Suppression of Low-frequency Lateral Vibration by Improving the Response of Pneumatic Actuator for Tilt Control

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Tilting vehicles have a certain problem area causing a possible motion sickness as caused by tilting delay on transition curve tracks and low-frequency rolling motions on straight tracks. The purpose of this study is to try to cope with this problem by controlling tilt angle toward the ideal target angle precisely with high response actuator. The new actuator have acquired high response and control stability by the following features: The driving source is pneumatic power as with a conventional system. For the servo valve, the flow control valve has been used for the reason of its good flow characteristics. In addition, the tilt damper, mounted parallel with the tilt actuator in conventional system, has been removed to reduce the friction. Furthermore, to ensure the control stability, the rate change of the piston speed of the actuator was fed back to the control algorithm. To examine the effect of the new actuator, we analyzed the ride comfort of a full vehicle model by multi-body dynamics simulation. We calculated motion sickness dose value for lateral motion (as abbreviated MSDVy) and ride comfort level (L_T) from the acceleration observed on the floor of the vehicle body. Consequently, we have indicated that the proposed system with the flow control valve was able to suppress the low-frequency lateral vibration, which causes motion sickness.

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