Hydrostatic Transaxle Dissection

Project III

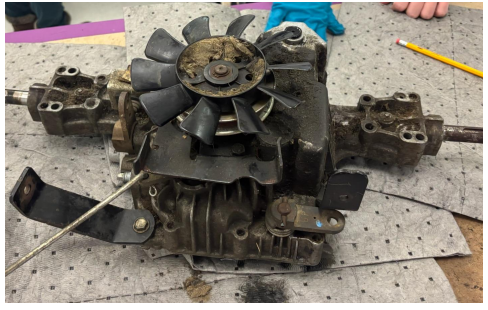
Fluid Dynamics

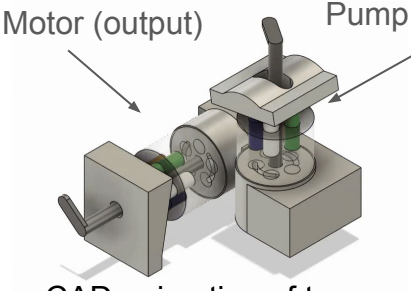
Purpose: Understand the fluid mechanics of a hydrostatic transaxle

Contributions: Disassembly, CAD, fluid mechanical analysis

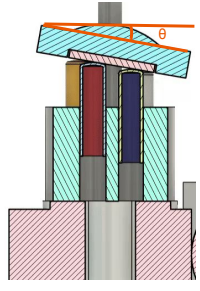
Technical details:

- Leveraged **hydrostatic equation** and **control volume analysis** to derive relations governing torque transfer and angular momentum given input pump angular speeds and swashplate angle
- Disassembled hydrostatic transaxle to understand principles of operation
- Designed a **CAD animation** in **Fusion 360** to illustrate the working mechanisms





CAD animation of transaxle



Displacement of pump

Pump Equations

Flow rate

$$Q = D_p(\theta)\,\omega_p$$

Positive displacement kinematics

$$D_p(\theta) = D_{\max}\sin\theta$$

Pump displacement

Motor Equations

Torque, Pressure, Efficiency

$$T_m = D_m \Delta p\, \eta_m$$

Momentum balance on piston control volume

$$\omega_m = \frac{Q}{D_m}$$

Continuity + control volume

Angular speed