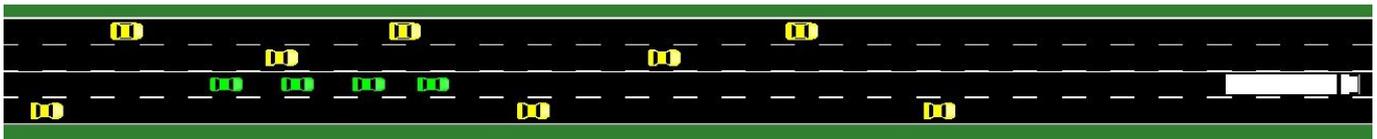


Bachelor/Master's Thesis

Cooperative Overtake Maneuver for Platoons

The ongoing growth of passenger transport leads to increased road traffic and pollution. Researchers and car manufacturers are trying to improve driving using Inter-Vehicle Communication (IVC), resulting in trends like Intelligent Transportation Systems (ITSs) or cooperative driving. One application there is Cooperative Adaptive Cruise Control (CACC) or *platooning*, which promises to improve today's driving a lot by increasing traffic flow, reducing fuel consumption, and improving safety.

Since forming such a convoy of vehicles requires complex *cooperative maneuvers* which usually is non-negligible effort, existing platoons should not be destroyed easily. On a freeway, which is the prime use-case for platooning, vehicles are driving with different speeds. A slower driving vehicle in front of a platoon could however tremendously decrease its beneficiary effects. Therefore, the entire platoon should instead perform a cooperative maneuver [1], [2] to overtake to slower driving vehicle.



■ Goals of the Thesis

The goal of the project is to design an algorithm for a cooperative overtake maneuver for a platoon of cars on a freeway. The maneuver should be based on V2X-messages that are exchanged between all members of the platoon. The algorithm should determine when it is necessary (and also safe) to overtake a slower driving vehicle and perform the overtake maneuver of the entire platoon without destroying it. In order to implement and test the algorithm, you should use Plexe¹ as a simulation framework.

To successfully complete this thesis, you need to do the following:

- Design an algorithm for the above task and implement it within the simulation environment.
- Evaluate its performance using well-stabled metrics, e.g., for safety and platoon benefits.
- Compare your approach with others, such as the (non V2X-based) one from Plexe.

■ Required Knowledge

You should have a basic understanding of *Vehicular Networking*, *Network Simulation*, and *Python*.

- [1] M. Düring, K. Franke, R. Balaghiasefi, M. Gonter, M. Belkner, and K. Lemmer, "Adaptive Cooperative Maneuver Planning Algorithm for Conflict Resolution in Diverse Traffic Situations," in *IEEE International Conference on Connected Vehicles and Expo (ICCVE 2014)*, Vienna, Austria: IEEE, Nov. 2014, pp. 242–249. DOI: 10.1109/ICCVE.2014.7297550.
- [2] A. Marefat, R. Aboki, A. Jalooli, E. Shaghghi, M. R. Jabbarpour, and R. M. Noor, "An adaptive overtaking maneuver assistant system using VANET," in *IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob 2014)*, Bali, Indonesia: IEEE, Aug. 2014, pp. 316–321. DOI: 10.1109/APWiMob.2014.6920314.

¹<http://plexe.car2x.org>