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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,
- 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.

Currently, three issues are planned for 2009, but the journal is moving towards quarterly publication.

International Journal of Fluid Power is abstracted and indexed in: Cambridge Scientific Abstracts, European Environmental Information Database, CEDEFOP-Training Village, Fachinformation Technik, Elsevier Compendex Engineering Information.

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Authors wishing to submit a paper for publication should send their manuscript in electronic form to Professor Monika Ivantysynova, Purdue University, Department of Agricultural and Biological Engineering, 225 South University Street, West Lafayette, IN 47907-2093, USA (email: Mivantys@purdue.edu). Detailed notes for authors appear on the inside back cover of the journal.

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THE INTERNATIONAL JOURNAL OF FLUID POWER 10TH ANNIVERSARY

In the past, there had been little opportunity for researchers in fluid power to publish their work in a universally accessible forum. Other venues existed, but there was no guarantee that the reviewer would be an expert in fluid power. Nearly ten years ago, my colleagues and I at Fluid Power Net International (FPNI) had a vision for filling this gap by creating an international forum for researchers in fluid power from all over the world to present their work in a journal reviewed by other experts in the fluid power arena. The *International Journal of Fluid Power* was thus born, the first issue being published in March of 2000.

Nearly ten years later, I am very proud that the *International Journal of Fluid Power* continues to live up to the original vision of those of us at FPNI. Since the establishment of the *Journal* we have presented 26 different fluid power software tools and have introduced 26 fluid power research centres from four different continents. Authors from 32 countries have submitted papers to the *International Journal of Fluid Power* during the last nine years. More than 300 papers have been submitted and reviewed since 2000. Additionally, I am pleased to report that the number of papers submitted by North American authors continues to grow. Last year, 10 out of the 26 submitted papers were from United States or Canadian authors.

The success of the *Journal* is in large part due to the dedication and effort of many of you and I would like to express my sincere thanks for your continuous support of the *Journal*. I wish to extend a special thanks to those who have reviewed papers and submitted manuscripts. Your efforts have helped create and maintain a high level of fluid power research published in the *Journal*. A list of reviewers since the *Journal's* inception is published in this issue. My sincere thanks go to all Associate Editors for their great help and advice. I would also like to thank all 20 members of the Editorial Board for their continuous support. Additionally, I would like to express my gratitude to Robert Rahmfeld, Ganesh Seeniraj, and more recently, Katie Livergood and Richard Klop for managing the review and proof reading process throughout the years. In 2005 Margit Ostrop took over the customer service of the *Journal* and I would like to thank her for her excellent service and the improvements she has made in this important area. And finally, my thanks to Kyle Williams for coordinating the *Journal's* Fluid Power Calendar and PhD Awards and Books section and all members of the Maha team who have helped with final print preparation.

The *Journal* has been online since March 2006. The online access has strengthened the *Journal's* position and will certainly facilitate continued increase in the number of citations. The *Journal's* website has been moved to a TuTech server and thus has a new web address: <http://journal.fluid-power.net>. We have very successfully continued our co-operation with the Japan Fluid Power System Society "*Fluid Power System*", the Italian "*Oleodinamica Pneumatica Lubrificazione*" and the German "*Ölhydraulik und Pneumatik O+P*". All three agreements allow for the *Journal's* articles to be translated and published in these partner journals after publication in the *International Journal of Fluid Power*.

Despite the success of the *Journal*, we have yet to be included in the Scientific Citation index. This is one of my most important goals for the *Journal* as we move forward. The *Journal* is up for re-evaluation this year and I would like to encourage all of you to refer to your past *Journal* publications as well as the publications of others in the *International Journal of Fluid Power* more often. Currently the *Journal* is indexed by Cambridge Scientific Abstracts, Elsevier Compendex Engineering Information, European Environmental Information Database, CEDEFOP Training Village and Fachinformation Technik.

All papers are peer reviewed by at least two experts. Very often three independent reviewers are involved to ensure that the review process is fair and that the *Journal's* final publication is of the highest quality. The current rate of successfully approved papers is 46%.

Once again, I would like to thank you all for your continuous support of the *Journal*. I believe that with continued dedication and effort, the *International Journal of Fluid Power* will successfully continue its mission in offering a unique platform for high quality information about ongoing research in fluid power technology world-wide.



