ETH zürich

Center for Sustainable Future Mobility (CSFM)

Results of the project **Rail Power:** **Power and energy for the future railways**

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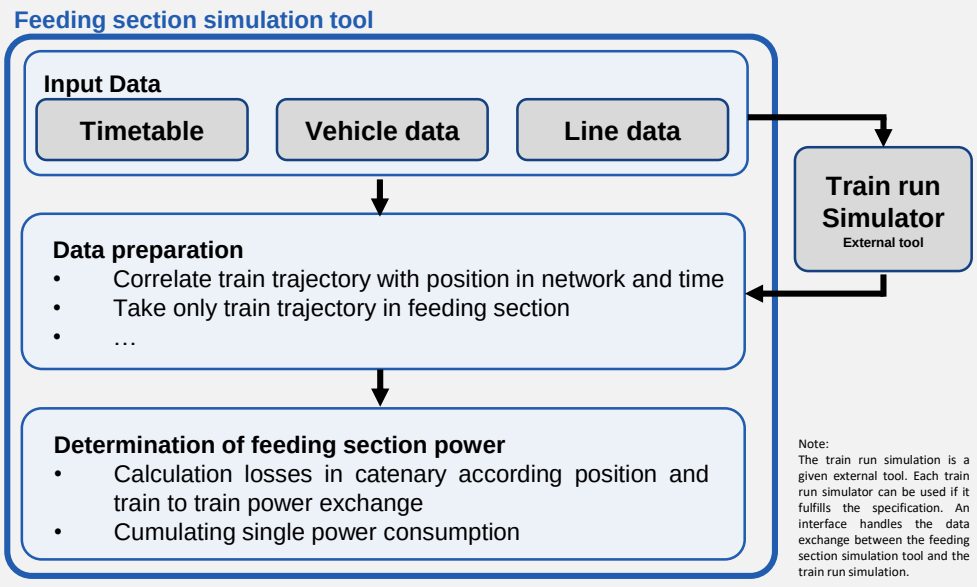
1 Introduction

The transportation sector's electricity consumption is expected to rise. This challenge makes it necessary to know how much energy is consumed. This research contributes to determining the impact of energy modeling for simulation, calibrating parameters, and developing a tool for simulating railway networks. Beyond this, probabilistic effects and future impacts will be investigated. In the following, three work packages (WP) of the project RailPower will presented.

2 Simulate a network with several trains (WP1)

Background
- The railway power supply is divided into different feeding-sections.
- A feeding section can be a single line or a network.
- A train journey usually crosses different feeding-sections
- The number of trains in each feeding section varies over time.
- In each feeding section, there can be interactions between multiple trains.

Goal:
- Develop a tool to simulate a network with several trains.



Verifying the tool by a 2 Step-Approach by using measurement data

Step 1 Using single train runs
- The train run simulator with its model is given
- The input parameters can be adapted (e.g., driving resistance)
  - ➢ Two calibration approaches were developed to determine the parameters.

Step 2 Feed section measurement
- The trajectories and power output are given and calibrated in Step 1
- Comparing and verifying the cumulated power consumption.
- Sources of error have been remove

3 Probabilistic effects (WP2)

The simulation of the train runs is influenced from:
- probabilistic effects and/or
- systematically technical effects.

Both can more or less influence power consumption and peaks.

It was examined, e.g.:
- Acceleration and declaration depending on train type and station
- Power Peaks and approaches for reducing them
- Dynamic efficiency and the impact on the energy consumption
- Temperature and their impact
- Data analyses to determine correlations

4 Future influences and scenarios (WP3)

- Overview of future influences of railway and power consumption
  - ➢ Report which considers +50 fields, identified according to +190 references
- Determining the impact of energy models on power consumption and energy-efficient train control. At EETC, the usual applied simplified modeling of energy
  - ➢ overestimate energy saving,
  - ➢ determines not the most energy-efficient trajectory.

5 Conclusion and expected impact

- The feeding section simulator, developed in this project, enables the Swiss Federal Railway to simulate the power demand of today's network now and the future timetables and networks. The tool can deliver many results for the SBB in the next few years. (WP1)
- Probabilistic effects (e.g., power peaks) significantly impact power supply, can be strongly reduced by control measures, and are an ongoing research topic. (WP2)
- Simplified modeling overestimates energy saving and does not reach the maximum saving potential.

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