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Recent advances in electro-hydrostatic actuation systems

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In niche market sectors such as flight-surface actuation and robotics, the demand for centralized hydraulic actuation is decreasing and has significantly fallen due to their deficiencies. These deficiencies include the requirement for a large centralized reservoir, high noise level, environmental and maintenance issues related to leaks, and low energy efficiency. As an alternative, electrical actuators in turn have their limitations that include: added friction, backlash (in geared systems), low torque/mass ratio, and increased cross-coupling effects in a multivariable context. Heavy-duty systems such as industrial robots and excavators therefore still use hydraulic actuation that offers large torque for a comparatively small final actuator size. An alternative actuation strategy that was traditionally viewed as being inaccurate is "hydrostatic" or the "closed system" concept. In this concept, as opposed to conventional open-circuit valve controlled hydraulics, the main component is a bi-directional pump that is directly connected to a linear or rotary actuator. In this concept, the pumping action controls the motion of the load without a need for oil reservoirs or servo-valves.

Traditionally, hydrostatic circuits were used in applications that did not have stringent requirements for positional accuracy, or where energy efficiency was paramount. Since the 1990's, the used of new computerized control methods using inner-loop feedback has led to significant improvements in their positional accuracy. Currently, hydrostatic concepts are being used in new high-power applications such as flight surface actuation. The presentation reviews the design of Electro-Hydrostatic Actuators and reports on the latest experimental results pertaining to their use in aerospace.

Biography

Saeid Habibi is the Chair of the Department of Mechanical Engineering at McMaster University and a Senior NSERC Industrial Research Chair. He obtained his Ph.D. in Control Engineering from the University of Cambridge. His academic background includes research into intelligent control, fault diagnosis and prediction, Variable Structure Systems, and fluid power. The application areas for his research have included aerospace and automotive. He spent a number of years in industry as a Senior Consultant for Cambridge Control Ltd, U.K., and as Senior Department Manager of Systems Engineering for AlliedSignal Aerospace Canada. He received 2 corporate awards for his contributions to the AlliedSignal Systems Engineering Process. He was the recipient of the Institution of Electrical Engineers (IEE) F.C. Williams in 1992.

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