Spine Biomechanics Proposal

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For the spine biomechanics project it will be the duty of CARRT to program a “CompactLogix System” to provide various types of torque control using a load cell and encoder data as input for a PID closed loop control system. The proposed methods are quasi-static testing, dynamic testing, and position control. The quasi-static testing method will control the applied torque using a torque step function. The input to this method includes the torque step size, the dwell duration, and the rise time. The dynamic testing method will allow the user to modify and display the torque of the controlled motor in real-time. The position control method will enable the user to select two encoder positions to oscillate between; in this control method torque is not considered.

The communication used between the user interface (PC) and the motor controller in this project is TCP/IP which is a common communication method. Similarly CARRT uses TCP/IP to communicate with its WMRA (Wheelchair Mounted Robotic Arm) motor controller. An Ethernet connection is very fast compared to other communication methods; with a data transmission rate of 10/100 Mbps. The current torque on the object is detected using a Miniature Reaction Torque Transducer. This torque load cell will give the program access to the instantaneous torque on the system, depending which model is purchased this can range from 5-Nm to 50-Nm. This torque can be controlled with a PID closed loop system. The input to this system will be the current torque and the user selected required torque, and the output of the system will be the power necessary to provide the selected torque. The RSLogix 5000 programming environment for the CompactLogix Controller will allow for a visual interpretation of how the motor/torque is being controlled by the program. This will allow the user to easily change the functionality of the program if changes or upgrades need to be made in the future.

The proposed programming project completion date estimate is August.

References:

Motor – MPL-320H

<http://www.datasheetarchive.com/MPL-320H-datasheet.html>

Motor Driver – Kinetix 350

<http://ab.rockwellautomation.com/Motion-Control/Kinetix-350-Servo-Drive#/tab5>

Motor Controller – 1769-L18

<http://ab.rockwellautomation.com/Programmable-Controllers/CompactLogix-1769-Controllers#/tab5>

Torque Load Cell – MRT2

<http://www.interfaceforce.com/mrt2-miniature-overload-protected-reaction-torque-transducer-p-74.html>