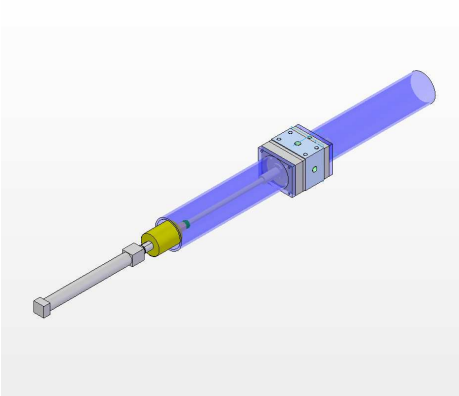
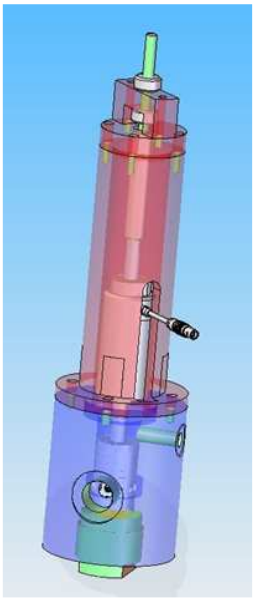
The Centre for Power Transmission and Motion Control

UNIVERSITY OF BATH

Research Project

INTEGRATED SYSTEMS FOR HIGH BANDWIDTH ULTRA HIGH PRECISION ACTUATION





Motivation

In modern industrial and science based environments there is a need to improve and expand the operational capabilities of hydraulically actuated machine systems. These systems are capable of delivering large forces over long strokes. However, the force bandwidth is relatively low when compared to piezoelectric actuation systems, which have much lower stroke for relatively high force capabilities. An ideal hydraulic actuator would achieve high performance standards for force levels, dynamic range of operation, stroke range, and precision. However, at present no such actuation system exists. The aim of the research being undertaken at the University of Bath is to investigate the issues related to component design and integration, control, and modelling methods that would enable a hydraulic actuation to operate as close to the ideal as possible.

Development of seal modelling techniques and active seal technology

Research is being undertaken to develop improved models for seal friction and leakage. These models will then be used to assist in the design of devices used to deform piston and rod seals such that the friction forces provided by the seals may be used to control large stroke and high frequency motion.

High flow/fast acting valve design

Research is also focusing on the development of a piezo-actuated hydraulic valve capable of achieving high flow rates with fast opening and closing times, and reasonable pressure drops. High flow and low pressure drop rates are achieved by the use of multiple metering edges achievable using the Hörbiger plate valve principle and a direct connection to the piezo actuator is used to move the poppet at high speeds.

Future work

The final phase of the project will see a combined hydraulic system incorporating the active seals, high flow/fast acting valves, system models, and modern control methods to achieve high performance standards.

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