Master Thesis Description

Coordinated Control of Heavy-Duty Vehicles Powered by Overhead Lines

Prof. Dr. Sangyoung Park & Prof. Dr. Setareh Maghsudi

Introduction: Unless there is a revolution in battery technology in the near future, we expect that overhead wire support such as eHighway from Siemens Mobility will be an effective solution for relieving the range anxiety of heavy-duty vehicles. While the infrastructure resembles the power lines for trams or trolley buses, there is much larger degree of uncertainty as any vehicle with an interoperable pantograph could join and be powered by the system. If there are too many vehicles drawing power, the reliability of the DC grid could be compromised. For this reason, we assume a monitoring/controlling infrastructure, which communicates over vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I), is mandated in the future.

Figure 1. Siemens Mobility eHighway & Hybrid drivetrain (https://new.siemens.com/global/en/products/mobility/road-solutions/electromobility/ehighway.html)

Topic description: In this thesis topic, we aim at comparing a number of different approaches for controlling the vehicles to ensure the reliability of the DC voltage of the overhead lines and smooth traffic flow. Each vehicle controls their own motion, so it is basically a multi-agent system, but they are bound by common constraints coming from the overhead lines and traffic flow. The specific objectives are as follows.

- Formulating the problem as a multi-agent game
- Solve the problem using mathematical framework(s), for example, i) minority game, ii) multi-agent bargaining, iii) centralized solution (constrained optimization problem)
- Test the solution, for example, on a SUMO-based simulation framework
- Comparing the different approaches in terms of reliability of the DC lines and traffic flow rates

Preferred skills: Game theory, combinatorial optimization, electrical

Contact: Prof. Dr. Sangyoung Park (sangyoung.park@tu-berlin.de) **and** Prof. Dr. Setareh Maghsudi (maghsudi@tu-berlin.de)