

## Driver longitudinal-acceleration control model combined with vehicle-lateral motion

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Some approaches to emulating expert driver's longitudinal and lateral integrated control using jerk information are studied in this paper. A trade-off strategy between longitudinal traction versus cornering traction was extracted experimentally by using jerk information to observe voluntary braking and turning during driving. The strategy is realized by determining the longitudinal acceleration command during combination motion by vehicle lateral jerk. The vehicle dynamical rationality of the method is also evaluated by computer simulation in view of instantaneous handling characteristics. Applying the strategy, we made a longitudinal driver model that works in coordination with any steering input. Adopting a programmed handling model and a preview-follower model for the steering input, we carried out computer simulation. We also carried out cornering and braking lane-change experiments with an expert driver. The simulation results and experimental results agree well and we confirm the model can emulate a certain part of the expert driver's control strategy for trading off longitudinal and lateral accelerations.

A trade-off strategy between longitudinal traction and cornering traction is experimentally extracted from the driver's voluntary braking and turning features using jerk information.

Two key results were obtained.

First, a basic longitudinal-motion control strategy for coordination with lateral motion was proposed.

$$G_x = -\text{sign}(G_y \cdot \dot{G}_y) \frac{C_{xy}}{1 + Ts} |\dot{G}_y| + G_{x\_DC} \quad (15)$$

Where,  $G_x$ : longitudinal acceleration(command),  $G_y$ : lateral acceleration,  $C_{xy}$ : gain,

$T$ : delay time,  $s$ : Laplace transformation,  $\dot{G}_y$ : lateral jerk,

$G_{x\_DC}$ : Offset which will be decided independently of the lateral motion.

Second, the combination of a lateral driver model and a longitudinal driver model based on this strategy makes it possible to emulate part of an expert driver's coordination control strategy.

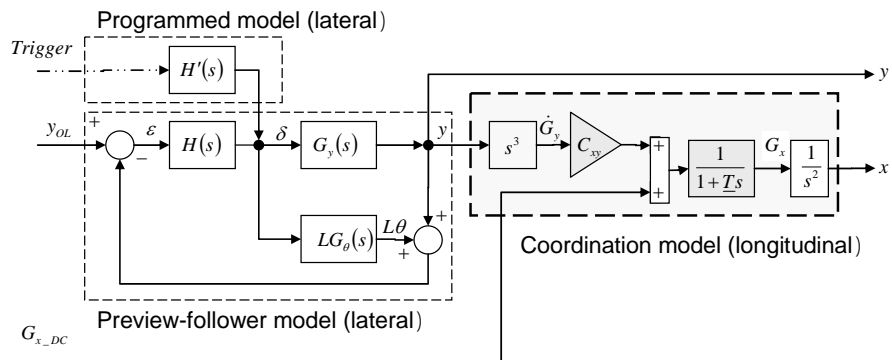


Fig. 1 Lateral and longitudinal coordination driver models

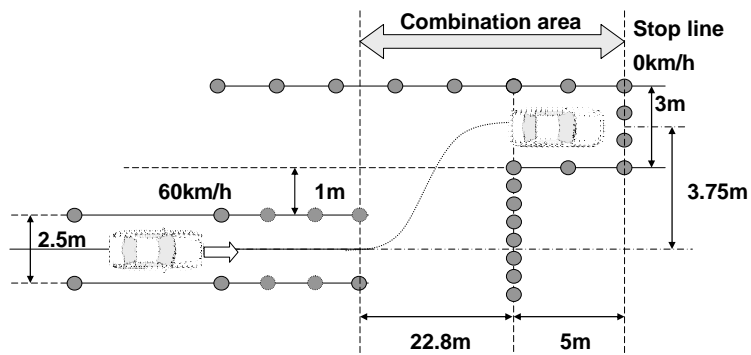


Fig. 2 Braking-lane-change task

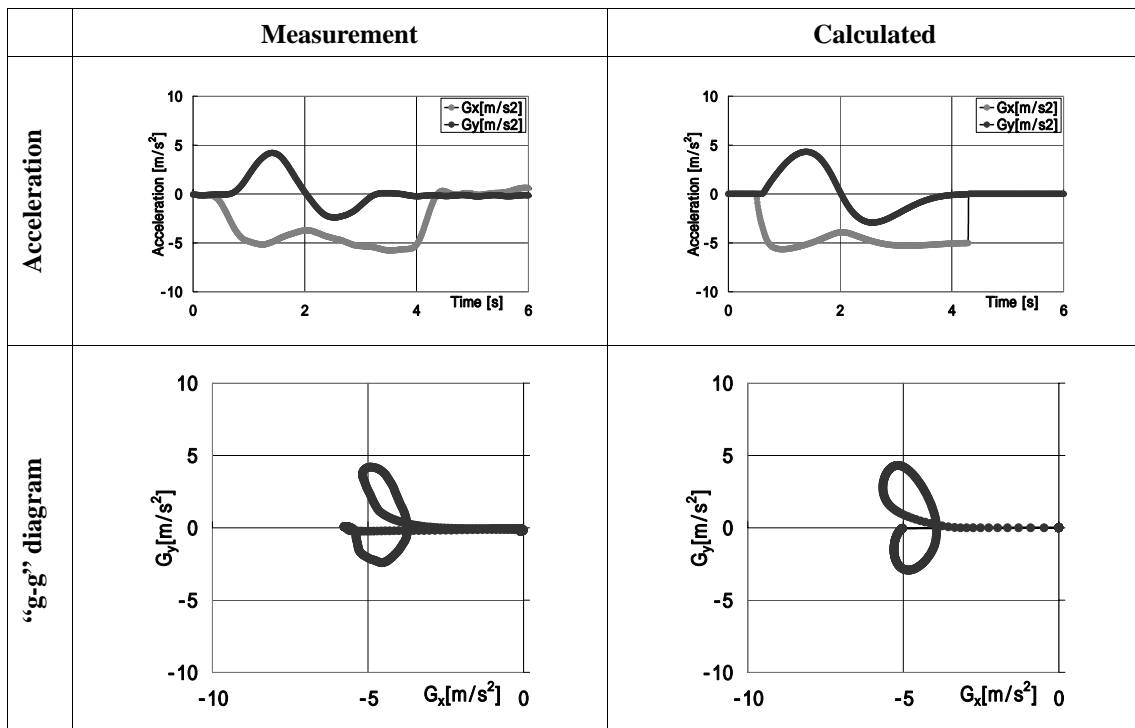


Fig. 3 Braking-lane-change