Development of an optimization model for railway traffic management in large stations

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Railway traffic management is a complex topic, as it encompasses different disciplines and fields of study, such as mechanics, automation, computer science and operational research. Moreover, different techniques and strategies could be adopted to enhance the efficiency of the railway system in different circumstances, the main example being traffic optimization along the tracks versus within the station areas. This thesis focuses on the latter case and has the aim of developing an optimization tool for minimizing the delay experienced by passengers within large stations when the traffic is subjected to perturbations.
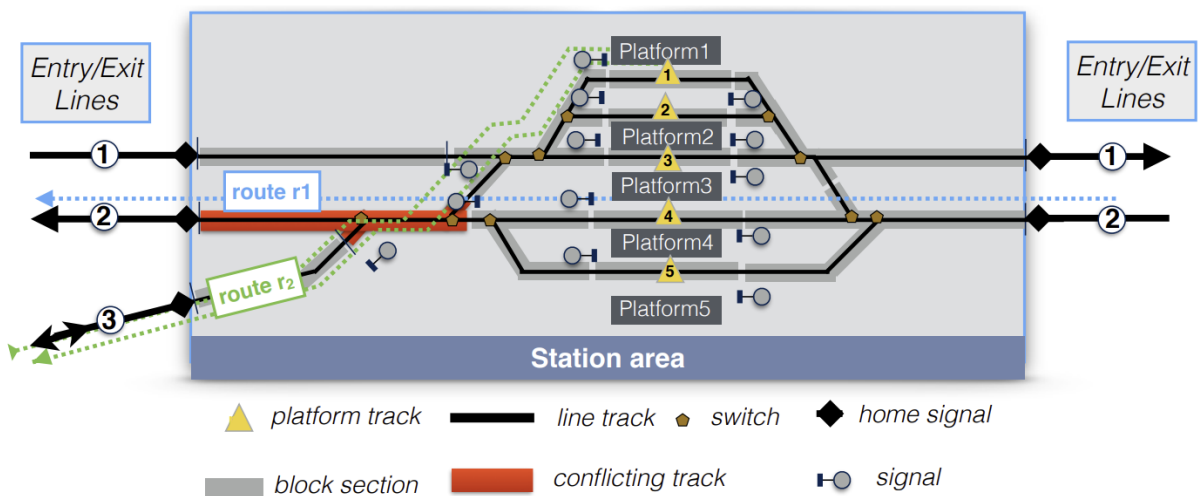

Figure 1: Example of a railway station layout. Figure taken from "R. García-Ródenas et al. 'A Mixed-integer Linear Program for Real-time Train Platforming Management', Transportation Research Procedia, Jan. 2022".

The issue at hand can be referred to as the Timetable Rescheduling (TTR) problem, which has been addressed in the relevant literature, often presented as a particular instance of the Job-Shop Scheduling problem. However, with the constant increase in railway traffic demand, new and more advanced techniques, strategies and tool are required. Thus, this project will cover the design, development and implementation of an optimization model as an answer to this problem.

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.