CFD analysis of damping characteristics of a hydraulic damper through geometrical modification and velocity variation

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Shock absorbers or hydraulic dampers are a power dissipating device. Fluid flow passages are responsible for variation in the damping or hydraulic characteristics in terms of damping force with respect to velocity. The piston inside the damper has a various orifice or piston valves that cause different flow losses. They play a crucial role in the performance and stability of systems, especially those involving fluid dynamics and mechanical vibrations. In this work, a Computational Fluid Dynamics (CFD) method is used to study the flow behaviour inside a rear side two-wheeler automobile mono tube damper for different number of orifices in the piston which are two, six and ten orifices opening with changing the throttling velocities based on previous experimental work in the literature. ANSYS 17R software is used to carry out CFD analysis, the continuity, and the Reynolds averaged Navier-Stokes (RANS) equations are used to describe the throttling behaviour inside the rebound and compression chambers. A new proposed model comprises a modification of the throttle valve by changing one of the original models with 6 orifices with geometrical design freedom, aiming to achieve better damping characteristics and design freedom. The damping action has been studied and verified by throttling viscous oil through orifices for different cases. The damping action is not affected by changing the location of the orifice for the same number. It is concluded that the damping force increases with increasing the velocity of the piston. However, the damping coefficient decreases. The damping force decreases as the number of orifices increases in the piston valve. Creating designs that are safe both for the operator, the machine itself and the surrounding environment is par for the course with shock absorbing and vibration technologies.

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