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Procedia Engineering 69 (2014) 512 – 517

Procedia Engineering

www.elsevier.com/locate/procedia

24th DAAAM International Symposium on Intelligent Manufacturing and Automation, 2013

Power Analysis of an Axial Piston Hydraulic Machine of Power-Intensive Hydraulic Drive System

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Abstract

Technical characteristics of positive-displacement hydraulic machines determine the prospects of increased application for known positive properties of positive-displacement hydraulic drive to improve machines of modern technologies performance characteristics. In return, an application of positive-displacement hydraulic drive is being restrained with comparatively high value of a start and reverse inert zone and, as a consequence, comparatively low speed adjustment range. That is resulting from volumetric and mechanical high level losses comprised hydraulic machines. For removal of disadvantages, searching a new hydraulic motors structural diagram should be done.

Keywords: Mechatronics; hydraulics; power drives

1. Introduction

Technical characteristics of positive-displacement hydraulic machines determine the prospects of increased application for known positive properties of positive-displacement hydraulic drive to improve machines of modern technologies performance characteristics.

The positive-displacement hydraulic drive has wide and varied range of application in modern technology. Traditionally, hydraulic drive is applied where the fast response, rapidity, small dimensions, large transmitted power and automated control are required.

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doi:10.1016/j.proeng.2014.03.020

The throttle control of high-power hydraulic drive is limited due to the low efficiency of a control process.

In return, an application of positive-displacement hydraulic drive is being restrained with comparatively high value of a start and reverse inert zone and, as a consequence, comparatively low speed adjustment range. That is resulting from volumetric and mechanical high level losses comprised hydraulic machines.

In recent times more advanced positive-displacement hydraulic drives are being constructed. This makes range of application to be extended in technology.

Global experience in the field of positive-displacement hydraulic drive allows assigning of two the most prevalent types of positive-displacement machines. These machines may be considered to be the base for engineering power-consuming drive with continuous loading conditions. These are:

- Bent axis hydraulic machines (BAH)
- Swashplate hydraulic machines (SWH)

The hydraulic machines with a bent axis (BAH) have comparatively low volumetric and mechanical level losses. As a consequence, reduced value of the start and reverse inert zone and increased adjustment range are occurred.

The hydraulic machines with swash plate (SWH) are more power-consuming, their dynamics and overall properties are higher.

Stated below research results and practical recommendations refer to the swashplate hydraulic machines. These machines are projected under a structural layout of widely known Sauer hydraulic machine type.

Given type of hydraulic machines is very promising. Primarily, because of the possibility of level operating pressure forcing.

Basic construction of swashplate hydraulic machines is being constantly improved and has suffered changes in recent years. That is allowed along with a simplification to increase level limit of operating pressure and to extend temperature span and range of regulation.

The main design concept grounds on application of hydrostatic unloaded slide bearing. Now this concept is still unchanged.

These hydraulic machines father development may be concentrate on pressure forcing, as also expansion of regulation range. This is possible as a minimum level of steady rotation frequency may be reduced.

Fundamentally, hybrid slider bearing has high alternative in design development.

The problem is to make design factors of slider bearing to meet the requirements of the operating conditions and external loading the best.

That is why the complete researches of hydromechanical processes in hybrid bearing of the swashplate hydraulic machines are necessary. The research results may be used for assessment of forced work mode, correct forecasting of losses and finding ways to reduce the losses.

Investigations of piston arrangements show, that hydromotors have high minimum level of steady rotation frequency at the start under the load. The reason for that is an interface seal leaks up to the breaking force. That is due to the significant friction load of piston mechanisms before motion start.

Because of the stated above feature of swashplate hydraulic motors, the inert zone of positive-displacement drive increases appreciably. The value of zone goes up then the operating pressure does. Here the inert zone shall be understood to mean a range of inclination of pump swash plate, by which hydraulic motor shaft is fixed.

This demerit is evident especially in the reverse mode and during the start under the load. By increasing inert zone the smooth running characteristic and accuracy of regulation process suffer.

For removal of disadvantages, searching a new hydraulic motors structural diagram should be done. The diagram has to save design and energy characteristics of the swashplate hydraulic machines. But alternatively, should improve force closure of the main part, providing reduction of superficial friction factor in a piston block.