Dr. Monika Ivantysynova,
Editor-in-Chief

Lafayette, Indiana
July, 2009



DESIGN AND CONTROL OF A SHIP MOTION SIMULATION PLATFORM FROM AN ENERGY EFFICIENCY PERSPECTIVE

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Abstract

Most hydraulic servo systems are designed with little consideration for energy efficiency. Pumps are selected based upon required peak power demands, valves are chosen primarily for their rated flow, actuators for the maximum force. However, the design of a hydraulic servo system has great potential in terms of energy efficiency that has, for the most part, been ignored. This paper describes the design and control of a large-scale ship motion simulation platform that was designed and built at Oak Ridge National Laboratory for the Office of Naval Research. The primary reasons to incorporate energy-efficiency features into the design are cost and size reduction. A preliminary survey of proposed designs based on traditional motion simulation platform configurations (Stewart Platforms) required hydraulic power supplies approaching 1.22 MW. This manuscript describes the combined design and control effort that led to a system with the same performance requirements, however requiring a primary power supply that was less than 100 kW. The objective of this paper is to illustrate alternative design and control approaches that can significantly reduce the power requirements of hydraulic systems and improve the overall energy-efficiency of large-scale hydraulically actuated systems.

Keywords: hydraulics, energy efficiency, ship motion simulation platform, sea states

POWER LOSS IN THE LUBRICATING GAP BETWEEN CYLINDER BLOCK AND VALVE PLATE OF SWASH PLATE TYPE AXIAL PISTON MACHINES

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Abstract

The lubricating gaps are the primary source of energy dissipation in piston machines. The paper presents results of a simulation study that investigates the effect that a wave-like micro surface shape variation applied to the valve plate gap surface has on power loss in the cylinder block-valve plate interface. Special attention is given to the relation between gap height, operating parameters, surface design and power loss. The effect of waved surface amplitude and frequency is also studied. Results indicate that power loss in the cylinder block-valve plate interface can be reduced by over 50 % on account of the waved surface compared to the standard cylinder block-valve plate interface design. The effect of the waved surface is most significant at low operating pressures. A special in-house code has been used for this research study. The simulation model covers fluid-structure interaction and micro motion of the cylinder block resulting from oscillating piston forces. Details of the model are explained. The model predicts the pressure and velocity fields generated in the lubricating film and calculates leakage, viscous friction and power loss.

Keywords: lubricating gaps, cylinder block-valve plate, axial piston pump, waved surface, energy dissipation

COMPOSITIONAL MODELLING OF FLUID POWER SYSTEMS USING PREDICTIVE TRADEOFF MODELS

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Abstract

System-level decisions can have a large impact on the success of any design project, including those in the fluid power domain. Regardless of efforts by designers to optimize individual fluid power components, poor decisions at the systems level can lead to poor system performance and unsatisfied design requirements. In this paper, we apply the principles of system-level decision making to the design of fluid power systems. We describe a methodology for modelling fluid power component technology using predictive modelling and data mining techniques in a way that facilitates system-level modelling and decision making. We demonstrate the approach on the design of a hydraulic log splitter.

Keywords: systems design, tradeoff modelling, parameterized Pareto frontiers

MECHANICAL MODELLING OF A BENT AXIS PUMP

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Abstract

In the technical literature numerous studies are found focused on the mathematical modeling of mechanical aspects of swash plate axial piston pumps. Instead, bent axis pumps are rarely considered despite their widespread use in mobile and fixed applications. This research paper presents the mechanical model of a bent axis pump that simulates the dynamic behaviour of the main measurable quantities (e.g. the shaft torque) and the mutual forces in interacting components. The model is parametric and thus apt in predicting the influence of geometric design variables on pumps mechanical characteristics. A number of simulation analyses grounded on the presented model and on an ADAMS multibody approach are considered and contrasted one another and with experimental torque data for validation purposes.

Keywords: bent axis pump, modeling, simulation

JAMMED ON/OFF VALVE FAULT COMPENSATION WITH DISTRIBUTED DIGITAL VALVE SYSTEM

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Abstract

The digital valve system is an on/off valve based directional flow control valve capable of accurate control of hydraulic actuators. The presented system has good features concerning fault tolerance since it can detect, diagnose and compensate faults on-line. This paper concentrates on fault compensation when a valve has jammed in the open –position and the system has internal leakage. The system can adapt to the fault and continue operation with only a small degradation in performance. This feature is unique in the area of hydraulics since the system has no extra components added. The cost for this compensation is increased calculation in the controller and increased energy consumption if a fault occurs. If these downsides can be accepted the system can be considered fault-tolerant and it could be used even in critical applications where failing is not an option. Fault tolerance can also be introduced as standard in every modern hydraulic application where good performance and fault tolerance are needed.

Keywords: digital hydraulics, valve faults, compensation
