Development of a simulation model for the assessment of a train energy consumption

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Evaluating the energy consumption of a train is no easy task, as multiple factors need to be considered, such as the characteristics of the vehicle, the driving strategy adopted and the signalling system implemented for regulating the train speed and distancing. Simultaneously, being able to assess the energy required throughout a railway operation is a crucial step towards its optimization, which has wide implications in the sustainability, resilience and efficiency of the railway system.

Another pivotal element of the energy consumption assessment of an electrical train is the estimate of the energy recovered through the mechanism of regenerative braking. It consists in re-entering some of the energy expended during the traction phase, making it available for other trains in the same railway area (usually delimited by substations on the track). With the implementation of this technology it is possible to drastically reduce the energy consumption of railways operations, therefore making its evaluation crucial for the state-of-the-art modelling of a railway-focused energy consumption assessment system.

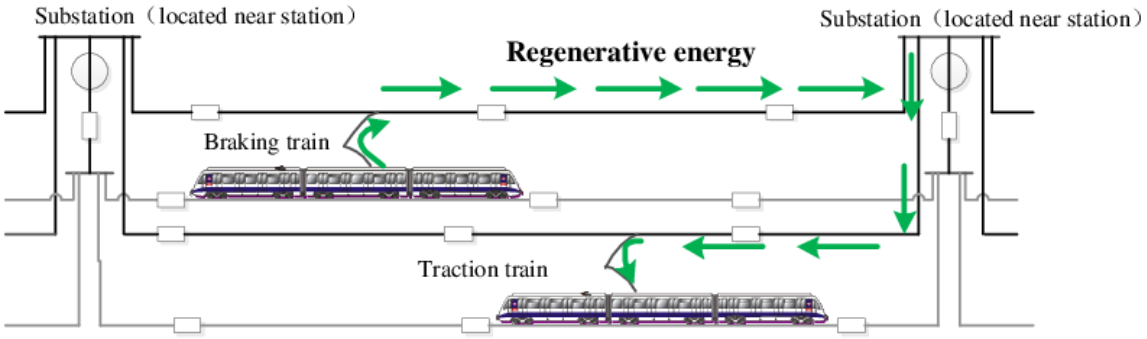

Figure 1: Scheme of the regenerative braking procedure.

This thesis project builds upon a simulation environment already developed in Matlab/Simulink, which emulates the longitudinal behaviour of two trains along a prescribed route. The simulator is capable of work under a varied set of conditions, mainly concerning the service to perform, the dynamical characteristics of the vehicles, the behavioural model of the drivers and the signalling system adopted. However, it currently lacks a module concerning the energy consumption evaluation and the control of the speed, which would be the focus of this project, alongside the general advancement of the simulator.

The thesis will be developed within the PNRR national research plan. Therefore, it will offer the candidate the possibility to work in a challenging and stimulating environment, in a multidisciplinary working group, composed also of industrial and other academic partners.