

1. Design vehicle stability controllers using the sliding surfaces as follows:

$$s_1 = \gamma - \gamma_{desired}$$

$$s_2 = (\gamma - \gamma_{desired}) + \rho \cdot \beta \quad \text{where, } \rho \text{ is negative.} \quad \text{- Eq.1}$$

2. evaluate the controllers through numerical simulations. The vehicle simulations should be conducted under the following conditions:

- Vehicle speed is 100 km/h.
- Front steering maneuver by a human driver and tire/road friction is shown in Fig.1.
- For numerical simulations, use the non-linear bicycle model in HW.3

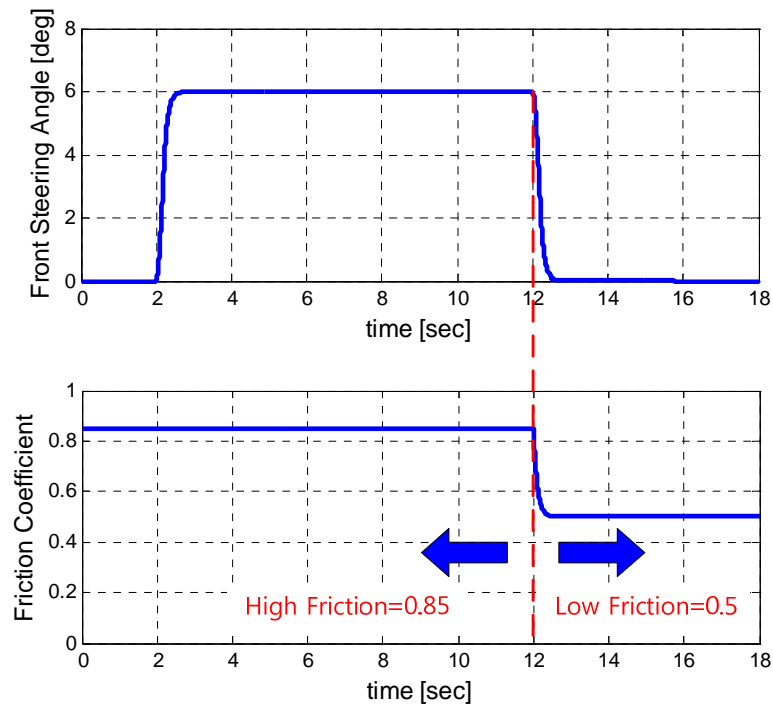


Fig.1 Front steering maneuver and tire/road friction

- (1) Compare vehicle behaviors for the two controllers, i.e., as body slip angle and yaw rate, with the different sliding surfaces given in Eq. 1.
- (2) Compare state trajectory in $\beta - \dot{\beta}$ and $\beta - \gamma$ planes.
- (3) Compare control performances and discuss the control effectiveness of the sliding surfaces.