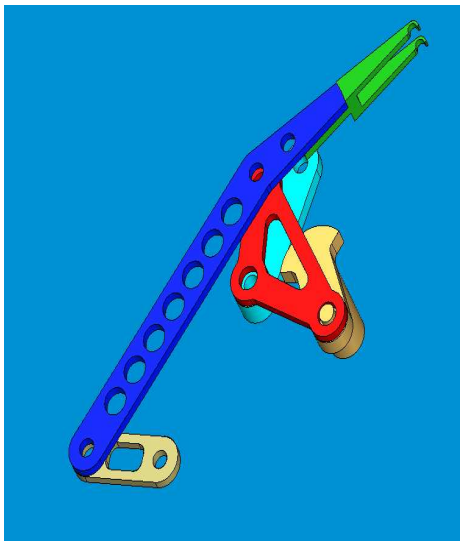
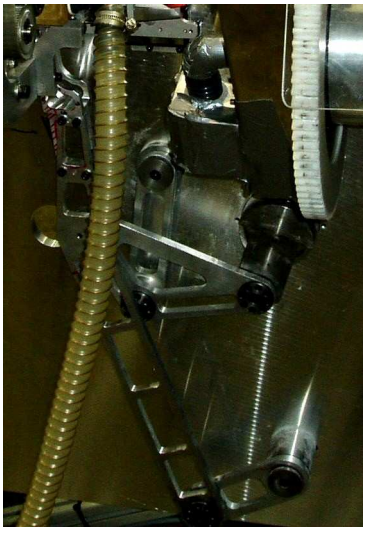
The Centre for Power Transmission and Motion Control

UNIVERSITY OF BATH

Research Project

THE OPTIMISATION OF HIGH SPEED CONTROL SYSTEMS





Motivation

When a servomechanism is actuated, dynamic instabilities in the mechanism induce vibrations, the magnitude of which increase with actuation speed. These vibrations can cause a range of operational problems, such a decrease in motional accuracy, increased mechanical loading and a reduction in operational efficiency. A common method used to limit the magnitude of these vibrations is to limit the operational speed of the mechanism even if a higher operational speed is more desirable.

The project aims to derive methods for designing mechanisms which vibrate very little during high speed actuation.

Methods for reducing harmonic content

A prototype servomechanism was provided by Molins ITCM to provide a basis for experimental work. This mechanism (depicted) had a vibration rich output motion. Using data from the test rig, tools and methods were developed to analyse and model the mechanism and control architecture. The mechanism was analysed using both forward and inverse dynamics.

With a model of the test rig and mechanism created, a method of reducing the amount of harmonic content in the mechanism's output motion was derived. A theoretical method was derived of achieving this effect using a shaped velocity demand signal in conjunction with integral control.

Future work

Alternative methods of improving system performance are to be investigated. In particular experimentation is planned for alternative control architectures as well as alternative geometric and mechatronic solutions. A test rig is to be constructed to verify results gained through simulations.

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ITCM
Innovative Technology for Custom Machinery

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