

Public Abstract

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Title:DYNAMIC AND EFFICIENCY CHARACTERISTICS OF AN INLET METERING VALVE CONTROLLED FIXED DISPLACEMENT PUMP

This project developed the inlet metering system. An inlet metering system represents a new option in hydraulic pump design. Traditional pressure controlled hydraulic pumps rely on either swashplate displacement (for variable displacement pumps) or bleed off valves (for fixed displacement pumps). Variable displacement pumps require mechanically complex parts which are expensive to machine and prone to break down. Bleed off valves represent a significant loss in system efficiency. In contrast, the inlet metering system is able to make use of a fixed displacement pump (which is relatively inexpensive and mechanically robust) and a two-way spool valve.

This dissertation goes through the process of designing the valve and pump dimensions, presents a theoretical dynamic analysis, studies the control law associated with this pump, and examines the energy requirements associated with inlet metering system operation. A prototype of the design was constructed and experimental data was used to validate the efficiency analysis.

The major finding associated with this work was that the inlet metering system can be designed to display a first order pressure response. This means that when the inlet metering system is operated, the actual pressure in the system will never exceed the desired pressure. In contrast, traditional hydraulic systems will display up to 60% pressure overshoot, meaning the systems must be designed to handle pressures significantly greater than operating pressures. Additionally it was found that the inlet metering system is more efficient than using a bleed off valve, but less efficient than using a variable displacement pump.