Abstract

Intelligent Transport Systems (ITS) are aiming to provide innovative services related to different modes of transport and traffic management, and enable various users to be better informed and make safer, more coordinated and smarter use of transport networks. Cooperative-ITS (C-ITS) support connectivity between vehicles, vehicles and roadside infrastructure, traffic signals as well as with other road users. In order to enable vehicular communications European Telecommunication Standards Institute (ETSI) delivered ITS-G5 - a of set of C-ITS standards. Considering the goals of C-ITS, inter-vehicle communications should be reliable and efficient.

In this thesis we study the performance, efficiency, and dependability of ITS-G5 communications for Cooperative adaptive cruise control (C-ACC) and platooning C-ITS applications. We provide an overview of currently available and ongoing standardization targeting communications in C-ACC/platooning. We study the performance of ITS-G5 beaconing in a C-ACC/platooning scenario, where we show that its performance may deteriorate when implemented in cooperative driving applications due to the kinematic-dependent design of the message triggering mechanism. We explain in detail the cause of this phenomenon and test it for a wide range of parameters. Also, we study the influence of different available ITS-G5 legitimate setups on the C-ACC/platooning fuel efficiency and demonstrate that proper communication setup may enhance fuel savings. This thesis also proposes a jamming denial-of-service attack detection algorithm for platooning. The main advantage of our detector is its short learning phase that not exceed a second and low detection delay of a few hundreds of milliseconds. Under some assumptions, the proposed algorithm demonstrates the ability to detect certain types of attacks with average probability above 0.9.