Abstracts

Group A: Fluid Power Components – Valves

A1 Simulation-Based Design of a Direct-Operated Proportional Pressure Relief Valve

M. Erhard, G. Schoppel, J. Weber

The development of pressure relief valves does not only put requirements on pressure-flow-characteristics, but also requires the maintenance of sufficient dynamics and sta-bility. To accomplish this task the simulation methods support the designing and opti-mization stage of the functional subsystems of a direct-operated proportional pressure relief valve. Therefore, an inverse simulation model is built for this valve type. CFD and FEM modeling techniques are applied to parameterize the control edge and solenoid performance. A final comparison between measurement and simulation results demon-strates the applicability and accuracy of used simulation methods for the valve design process.

A2 Intrinsic sensor properties of solenoid actuators for fluid power

A. Gadyuchko, V. Kireev

A systematic of the intrinsic sensor effects on electromagnetic solenoid actuators has been developed. Correlation of specific regions of a flux-current diagram $\Psi(i,x)$ with a stroke, spring preload, friction, pressure has been investigated for a number of solenoid types. Quasi-static and step response excitation coil measurement is introduced in a measurement device MagHyst® which has been used to identify the flux-current diagrams with the stroke as a parameter and to validate the results.
The main advantage of the method is that it does not need any additional sensors apart from the excitation coil of the electromagnet itself. The measurement can be carried out at real operation conditions and under load.

A3 Use of Fiber Reinforced Plastics in cartridge valves manifold

A. Bonanno, R. Paoluzzi

The concept of the work presented starts from the fact that since years, the fluid power industry is basing its performance on metallic materials and components, reaching a high level of performance. Nevertheless, some constraints hinder further development in terms of high weight of stainless steel components, or limit in the use of environmentally friendly operating fluids for the oxidation of metals. The use of lighter material (Fiber Reinforced Plastics – FRP) in fluid power applications could perform a substantial development of the energy efficiency tanks to weight reduction and to optimization of fluid-dynamic of hydraulic circuit components, and consequently, a reduction in environment emission caused by off-road machine. In the paper presented here the authors handle the numerical simulation of a fluid power manifold for a cartridge valve. Starting from the numeric analysis of the actual (metallic) part, the authors have performed a numerical re-design, using fiber reinforced plastics as base material, with the aim of having the same metallic manifold's strain. The results are encouraging and show the limits and the advantages connected to the FRP use in fluid power components.

A4 Multi-variable Control Concepts for a differential cylinder with an independent metering valve configuration

C. Meyer, T. Bosse, D. Weiler, H. Murrenhoff

In this article a novel idea how to realize energy efficient multi-variable control concepts for a differential cylinder with an independent metering valve system for industrial applications is presented. The Extension of the operating area of such a system by using energy regeneration and pressurization control is also discussed. The proposed control concepts for the system are a LQR configured multivariable state-feedback controller with an integral extension and a decentralized decoupled controller. It is shown that the degrees of freedom in this new control approach can be used to control the position and the rod side pressure level and therefore the pressurization level of the cylinder drive at the same time. The main focus in this paper is the decentralized control compared to the already presented LQR MIMO controller in /5/ and /6/. In addition, the principal structure of the logic control system that recognizes the possibility of a regenerative mode and then switches to the most energy efficient valve configuration is revised briefly. The functionality and the performance of both controlled systems are compared by simulation results of a differential cylinder drive.