Abstract

Vehicle platooning is one of the promising solutions to improve traffic performance in terms of traffic efficiency, fuel consumption, and road safety. The main objective of a vehicle platoon is to maintain a safe inter-vehicle spacing between adjacent vehicles in such a way that collisions are avoided in the presence of different disturbances and uncertainties. Platoons can be formed and maintained using either a vehicle's on-board sensors, or a combination of sensor information and inter-vehicle communication. Finding a method of controlling a vehicle platoon that can withstand adverse conditions safely is challenging. Platoon control can be differently affected by adverse conditions.

This project investigates the design of adaptive cruise control systems for autonomous vehicles in non-ideal communication and non-ideal actuation conditions. Analysis of the behaviour of a platoon in highway merging scenarios is compared to platoon behaviour in regular highway travel using computer simulations. The string stability of a platoon (i.e. how fluctuations from the leading vehicle propagate into the platoon) is strongly linked to safe behaviour. String stability across a range of non-ideal conditions is investigated for connected and non-connected controllers. The simulation results show that the string stability of a connected controller can be significantly degraded by non-ideal communications. The string stability of a non-connected controller can deteriorate due to non-ideal actuation conditions.

These results could inform future work into the critical factors that determine how adverse conditions may influence the decisions of a platoon controller.