BDRL-UP-11: Robot Leg/Arm Joints with Variable Stiffness

Problem Statement

Problem involves to research, select and construct one of the state-of-the-art designs in the literature which manages to dynamically change the stiffness properties of the passive compliant mechanisms (such as springs) that are used in the joints of robotic arms, legs or other structures.

Project Description

A very important problem for jointed robots, being able to change the stiffness properties of the passive compliant mechanisms used in the joints would carry the robotics field a couple steps closer to the nature. All animals have the ability to dynamically adjust their muscle stiffness in order to comply with the dynamism of the environment. Being able to do so for our robots' muscles, i.e. joint mechanisms would help us to increase their abilities to move, manipulate and survive possible forces exerted on them.

In this project, you will be asked to undergo a literature search and select one of the state-of-the-art variable stiffness researches for construction. You will be provided with the selected best and latest designs which solve the defined problem. Your job will be to understand the underlying principle, manufacture and build the required parts and construct the whole system.

Expected Project Outcomes

Depending on the selection, you will be asked to demonstrate the changing stiffness of the robotic joint design and its ability to comply with given tasks. In order to see the results clearly, you may be asked to build a simple robotic arm or leg which includes the built joints.

Optional Extras

Although the problem seems complicated, the best thing about the designs is the simplicity lying in their sub parts and constraints, therefore building such systems may not require extensive mechanics knowledge.

Desired Skills / Background

Team could be up to 3 participants, preferably ME students. Desires skills would be;

- Knowledge about dynamics and kinematics,

- Mechanical construction experience,

- Motor and feedback control.

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