Energy saving and system optimisation in cyclic loaded hydraulic power transmissions.

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Abstract
A number of hydraulically driven machines are subjected to cyclic loads. Also these loadcycles may sometimes be completely changed. This situation for the workload is found typically in transmissions of production machines. Conventional hydraulic transmissions are difficult to adjust to these variable load sequences with respect to energy-consumption. In this paper a new concept for the hydraulic energy supply for cyclic loads is presented. The proposed system is based on a conventional pump-accumulator energy supply system. A conventional accumulator system can save energy in cyclic loaded machines, but the reduction of the losses is limited by the introduction of system dependent losses.
In the proposed energy supply the potential of energy saving is nearly full exploited. In this system both the pump and the accumulator may be connected to or disconnected from the system. The hydraulic energy supply can thus be switched to a flow- or to a pressure system. Proper choice of the switch-times or duration of the time of connection during a cycle can lead to system pressure and system flow closely following the desired pressure and flow sequence. For different load cycles a different set of optimal switch-times have to be calculated in order to minimise the losses in the hydraulic power supply. In this paper attention will be paid to the method used to determine the optimal set of switch-times for a given load sequence. The optimization has to deal with a non-linear system with non-linear constraints. The design of optimal systems will be discussed and the theoretical results for energy saving will be shown. These theoretical results are compared with some practical results. Finally, the practical implementation of the proposed system will be discussed.