

Stability and Intervehicle Distance Analysis of Heterogeneous Platoons in Look-Ahead Topologies

Amir Zakerimanesh, *Student Member, IEEE*, Tony Z. Qiu, *Member, IEEE*, Mahdi Tavakoli, *Senior Member, IEEE*

Abstract - This paper investigates stability and intervehicle distances (IDs) of heterogeneous platoons under look-ahead topologies and disparity in control gains of position, velocity, and acceleration feedback. When it comes to transient intervehicle spacing, internal stability falls short in guaranteeing a non-colliding distance between vehicles. In other words, having a safe distance between neighboring vehicles requires choosing proper control gains among stable control gains.

As such, we formulate the behavior of IDs during platoon travel and find numerically suitable control gains. For formulation, we split the platoon into successive pairs of vehicles and find distance dynamics between neighboring vehicles. Since the platoon is in a look-ahead structure, for the stability of the platoon, we need successive stable distance dynamics. By setting collision and safe distance limits on the formulated IDs, we identify proper control gains for having a non-colliding platoon. Finally, simulation results are provided to illustrate the validity of the theoretical findings.