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Vehicle model simulation to predict the judder vibration reduction performance of hydraulic bushing

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A Generally, judder vibration is a low-frequency vibration phenomenon caused by a braking force imbalance that occurs when a vehicle is lightly decelerated within a range of 0.1 to 0.2g at a speed of 120 to 60 km/h. This comes from the change in the brake disk thickness (DTV), which is mainly caused by the side run-out (SRO) and thermal deformation. The adoption of hydro-bushing in the low arm G bushings of the vehicle front suspension has been done in order to provide great damping in a particular frequency range (<20Hz) in order to prevent this judder vibration from being transmitted to the body. The hydro bushing was formulated using a lumped parameter model. The fluid passage between the two chambers was modelled as a nonlinear element such as an orifice, and its important parameters (resistance, compliance) were measured using a simplified experimental setup. The main design parameters are the ratio of the cross-sectional area of the chamber to the fluid passage, the length of the fluid passage, etc., and their optimal design is such that the loss angle is greater than 45° in the target frequency range of 10 to 20 Hz. The hydro bushing designed for reducing the judder vibration was prepared for the actual vehicle application test and applied to the actual vehicle test. In this study, the proposed hydro bushing was applied to the G bushing of the low arm of the front suspension system of the vehicle. The loss angle of the manufactured hydro bushing was measured using acceleration signals before and after passing through the bushing. The actual vehicle test was performed on the noise dynamometer for the performance analysis of the judder vibration reduction.

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