



# Pressure shifted and displacement adjusted valve timing

## Methods for adjusting hydraulic pump/motor valve timing.

**IP Status:** Provisional Patent Application Filed; **Application #:** 63/076,645

### Applications

- Hydraulic pumps and motors

### Technology Overview

All hydraulic motors and many hydraulic pumps require active valves to control flow entering and exiting the fluid chambers of the machine. Poorly designed valve timing and area profiles can cause a substantial decrease in efficiency due to throttling losses. In addition, the energy lost due to throttling is absorbed by the working fluid, raising the temperature of the fluid and requiring a larger cooling system.

Researchers at the University of Minnesota have developed new methods for optimizing valve timing of a hydraulic actuator/motor. This technology includes two different approaches: a pressure shifted valve timing approach, and a displacement adjusted valve timing approach. Both of these methods for changing valve timings allow for fully mechanical valve actuation, which is a more reliable method than electrical actuation. This technology offers a variety of methods to actuate the adjustable valve timing including hydraulic rotary actuators (vane or screw type), linear actuators, or electric motors coupled to gear drives. A key advantage of this technology is that the valve timing can be created using a fixed geometry, such as a simple valve plate (that is low cost), and the variability comes from angularly adjusting that fixed geometry. Other advantages include: Improved efficiency Reduced noise Higher reliability Simple implementation

### Phase of Development

**TRL: 2-3**

Proof of concept/simulation

### Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

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### Licensing Terms

### Technology ID

2021-043

### Category

Engineering & Physical  
Sciences/Design Specifications  
Engineering & Physical  
Sciences/Instrumentation,  
Sensors & Controls  
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### Researchers

- [James Donald Van de Ven, PhD](#) Professor, Mechanical Engineering
- [Thomas R. Chase, PhD](#) Professor, Mechanical Engineering

### References

1. Boyce-Erickson, Grey C., Thomas R. Chase, and James D. Van de Ven. , <https://doi.org/10.1115/FPMC2020-2779>, Fluid Power Systems Technology. Vol. 83754. American Society of Mechanical Engineers, 2020.