

Principles and applications of DYC in transient state. 3rd report.

Shigeharu Shibahata ¹⁾ Yasuji Shibahata ¹⁾

¹⁾Vlabo

2 wakabayashi, Setagaya, Tokyo, 154-0023, Japan (E-mail: yasuji_shibahata@yahoo.co.jp)

KEY WORDS: vehicle dynamics, electronic stability control, motion control, yaw moment, DYC, transient state

It has been empirically said by many 4WD developers that 4WD vehicles with the same specifications have better straightness at high speeds than 2WD vehicles. In this report, we focus on the yaw moment caused by the friction of the two differential gears in the front and rear of the 4WD vehicle, and examine the steering response and crosswind disturbance sensitivity of the vehicle. The yaw moment of a 4WD vehicle generated in proportion to the yaw rate by the differential gear is almost twice that of a 2WD vehicle. As a result, the steering responsiveness of the 4WD vehicle is improved as compared with the 2WD vehicle, and the disturbance suppression effect against crosswinds is improved by about 5%.

1. Clarified the front-rear driving force distribution characteristics of a 4WD vehicle with a torque control clutch. It was found that the driving force distribution ratio of rear axle can be controlled from 0 to 50% or more by appropriately setting the rear wheel acceleration ratio. In this report, the study was conducted assuming that the front-rear driving force distribution ratio is constant at 50%. (Fig.1)
2. As a result of examining using ramp steering and sine cycle steering as typical steering angle inputs, it was found that the steady response gain at a small steering angle is reduced and the damping property is improved in the 4WD vehicle compared to the 2WD vehicle. The difference between the 4WD vehicle and the 2WD vehicle becomes more pronounced as the steering angle becomes smaller. (Fig.2)
3. It was found that the yaw rate peak value generated for the crosswind disturbance input at the wind speed, which is likely to be encountered on a daily basis, is reduced by about 5% in the 4WD vehicle compared to the 2WD vehicle. (Fig.3)
4. It is considered that the above-mentioned difference in steering response characteristics and disturbance sensitivity of 4WD vehicles to 2WD vehicles is one of the reasons why it has been empirically said that "4WD vehicles have a better sense of straightness at high speeds than 2WD vehicles."

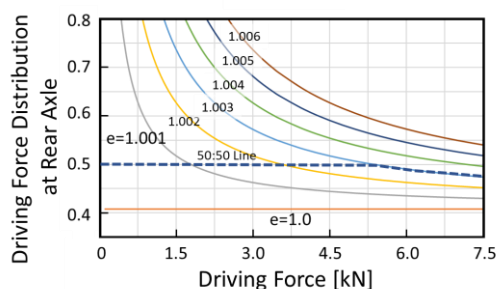


Fig.1

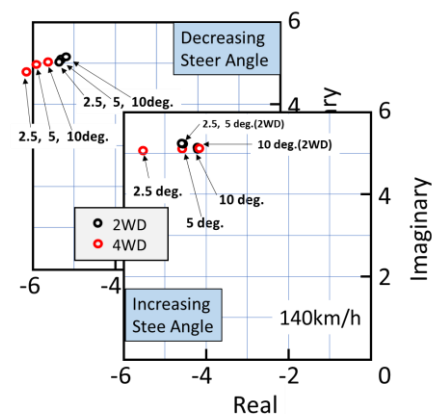


Fig.2

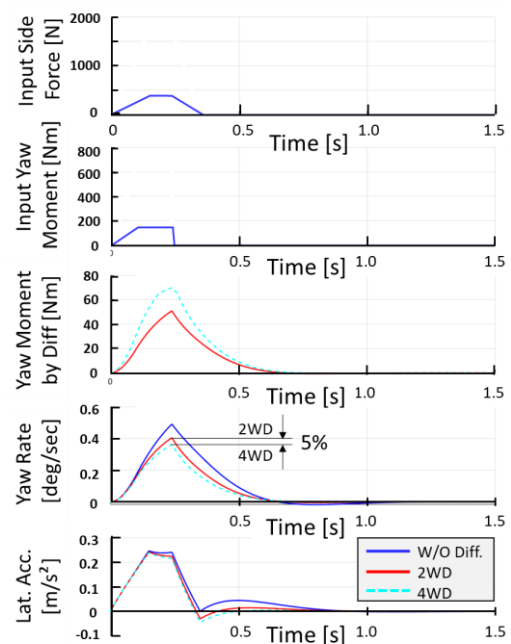


Fig.3