Design of Switching Strategy for Adaptive Cruise Control Under String Stability Constraints

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Abstract:

An Adaptive Cruise Control (ACC) system is a driver assistance system that assists a driver to improve driving safety and driving comfort. The design of ACC controller often involves the design of a switching logic that decides where and when to switch between the two modes in order to ameliorate driving comfort, mitigate the chance of a potential collision with the preceding vehicle while reduce long-distance driving load from the driver. In this thesis, a new strategy for designing ACC controller is proposed. The proposed control strategy utilizes Range vs. Range-rate chart to illustrate the relationship between headway distance and velocity difference, and then find out a constant deceleration trajectory on the chart, which the following vehicle is controlled to follow. This control strategy has a shorter elapsed time than existing ones while still maintaining a relatively safe distance during transient process. String stability issue has been addressed by many researchers after the adaptive cruise control (ACC) concept was developed. The main problem is when many vehicles with ACC controller forming a vehicle platoon end to end, how the control algorithm is designed to ensure that the spacing error, which is the deviation of the actual range from the desired headway distance, would not amplify as the number of

following vehicles increases downstream along the platoon. In this thesis, string stability issues have been taken into consideration and constraints of parameters of an ACC controller are derived to mitigate steady state error propagation.

Description:

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