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Modeling and Control Design of a Centralized Adaptive Cruise Control System

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Abstract : A vehicle driving with an Adaptive Cruise Control System (ACC) is usually controlled decentrally, based on the information of radar systems and in some publications based on C2X-Communication (CACC) to guarantee stable platoons. In this paper, we present a Model Predictive Control (MPC) design of a centralized, server-based ACC-System, whereby the vehicular platoon is modeled and controlled as a whole. It is then proven that the proposed MPC design guarantees asymptotic stability and hence string stability of the platoon. The Networked MPC design is chosen to be able to integrate system constraints optimally as well as to reduce the effects of communication delay and packet loss. The performance of the proposed controller is then simulated and analyzed in an LTE communication scenario using the LTE/EPC Network Simulator LENA, which is based on the ns-3 network simulator.

Keywords : adaptive cruise control, centralized server, networked model predictive control, string stability
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