Research Project

Piezoelectric Actuation for Hydraulic Servovalves

First stage housing   First stage LVDT

Second stage LVDT
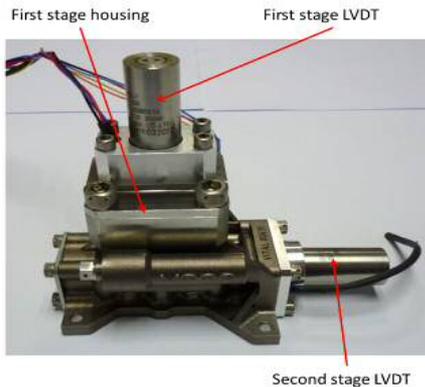
Motivation

Electrohydraulic actuation systems are at the heart of many high value machines. They consist of complex, high precision, electro-mechanical components, of which the servovalve is the prime example. Hydraulic component manufacture using additive manufacturing (AM) will create a revolutionary change in performance, cost and weight. The specific focus of the study is to create an aerospace servovalve demonstrator using AM valve body. The pilot stage is a low leakage mini spool actuated by piezoelectric ring bender. The secod stage feedback will be electrical instead of the conventional mechanical feedback.
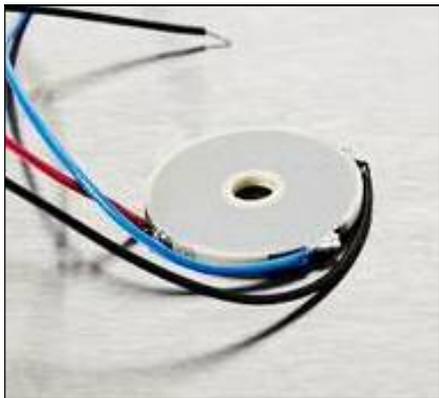
Piezoelectric Actuation

Through the use of AM, new opportunities arise for integrating actuation within a valve. A piezoelectric ring bender actuator moves the pilot stage spool of a two stage servo valve. A small pilot stage spool was chosen to reduce the internal leakage and thereby increase efficiency. The novel design, integration and control of piezoelectric actuation and electrical feedback to an aerospace environment is a challenging task. This new design could reduce the complexity, part numbers, weight and increase the efficiency of the valve. These are all important factors for future aircraft.

Reliability, Mounting and Control

The piezoelectric ring bender is submerged in a hydraulic fluid. It is important to ensure that the piezoelectric ring bender will not fail in service. Reliability tests are being conducted. To maximise the work output of the piezoelectric ring bender, optimised mounting design is essential. This involves understanding the trade-offs in dimensions and material for the mounting clamp around the circumference of the ring bender. All piezoeletric actuators have hysteresis, and investigating hysteresis compensation to improve control accuracy is part of the current study.

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