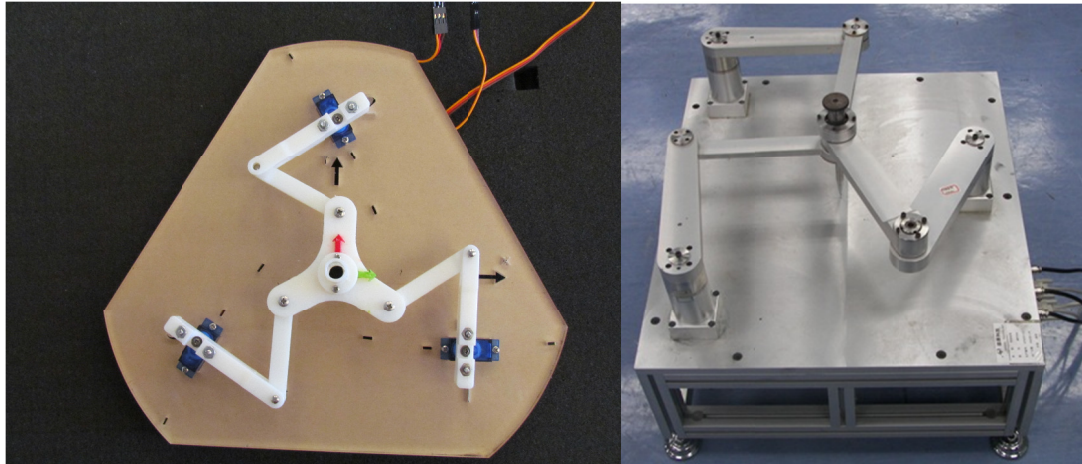


Development and Control of a Robotic Parallel Manipulator via Pneumatic Artificial Muscles

Master Thesis Proposal in Automatic Control



Indicative pictures of existing planar parallel manipulators [1], [2]

Over the last decade, there has been an increasing scientific interest in robotic manipulators that are lightweight, safe and compliant. In such cases, the selection of the type of actuation that will power the manipulator is of utmost importance. The Pneumatic Artificial Muscle (PAM) has drawn the attention of the scientific community regarding its merits for utilization in biorobotic, medical and industrial applications. By mimicking the operation and properties of the organic muscle, the PAM provides a suitable solution for safer user interaction, as well as more strong and natural motion through inherent compliance, absence of mechanical parts, as well as an impressive power-to-mass ratio.

In this master thesis the participants will have to develop and control a planar parallel manipulator (LTU-RPM) via the use of PAMs. LTU-RPM will possess the ability of:

- Moving its end effector on a planar workspace,
- Performing complicated movement scenarios via accurate position control,
- Possessing force feedback for safe human-robot interaction.

Force, angular and other required measurements will be acquired with the utilization of various sensors (IMUs, Force/pressure sensors, VICON).

- The development of the LTU-RPM will require the handling of various mechanical and electronic components (pressure regulators, I/O Cards, microprocessors, sensors etc.)
- The programming of the LTP-RPM will require the use of various software packages (Matlab, ROS, LabVIEW) and various of operating systems (Windows, Linux, Arduino etc.)
- Knowledge in Computer-Aided-Design (CAD) and Rapid Prototyping (3D Printing) will be considered a plus.
- Guidance will be provided by the supervisors on a weekly discussion basis.

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References

- [1] http://nri-csa.vuse.vanderbilt.edu/joomla/images/Harpeth_Hall_Winterim/Parallel_3RRR_Robot_Classroom_Guide.pdf
- [2] http://www.intechopen.com/books/parallel_manipulators_new_developments/kinematic_parameters_auto-calibration_of_redundant_planar_2-dof_parallel_manipulator