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OIL-HYDRAULIC POWER UNITS - STATE OF THE ART

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ABSTRACT

Despite the evolution of electric drives and their undeniable advantages, hydraulic systems play an important role in today's technologies. Due to the ability to operate enormous power densities, industrial hydraulics are irreplaceable when large forces and binaries are required. Its importance can be characterized by the economy it represents and by the development potential associated with scientific interest. This paper summarizes the technologies used in the production of oil-hydraulic power, seeking to identify the trends of development and the research opportunities that come from the demands of the current developments.

Keywords: oil-hydraulic, fluid power, efficiency, digital hydraulic.

INTRODUCTION

The production of hydraulic power comprises the transformation of electrical energy into hydraulic energy just as it is necessary for the actuators. The technology to perform this transformation in the most efficient way possible has been the subject of research over the years. The quality of the hydraulic power supplied to the actuator is part of the central concerns in the oil-hydraulic power unit projects.

Although the performance of the hydraulic components is individually good, the overall efficiency of hydraulic systems is generally low, as pointed out by (Heikkilä and Linjama, 2013) and (Linjama and Vilenius, 2005). According to the study by (Love et al., 2012), the energy consumed in the USA in the fluid power sector in 2011 was between 586 and 849 TWh, producing 308 to 380 million tons of CO_2/Year. Oil-hydraulic and pneumatic systems have an average efficiency of only 22%, in which the mobile oil-hydraulic contributes 21% and the pneumatic with 15% as reported by the same author.

According to the US Census Bureau, in 2008 the annual turnover in fluid power was over $244 billion providing more than 750,000 jobs. Considering that the US economy is 1/3 of the world economy (Stelson, 2011) there is a significant economic and scientific potential development.

RESULTS AND CONCLUSIONS

Resistive or throttling control is the most common way to control hydraulic actuators, (Linjama et al., 2015). Since it is a dissipative control process, its efficiency is very low, as documented by (De Negri et al., 2014) and (Xue et al., 2016). The dynamics and low cost of hydraulic power units with resistive control make this type of technology widely implemented.

Volumetric control systems have been implemented instead of resistive control systems when there is increased concern about energy savings., (Heitzig et al., 2012) e (Liermann, 2013).

Volumetric control based on frequency inverters has been widely used for energy savings in hydraulic power units in recent years (Sugimura and Suzuki, 2012). The advantages associated with the use of variable displacement pumps can be achieved with fixed pumps and speed motor control. However, this type of technology has a reduced dynamic due to the dedicated control that is associated.

The concept of Digital Hydraulic Power Management Systems (DHPMS), seeks to meet the market demand for ever more efficient hydraulic systems. In order to compete with electromechanical systems, DHPMS must have high efficiency, dynamics, competitive implementation costs and widely studied control systems.

Research has shown that the total efficiency of DHPMS systems can reach 80% (Heikkilä et al., 2010). These values vary considerably with the working pressure. However, according to the same author, as the working pressure increases, the volumetric efficiency decreases and the hydro mechanical efficiency increases.

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