

Semester Thesis or IDP

Modeling of Disruptions and Operational Conditions in Battery Electric Road Freight Logistics

Motivation

Road freight logistics operates under tight margins, while disruptions often cause substantial follow-up costs. At the same time, electrification, driven by the European Commission's emission targets, adds new constraints and decisions to daily operations. To realistically represent battery-electric truck (BET) fleets, it is essential to understand typical sources of disruption such as traffic congestion, weather effects, or unreliable actors in the supply chain, as well as operational conditions like time windows and order flexibility.

At the chair, several simulation models are developed that require a realistic integration of real-world logistics properties. However, current research lacks a comprehensive and systematic model that captures both disruptions and operational conditions in truck operations. This gap limits the realism and reliability of existing simulations.

Thesis topic

The objective of this thesis is to identify and characterize relevant disruptions and operational conditions for BET fleets. Building on this analysis, a scientifically grounded model will be developed in Python to enable more realistic simulations of BET operations in logistics. Existing modeling approaches from the literature should be reviewed, adapted, and integrated where suitable.

What you get

- Contribute to scientific research in a highly future-oriented field of commercial transport mobility
- In case of excellent working performance: Opportunity for a follow-up thesis work (master's thesis) and co-authorship in a scientific paper
- Close supervision with weekly meetings



Work packages

- Literature research disruption types and operational conditions, as well as existing approaches to model them
- Comparison of different modeling approaches
- Development of a framework to integrate disruptions and operational condition in order data
- Validation of the proposed approach
- Evaluation of key factors influencing disruptions

Requirements

- Passion for e-mobility and energy-transition-accelerating technologies
- Initial programming experience in Python
- Independent and structured way of working
- Very good German or English language skills

I am looking forward to receive your complete application with a CV, current overview of grades, a brief motivation, and any other documents. **The thesis can be written either in German or English.**

Contact

Fabian Bussieweke, M.Sc.
E-Mail: fabian.bussieweke@tum.de
Tel.: +49 (0) 89 289 10410

Start date

From now

Workplace

FTM (Garching Forschungszentrum) or remote