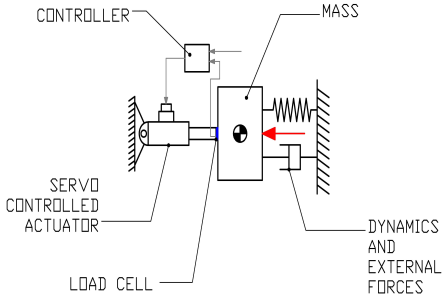
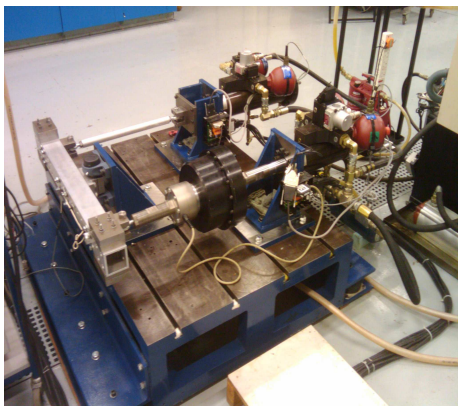
The Centre for Power Transmission and Motion Control

UNIVERSITY OF BATH

Research Project

ROBUST ELECTROHYDRAULIC FORCE CONTROL





Motivation

In dynamic structural testing it is often necessary to apply controlled forces to a specimen. In Formula 1 development, full vehicles are tested for their dynamic response using large, multi-axis test rigs. Such rigs must simulate the motion of the race track but must also provide a simulation of the down-force exerted on the car. For this, force controlled actuators are used and the high response needed, means that hydraulics are typically used.

Natural velocity feedback

The inherent stiffness of hydraulic actuators is generally welcomed as it provides a high degree of tolerance to disturbance forces when the actuator has a position demand. In the force controlled case, however, small disturbances in position or velocity result in large force error, something known as the effect of 'natural velocity feedback'. The motion of the specimen must therefore be compensated for in the control architecture, such that this disturbance effect is reduced. Velocity feed-forward, coupled with additional compliance in the force link are being optimised as part of this research, to tackle this problem.

Robustness

The dynamics of the specimen are often not known well. The force control algorithm must therefore be *robust* to such uncertainties. Measurement of the motion of the specimen is being developed such that the control algorithm may respond as if the actuator was working against a stationary load and hence the effect of specimen dynamics will be minimised.

Future work

A purpose built DYnamic ANAlysis test rig (DYANA) has been built on which to thoroughly examine the effects of various specimen and conditions on the force control algorithms being developed. A non-linear feedforward velocity control loop is planned for the forthcoming work.

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