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AIMS AND SCOPE

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AN OVERVIEW OF MAGNETO- AND ELECTRO-RHEOLOGICAL FLUIDS AND THEIR APPLICATIONS IN FLUID POWER SYSTEMS

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Abstract

The rapid change in viscosity of magnetorheological (MR) and electrorheological (ER) fluids subjected to a magnetic or an electric field, respectively, has attracted the attention of many researchers. However, as MR fluids show higher yield stress than ER fluids, they have merited more attention during the last few years. In this paper we present an overview of magneto- and electrorheological fluids, their basic properties, behavior under different flow types and their uses in fluid power systems, among others.

Keywords: magnetorheological fluids, electrorheological fluids, smart materials, fluid power

APPLICABILITY OF A LAMINAR FLOW BASED MODEL IN PIPEFLOW MODELLING OF WATER HYDRAULIC SYSTEMS

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Abstract

Turbulent flow in pipes is usually avoided in traditional oil hydraulics. However, using water as a hydraulic fluid, the flow can be regarded as turbulent and the Reynolds number is usually between 10000 and 200000. Most of the pipe models are formed assuming the flow to be as laminar. One pipe model has been developed using a variational method and modal approximation. In this research the applicability of this model to simulate strongly turbulent pipe flow has been studied. The comparison between the simulated and measured results is made in time domain. These results show that this pipe model can be used in practical designing also when the flow is turbulent.

Keywords: turbulent flow, water hydraulics, pipeline, pressure transient

STATIC-PERFORMANCE BASED COMPUTER-AIDED DESIGN OF A DDV AND ITS SENSITIVITY ANALYSIS

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Abstract

Direct Drive valves (DDV) are gaining increasing acceptability for their simple configuration, low leakage, and low cost. Two major components of the present single-stage DDV are a spool valve and a linear force-motor. The objective of the present investigation was to formulate a design methodology and a static performance simulation tool for the DDV. The present work includes lumped and chiefly one-dimensional, non-linear field modelling of flow through the spool valve and magnetic flux in the motor. Detail modelling has been done only for leakage flow in the spool-bushing radial clearance of the spool valve, since it has critical bearing in the performance analysis. A computer-aided tool for designing a single stage valve, based on some additional simplifying assumptions of the lumped model, has been presented. The static performance algorithm was developed on SIMULINK, without invoking the design-level simplifications. The simulation tool has been used to carry out a design validation against the known performance of Moog Series D633 valve. Different designs of the valve, corresponding to different actuation specifications were obtained, and their static performances have been investigated. Also a sensitivity analysis has been carried out to study the effects of tractive air gap area ratio in the motor and port lap conditions in the spool valve.

Keywords: direct drive valve, linear force motor, spool valve, flow gain, pressure gain, design, static performance analysis, sensitivity analysis

CONTROLLED VALVE PLATE IN BENT AXIS HYDRAULIC MOTORS

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Abstract

The research object of the given work is the bent axis hydraulic motor (BAHM). In this paper the interaction of the rotating cylinder block and motionless valve plate (VP) is investigated. The research aims are focused on evaluation of the experimental and theoretical data of the VP friction torque and hydraulic fluid leakages. The up-to-date technologies require the BAHM components to be more reliable and durable. On the way of BAHM design improvement, the new VP is introduced in this paper. The new design features provide more reliable fluid lubrication in the gap between VP and cylinder block and increase the durability of the piston cylinder assembly in heavy operation modes. The laboratory tests proved the efficiency of the new VP design.

Keywords: bent axis hydraulic motor, valve plate, hydraulic fluid, fluid leakage

KNOWLEDGE AND REASONING: ISSUES RAISED IN AUTOMATING THE CONCEPTUAL DESIGN OF FLUID POWER SYSTEMS

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Abstract

Much progress has been made in the area of computer-aided designer support, but little has been made in that of design automation. Where progress has been made, it has been largely in the analytical aspects of the task (for example, simulation and stress analysis) – tasks for which computers are more suited than humans. Less tractable is automation of the early, conceptual, phase of design, heavily reliant as it is on the expert knowledge of the design practitioner. Emulating this computationally is the domain of Artificial Intelligence (AI) and requires a detailed understanding of the nature of the design process (Darlington et al, 1998).

This paper discusses some of the issues raised during an investigation in to the automation of the configuration phase of fluid power system design, and identifies some of the hurdles to be cleared before automation, supported by AI, becomes a reality. Two models, developed by the authors, are chosen to illustrate the way in which very different approaches can be taken to automating the same task with an emphasis on the knowledge that is used by designers, which must be acquired and used in automation.

Keywords: configuration design, design knowledge, automation, neural networks, case-based reasoning