Models for steady-state performance of hydraulic pumps: determination of displacement

W.J.A.E.M. Post

Eindhoven University of Technology
Department of Mechanical Engineering
W-hoog 4.108
P.O. Box 513, 5600 MB Eindhoven
The Netherlands

Abstract
Models for the steady-state performance of hydraulic pumps and motors are important for the modelling of hydrostatic transmissions. These models are not only necessary for predicting the performance of hydrostatic transmissions, but also in comparative studies of systems incorporating hydrostatic transmissions.

The models for these components can be roughly categorised into two groups. One of these groups can be regarded as mathematical models based on basic physical effects, the second group on fitting measured data. In common is a generally accepted mathematical model for the main types of losses. The first group of losses is referred to as flow losses, the other group as hydro-mechanical losses. In order to make a distinction between the main types of losses it is necessary that the displacement (per revolution) of the unit is not only known, but that its behaviour is also predictable. The general accepted "theoretical displacement" is expected to be constant for all conditions of the relevant quantities.

If the displacement is not constant, then no clear distinction can be made between effects caused by the variation in displacement and by other relevant quantities in the determination of the losses. In that case it is not possible to find adequate mathematical models for these losses.

In this paper several methods for the determination of the (theoretical) displacement of pumps are investigated and attention is paid to the uncertainty in the determination. The possible effects of the displacement not being constant are discussed on the basis of mathematical models for hydraulic pumps.

This study is based on theoretical and on experimental research.