Research Project

DESIGN AND CONTROL OF A GENERIC WRIST PROSTHESIS SIMULATOR

Motivation
The use of the wrist joint is essential in many basic daily tasks, but sometimes the joint is affected by diseases such as Rheumatoid Arthritis and Osteoarthritis, causing stiffness and pain.

Replacement with a prosthetic wrist may be a solution. However, the wrist is a complicated joint, and any prosthesis must be tested to determine its performance and limitations. Hence a wrist simulator rig (left) has been designed to simulate the motion of wrist prostheses.

Control of the wrist simulator
The simulator will be used to assess the performance of wrist prostheses. Hence, if a dislocation or high tendon tensions occur, we must be confident that this is due to the implant and not to the simulator mechanics or control. The aim of this project is to develop a motion controller which is robust and can reject external force disturbances. The controller is realised via Matlab/Simulink and dSpace™.

A dynamical model of the simulator has been developed and is being used to design, test and validate a robust $H_{\infty}$ controller before its implementation on the rig.

Implant materials and geometries vary. The first model is of a spherical joint (top) and will then be modified to suit other types of prostheses.

Future work
Once the control design of the rig completed, the simulator will be able to test the performance of a variety of wrist prostheses and it will help to determine whether new designs are safe to implement in the human body.

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