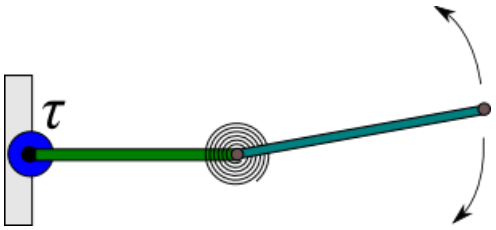
BDRL-UP-9: Under Actuated Control

Problem Statement

The problem, generally considered a bio-inspired control approach for actuated systems in robotics, involves the control of a single actuator to control the motion of a multiple degree of freedom system which includes passive compliant systems.

Project Description

In this project, you are asked to come up with a control method for a single actuator in a comparably simple mechanism shown in the following figure:



In the shown system, there will be an electric motor shown with blue circle which is mounted on a vertical fixed reference point (e.g. wall or a suitable port). Mounted on the shaft of this motor, there will be a two link robotic arm. The joint between these two links will be a rotary spring-damper system which will be our passive compliant mechanism.

The aim of this project is to control the motion of tip of the two-link arm so that it would be moving with a limit cycle. In other words, you should be able to control the actuator so that the tip of the arm would be oscillating in the free air with the given frequency.

Expected Project Outcomes

The project would be called complete if the tip of the robot arm moves with the desired frequency. You will also be asked to minimize the power consumption on the motor. For this, you are free to include another passive compliant mechanism on the joint which connects the arm to the actuator.

Optional Extras

You are free to choose the method to detect the frequency of the tip of the robot arm. You may use visual detection systems (labeling the tip with an easy marker such as a bright color and track it with a camera) or inertial sensors mounted on the tip (such as 2D accelerometers).

Desired Skills / Background

Team could be up to 2 or 3 ME and/or EE students. It is recommended to have a CE teammate if visual tracking method is chosen. Desires skills would be;

- Knowledge about dynamics and kinematics
- Feedback and motor control
- Experience on object recognition and motion capture for visual tracking

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