**4 compare the behaviors in terms of safety comfort and system response**

Using our simulation, adaptive cruise control has been implemented with three different scenarios:

1. The first one using a simple threshold to change between velocity control and spacing control algorithms
2. Secondly, it calculates both velocity control and space control in the way that it uses the minimum of SC and VC for the leading distances more than target distances, otherwise using SC.
3. At last, to solve possible chattering in the state transient when the relative distance is near the target distance, the hysteresis algorithm has been implemented.

**Simulation Results:**

Figure 1Acceleatios

As shown in figure 1, the first one has lots of temporary quick changes which is not suitable for torque generators (engine here); moreover, it has a very fast and big overshoot. To put it in a nutshell, Although this method is not that bad concerning the safety measurements as a result of its fast response, it would cause possible damages to the engine and also lower the passenger's comfort. The second algorithm has the least over/undershoots, fastest in responding to changes. The third one, however, is slower than the second algorithm and has some underdamped (ζ < 1) oscillations in the way of reaching a steady state.

as it is shown in figure2, both first and third algorithm has not-negligible over or undershoots which lowers the passenger comfort and also safety in high speeds. Same as before, the second mode has the best result among all.

Figure 2Velocities

in figure 3, the relative distances are compared to the target safety distances. Here, it is possible to compare different algorithms more precisely for the safety criteria.

Figure 3Relative Distances

The first and the third ones have big undershoots in the relative distance which passes the afty distance. This problem could be very dangerous especially at higher speeds.

The second one is also passed the safety distance but in lower amounts and it fixes itself somehow fast.