



The Next Generation of Hydraulic Controls

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Contact Information:

Dr. Lonnie Love
Phone: 865-576-4630
lovelj@ornl.gov
Dr. François Pin
Phone: 865-574-6130
pinfg@ornl.gov
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6305



Energy Efficient Hydraulics Through Quasi-Hydrostatic Control

(Reducing Energy Losses for High Performance Hydraulic Systems)

Technology Need

While hydraulics provide superior power to weight and power to volume ratios over electric actuators, hydraulics suffer from large energy losses in applications with large fluctuating loads. There is a need to improve the efficiency of these actuators without adversely affecting their performance.

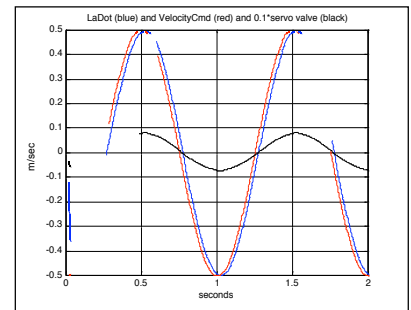
General Approach

Traditional hydraulic control has been achieved by means of a constant pressure hydraulic source utilizing a fluid control device such as a servo valve. A servo valve is notoriously lossy and can consume at least 1/3 of the overall power generated by the pumping source. The quasi-hydrostatic control approach, a combination of flow control (to reduce losses) and pressure control (to achieve good tracking) has been explored to address this deficiency. The specific advantage of this approach is a large reduction in the peak power required from the pump, resulting in significant improvements in efficiency.

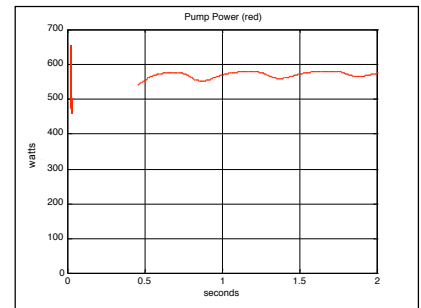
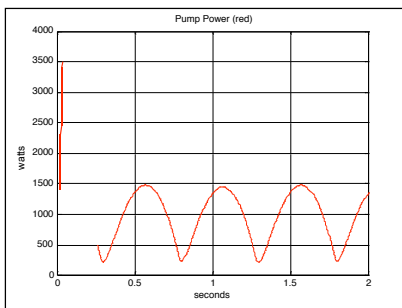
Example

As an example, a comparison was made between a conventional

constant-pressure control system and the quasi-hydrostatic approach on a single hydraulic cylinder by means of computer simulations. The peak power from the constant pressure pump, after the initial transient, is 1,500 W whereas the peak power from the quasi-hydrostatic controlled system is 570 W. The savings are even greater if the transients in the system are considered. Just as important, is that there appears to be little difference between the two methods in terms of the tracking performance. As can be seen from these simulations, a quasi-hydrostatic actuation methodology shows significant improvements in efficiency (maximum actuation power requirements cut in half) without sacrificing tracking.



Tracking for quasi-hydrostatic. (Similar to constant pressure.)



Power requirements for constant pressure and quasi-hydrostatic actuation. (Constant pressure on the left and quasi-hydrostatic on the right. Note the different scales.)