講演番号	036

文献番号	20225036

Extraction of Vehicle Motion Characteristics to Reduce Passenger's Head Motion for Suppressing Motion Sickness in Autonomous Driving

Kenta Maeda, Takahiro Ito, Junya Takahashi, [1] Kentaro Ueno, Shuji Ohshita, [2] Kai Watanabe, Ryoga Hoshino, Yoshio Kano, Makoto Yamakado, Masato Abe [3]

1) Hitachi, Ltd.
832-2 Horiguchi, Hitachinaka, Ibaraki, 312-0034, Japan (E-mail: kenta.maeda.ya@hitachi.com)
2) Hitachi Astemo, Ltd.
4-7-1 Onna, Atsugi, Kanagawa, 243-8510, Japan
3) Kanagawa Institute of Technology
1030 Shimo-ogino, Atsugi, Kanagawa, 243-0292, Japan

KEY WORDS: **vehicle dynamics, chassis/component, dynamic model,** motion sickness, head motion [B1]

In this paper, the head motion of the passenger is measured and analyzed to extract the feature of the vehicle motion to reduce passenger's head motion and the possibility of motion sickness. This paper focuses on MSI (Motion Sickness Incidence), which predicts the susceptivity of motion sickness based on vehicle motion and passenger's head motion.

First, we hypothesized that G-Vectoring Control (GVC) as shown in Fig. 1 could reduce head motion, and verified its effect using the Driving Simulator (DS), confirming that it suppressed head motion in some subjects as shown in Fig. 2.

Second, in order to clarify the relationship between GVC and head motion, a head motion model based on viscoelasticity and active roll was derived as following state equation.

$$\begin{bmatrix}\dot{\theta}\\ \ddot{\theta}\end{bmatrix} = \begin{bmatrix}0 & 1\\ -\frac{K}{M} & -\frac{C}{M}\end{bmatrix}\begin{bmatrix}\theta\\ \dot{\theta}\end{bmatrix} + \begin{bmatrix}0\\ \frac{1}{r} - k_h\end{bmatrix} a_y$$

Then, the head motion model was modified based on the hypothesis of a mechanism in which the passenger naturally acts to strengthen the stiffness (viscoelasticity) of the neck due to the perception of longitudinal acceleration, as shown in Fig. 3.

The head motion at GVC ON was compared with that predicted by the model as shown in Fig. 4. As a result, the model was not able to reproduce the actual reduction in head motion.

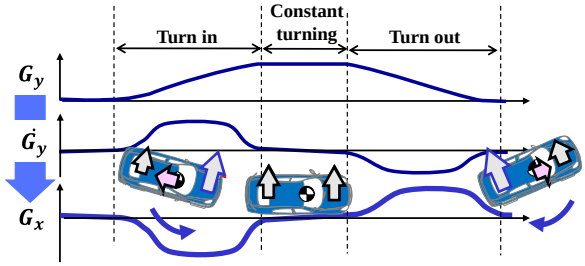
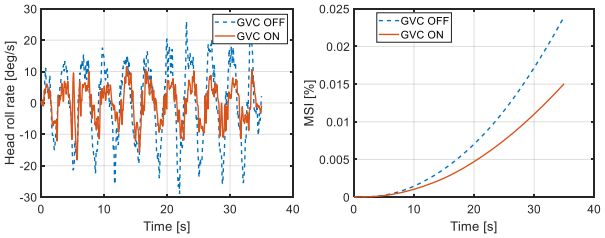


Fig. 1 Concept of G-Vectoring Control (GVC).



(a) Head roll rate. (b) MSI.

Fig. 2 Waveform of head roll rate and MSI of subject 7.

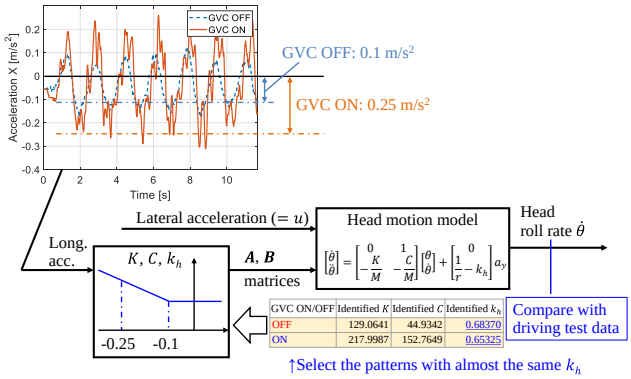


Fig. 3 Change ***A*** and ***B*** according to longitudinal acceleration.

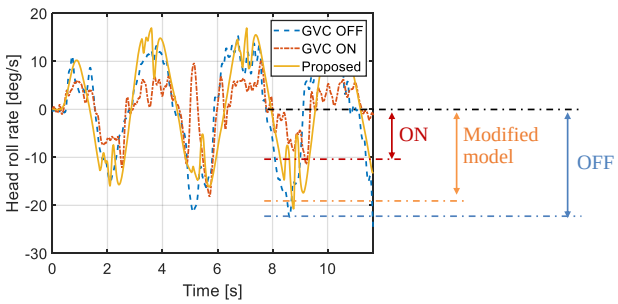


Fig. 4 Head roll rate compared with DS data and predicted.