AUTOMATED PASSENGER TIME OPTIMAL ROBUST TIMETABLING USING MIXED INTEGER PROGRAMMING

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ABSTRACT

Static railway timetabling is one of the most complex combinatorial problems in industry. Strangely, in practice, computers and current software only assist this process in the tasks of *bookkeeping* of routes and times and generating time-space diagrams.
The *feasibility check* of minimal run and dwell times, time-continuity or heading times is rarely automated. These and timetable *quality measurements* only exist in simulation tools which are run as an afterthought after planning.
To the best of our knowledge, no national schedule has been *automatically generated by an optimising system*. Some research in generating *feasible* schedules existed though. We extended this with our fundamental concept of *minimising stochastically expected passenger time.* This includes expected ride, dwell, turn-around and transfer times and implies robustness. We minimise this as the goal function of our mixed integer programming model which contains all further constraints. We developed software that reads in an existing planning and typical delays of *all periodic passenger trains in Belgium*. In a few hours, we can generate a schedule that significantly lowers the expected passenger time in practice compared to the current schedule. This optimisation is a result that exceeds the previous record with roughly a factor two in number of trains. The goal function of our model is very detailed and complete, which means that the resulting timetable is not only of high quality but also applicable in practice.

KEYWORDS

Railway Timetabling, Mixed Integer Programming, Stochastic Optimisation, Expected Passenger Time.