CONTROL SYSTEM THEORY   **Fall 2010**

HW#5   **Assigned: October 13 (We)**
                                                     Due: October 25 (Mo)

Consider a longitudinal vehicle model as follows:

The control inputs of the vehicle model are a throttle angle, brake pressure and an initial vehicle speed. The outputs of the vehicle model are a longitudinal acceleration, a vehicle speed, a shaft torque and a gear degree. The maximum value of throttle angle is 100 %. Also, the maximum caliper pressure is 20MPa.
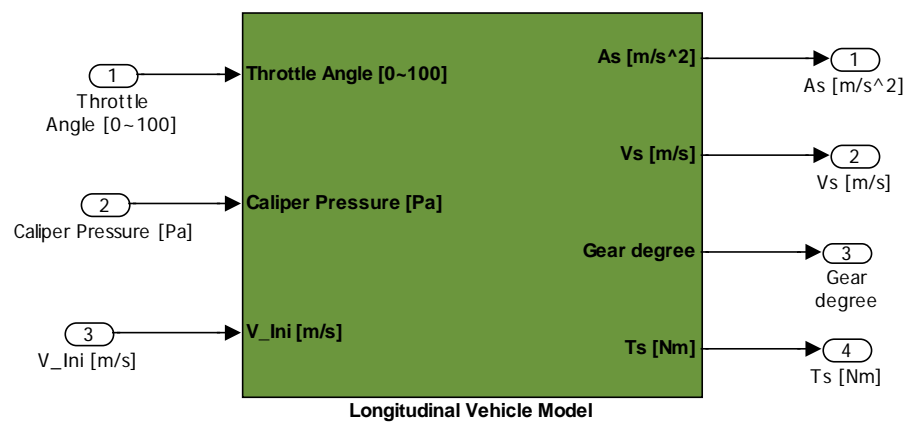

Fig.1 Longitudinal Vehicle Model

In order to track a desired acceleration for following the set speed or the preceding vehicle, the control input can be calculated as follows:

▪ Throttle Angle Input (when the desired acceleration is positive.)

$$\alpha(t) = -K_{P\_\alpha} \cdot \left(a_x(t) - a_{des}(t)\right) - K_{I\_\alpha} \cdot \int \left(a_x(t) - a_{des}(t)\right) dt$$

▪ Brake Control Input (when the desired acceleration is negative.)

$$P_b(t) = K_{P\_brake} \cdot \left(a_x(t) - a_{des}(t)\right) + K_{I\_brake} \cdot \int \left(a_x(t) - a_{des}(t)\right) dt$$

1. Design a speed controller for following the set speed profile as shown in Fig.2

(a) Compare the set speed profile and a longitudinal speed.

(b) Compare the desired acceleration and a longitudinal acceleration.

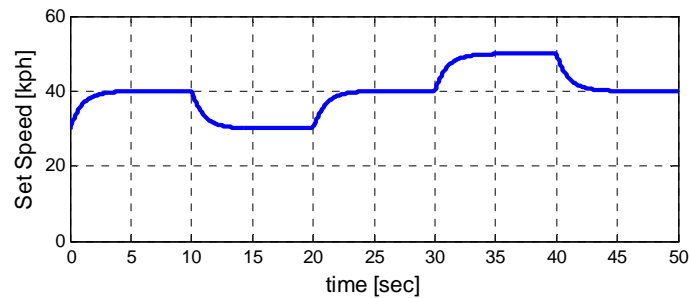(c) Plot control inputs such as a throttle and a brake pressure.

Fig.2 Set Speed Profile [kph]

2. Design a SCC algorithm for following the preceding vehicle as shown in Fig.3 The initial
clearance is 13m.

(a) Compare the preceding vehicle speed and a longitudinal speed.

(b) Compare the desired clearance and a clearance between a preceding vehicle and a subject vehicle.

(c) Compare the desired acceleration and a longitudinal acceleration.

(d) Plot control inputs such as a throttle and a brake pressure.
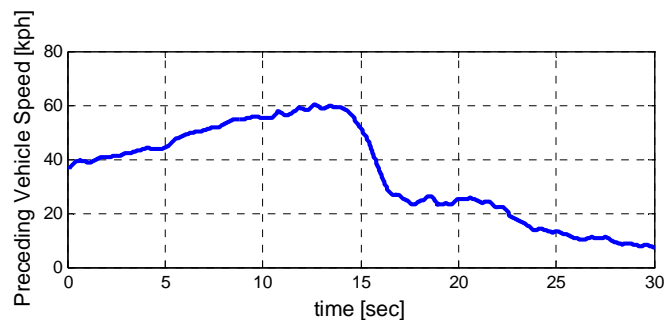

Fig.3 Speed Profile of Preceding Vehicle [kph]

[Notice]

Longitudinal vehicle model in Fig.1 and the speed profile shown in Fig.3 are uploaded in the below
internet address.

- Web-Site: http://vdcl.snu.ac.kr/

- File name of Vehicle Model: "Longitudinal_Vehicle_Model.mdl "

- File name of Speed Profile of Preceding Vehicle: "Preceding_VehicleSpeed.dat "