

Design of a Novel Actuation System for Variable Displacement Gear Machine

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External spur gear pumps are exceedingly useful components in common hydraulic systems. The main issue with external gear pumps is that all current models are limited to only fixed-displacement. This means that for every revolution of the gears inside the pump, a set amount of fluid will always be displaced. Consequently, external gear pumps are limited in their use because they can only operate at full throttle causing inefficiencies when reduced displacement is needed. The successful procurement of a variable displacement gear pump will allow a more efficient use of hydraulic systems, such as in the displacement controlled systems used in some heavy construction equipment. In this research approach, the displacement is varied by changing the timing of the gears inside the pump. More specifically, changing the timing of the gears' connections with the inlet and outlet grooves alters the available volume in the gears' spaces, subsequently varying the displacement. With this in mind, additional research was conducted to develop an actuation system for the aforementioned process. This includes the design of new gears, bearing blocks, and additional hydraulics for use in a modified existing commercial pump. Simulations have shown the implementation of the design allowed for a 67% reduction in displacement, and thus successful introduction of variable displacement into an external gear pump. Additional research is needed to determine the optimal designs for the actuation system and variable displacement concept used in the gear pump.