AN INVESTIGATION OF COMBINED TWIN ACCUMULATOR SUSPENSION AND ANTI-LOCK BRAKING SYSTEM FOR PASSENGER CARS

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Abstract

Although anti-lock braking system and active suspension improved vehicle ride comfort, and reduced braking time and distance, their two main drawbacks are the required energy input levels and the high component costs for active suspension. The anti-lock braking system with twin accumulator suspension is proposed which addresses these two drawbacks. Braking and ride performances for twin accumulator are examined theoretically using half vehicle model. The effect of twin accumulator suspension elements on ride performance, the braking time and distance is investigated. The anti-lock braking system and twin accumulator suspension is compared with the anti-lock braking system (ABS) combining passive suspension. The results obtained showed that twin accumulator suspension with the anti-lock reduces braking time and distance compared with twin accumulator suspension. Also, the anti-lock braking system and twin accumulator suspension improves ride comfort, however, it does not reduce time and distance to improve safety in vehicles compared with ABS combining passive system.

Notation

A	Vehicle aerodynamics reference area	Mb	Body mass.
Af,r	Front and rear cylinder cross section area.	Mt	Total vehicle mass.
$C1f, C2f$	First and second front valves damping coefficients.	Mwf,Mwr	Front and rear wheel mass.
$C1r, C2r$	First and second rear valves damping coefficients.	$Q2f,r$	Flow through the front and rear second valve.
Fd	Aerodynamic drag force.	$\dot{Q}2f,r$	Flow rate through the front and rear second valve.
Frf, Frr	Front and rear tyres rolling resistance forces.	Rd	Front or rear wheel dynamic radius.
Fxf, Fxr	Front and rear tyre-road friction forces.	Tbf,Tbr	Front and rear brake torque.
Fzf, Fzr	Front and rear normal force	V	Vehicle longitudinal acceleration.
H	Vehicle height from center of gravity to the road surface.	Zbf, Zbr	Front and rear body vertical displacement
Ip	Body moment of inertia	Zof, Zor	Front and rear road input
Jwf, Jwr	Front and rear wheel inertia.	Zwf, Zwr	Front and rear wheel vertical displacement
$K1f, K2f$	First and second front accumulators stiffness.	$\Xi n1,2,3$	Constants depending on the type of road.
$K1r, K2r$	First and second rear accumulators stiffness.	λ	Longitudinal wheel slip ratio.
Ktf, Ktr	Front and rear tyre stiffness.	Θ	Body pitch angle
Lf, Lr	Front and rear distance from front and rear axle to center of gravity.		