Aufgabenbeschreibung

Bachelorarbeit/Studienarbeit N.N.

Development of a robust and responsive SEA control algorithm for accurate force control

The Institut für Medizingerätetechnik is investigating Series Elastic Actuators (SEA) for use as compliant actuators in human machine interaction. SEAs use an elastic element (spring) in combination with an actuator (DC motor) to provide accurate and stable force control. However, the elastic element in this system can make the control more complex than standard PID control. Therefore, this project is focused on developing a robust, stable and responsive control algorithm for providing accurate force control. Specifically focusing on replicating the stiffness’s of various soft materials. Computer modelling and simulation of the system will be first created to develop the control algorithm. The control algorithm is required to both track the user movement, reducing the felt resistance of the motor gearbox, and create the sensation of a wall being interacted with i.e. a step force output. The final algorithm will be tested on an actual system setup and validated by user interaction and a torque sensor.

The main points to be addressed are:

- Review and evaluation of SEA control methodologies.
- Creating a SEA MATLAB (discrete) model accounting for system limitations.
- Develop a control algorithm to create a step function, impulse (as close as possible) and zero point tracking torque output.
- Develop control algorithm to create a ‘virtual wall’ i.e. when the displacement of the output reaches a certain angle a step torque function is applied until the angle is reduced again.
- Apply control algorithm to current SEA setup and validate response with torque sensor.
- Optimise control algorithm so different ‘hardness walls’ (different torques) can replicated.

Supervision will be provided in English by a native English speaker (From New Zealand). As a result, the thesis should also be written in English.