Analysis of Fluid Characteristics in Double Acting Hydraulic Cylinders with Varied Piston Head Geometries Using SolidWorks Simulation

Supervised by (Azamataufiq Budiprasojo S.T., M.T)

Naufal Teguh Wijaya

Study Program of Automotive Machine

Majoring of Engineering

ABSTRACT

This study focuses on analyzing the fluid characteristics in double-acting hydraulic cylinders by varying the geometry of the piston head. The research aims to evaluate the effects of these geometric variations on fluid pressure distribution, push/pull forces, and overall system efficiency. The simulations were conducted using SolidWorks CFD 2022, with a fixed working pressure of 20 bar and a fluid flow velocity of 10 m/s. The piston head geometries tested include normal, fillet, inverted fillet, chamfer, and inverted chamfer designs. The results indicate that variations in piston head geometry significantly influence pressure distribution and force generation. The inverted chamfer and inverted fillet designs demonstrated superior performance, with more stable pressure distribution and higher push/pull forces compared to the conventional design. These findings align with Pascal's Law, confirming that larger surface areas yield greater force output. Additionally, the modified designs exhibited reduced pressure fluctuations, which can enhance the longevity of hydraulic fluid and system components. This research provides valuable insights for optimizing hydraulic cylinder designs in heavy machinery and industrial applications, offering a foundation for future studies on geometric modifications to improve hydraulic system performance.

Keywords*: Hydraulic Cylinder, Piston Head Geometry, Fluid Dynamics, SolidWorks Simulation, Pressure Distribution.*