university projects