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AIMS AND SCOPE

The *International Journal of Fluid Power* is dedicated to the latest advances in the science and technologies associated with hydraulics and pneumatics. The aim of the journal is to provide the engineering community with high quality information concerning developments in research, design and application of fluid power technology. Special emphasis is placed on papers concerned with components and system integration by embracing key aspects of:

- analysis, modelling and control,
- monitoring and fault diagnosis,
- artificial intelligence applications,
- component and systems design,
- computer software and hardware interfacing and
- computer aided engineering for both static and dynamic analysis of fluid power systems.

In addition, the journal commissions and publishes state-of-the-art reviews on both existing and emerging technologies, and with a philosophy of maintaining scientific rigour and the practical realities of fluid power. The International Editorial Board is composed of leading members of the fluid power community having expertise covering the broad spectrum of fluid power, and all papers are peer reviewed by at least two experts. Technical quality and integrity are considered crucial to the review process. The Associate Editors and the Editorial Board also undertake an active role in ensuring that this is achieved.

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DESIGN OF CYLINDER DRIVES BASED ON ELECTRORHEOLOGICAL FLUIDS

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Abstract

Short response times make electrorheological fluids (ERF) particularly suitable for the control of high dynamic applications. This paper deals with the usability of these controllable fluids and furthermore with the essential components to build up electrorheological cylinder drives. Hands-on experiences are explained in order to support the design of such systems. A design concept developed at IFAS has been applied to a new cylinder drive. The concept considers a total modularisation of the drive and the electrorheological valves. This paper demonstrates the advantages of this concept when using ERF.

Keywords: electrorheological fluid, response time, design concept, power supply, electrorheological properties, yield stress, cylinder drives, dynamic applications, modularisation, valve design

MONITORING THE CONDITION OF A VALVE AND LINEAR ACTUATOR IN HYDRAULIC SYSTEMS

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Abstract

The topic of condition monitoring has been a growing area of research in both academia and industry for much of the last two decades. Condition monitoring of fluid power equipment has been no exception to this trend. Much of the research work associated with monitoring the condition of fluid power equipment has centered on pump and motor components due to their relatively high cost and complexity. The work in this paper focuses on the lesser expensive, but more common components of valves and linear actuators. The primary focus of the work presented here pertains to assessing the independent component condition of a valve-controlled linear actuator circuit. The paper first presents simulation studies to establish techniques for proper data collection, neural network training and output interpretation. The neural network approach is then applied to a valve and linear actuator of a John Deere 410E Backhoe Loader. The results indicate that the concept can be applied to a commercial system and is feasible for implementation.

Keywords: condition monitoring, neural network, valve, cylinder, actuator

PUMP CONTROLLED ACTIVE ROLL STABILIZER

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Abstract

The roll tendency of a vehicle can be significantly reduced if the stabilizer bar stiffness is actively controlled. Present electro-hydraulic solutions for vehicle active roll stabilization (ARS) use valve controlled actuators. An energy efficient pump controlled actuator concept for ARS is the focus of this research. This paper develops a non-linear model for the system and shows that the pump dynamics are sufficient for this actuator application. A simple control structure is developed from the linearized system model and the energy consumption of the system is determined for a realistic vehicle maneuver.

Keywords: displacement controlled actuator, swash plate control, Anti-roll bar, rotary actuator

TIME DOMAIN FLUID TRANSMISSION LINE MODELLING USING A PASSIVITY PRESERVING RATIONAL APPROXIMATION OF THE FREQUENCY DEPENDENT TRANSFER MATRIX

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Abstract

Flow and pressure transients in fluid transmission lines can be analysed starting from a modal approximation of the frequency domain irrational transfer matrix, relating pressure and flow rate at the line ends in Laplace transform. The obtained rational approximation can be converted in a state space representation and used in variable time step simulators to evaluate the influence of the line on fluid servosystems dynamics. Particular attention must be given to the causality, to the stability and to the energy passivity of the resulting line model.

In this paper the application of a numerical approximation technique (Vector Fitting) to the frequency dependent transfer matrix describing the pipeline dynamics is proposed. The admittance matrix formulation is chosen, introducing an effective passivity enforcing technique, to ensure the energy passivity of the approximated matrix, thus preserving in the model the physical meaning of the real system.

The rational approximation of the transfer matrix, combined with the passivity enforcement methodology, is applied to the study of the transient response of a single uniform line and of compound hydraulic line systems, showing the agreement between the simulation and the solution obtained with inverse fast Fourier transform.

Keywords: Fluid Lines, Transient Response, Modal Analysis, Transfer Function, Rational Approximation, Passivity Enforcement.

HYBRID FORCE CONTROL
WITH ON/OFF ELECTROPNEUMATIC STANDARD DISTRIBUTORS

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Abstract

This paper presents a new control method applied to the electro-pneumatic field. This strategy originates from the hybrid control theory recently developed for the control of asynchronous or synchronous electrical motors, e.g. Retif (2004). The interest of this strategy concerns the possibility of using standard on/off distributors instead of the usual servodistributors (components issued from proportional technology) for the force control of a pneumatic cylinder. Distributor components have less performance but are cheaper than a servodistributor. The aim is to obtain, with a distributor, the same performances as servodistributors on the global system.

Based on both cylinder and distributor models, the hybrid control presented here chooses the best state for each on/off distributor to reach the desired force value. Experimental results are presented and discussed.

Keywords: hybrid control, on/off distributor, valve, electro-pneumatic, experimental results, force control