UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Shadow Control of a fully modular prosthetic arm with 3-DoF Shoulder

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Description

Motivation and application domain

This thesis will be held in the Laboratory of Rehab Technologies - INAIL - IIT (https://www.iit.it/research/lines/rehab-technologies-inail-iit-lab) within the Hannes project.
Hannes is a multi-joint prosthetic system developed by the collaboration with Istituto Italiano di Tecnologia (IIT) and the INAIL Prosthetic Center of Budrio. The thesisâ€™ objective will concern the development of a custom-made cartesian-based control of the multi-joint prosthetic system composed by the Hannes hand, 2-DoFs wrist, 1-DoF elbow and 3-DoFs shoulder.

General objectives and main activities

The main objective of this thesis is to develop a Shadow Control (Direct Kinematic) to move the Hannes System in both real and virtual environment. At the current state, the 3D space Shadow control is focused on 1DoF shoulder (Flexo-Extension, FE), 1 DoF for Elbow (FE) and 2 DoF for Wrist (FE and Prono-Supination) by using 3 Inertial Measurement Units (IMUs) placed on the human arm, namely on the hand, the forearm and the arm. The IMUs are used to extract orientation information from accelerometers, gyroscopes and magnetometers, from which the position of the arm in the 3D space is computed. During this research project the candidate will expand the current state integrating 2DoF for the Shoulder, namely Ab-Adduction and Intra-Extra Rotation, and developing the control of such 3DoF joint.
The validation of the controller will be then performed via different approaches including Motion Capture systems and encoders.
The result will be the control of the full Hannes Arm System in both virtual and real world.

Training Objectives (technical/analytical tools, experimental methodologies)

1. Design, implementation and execution of experiments on custom testbenches.
2. Software development for both calibration and kinematic data analysis.
3. Mixed software skills (Matlab, Vicon, Unity, C#, C).

Place(s) where the thesis work will be carried out: Department of Rehab Technologies, IIT (Genova-Morego)

Additional information

Maximum number of students: 1