Mathematical algorithms cut train delays

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Credit: AI-generated image (disclaimer)

Commuters are already seeing a reduction in delays and waiting times thanks to new software able to adapt railway schedules in real time following unforeseen disruptions.

The software is based on unique algorithms developed by researchers within the ARRIVAL ('Algorithms for Robust and online Railway optimisation: Improving the Validity and reliability of Large scale

systems') project.

Traditionally, railway operators have had very little computer assistance to deal with disruptions. And before the ARRIVAL project, there had been surprisingly little research in two different forms of planning: robust and real-time. For railways, a robust plan seeks to optimise planning before operations so that the schedule can absorb disruptions without impacting significantly on journeys.

But even the most robust plan cannot compensate for every disruption, especially if they occur during operations. Real-time planning allows for re-scheduling within strict time limits, sometimes before the full extent of the disruption is known. An effective real-time plan is one that retains as much as possible of the solution that would have been put in place had the entire sequence of disruptions been known in advance.

The new software is the result of breakthroughs in three key areas. First, the team developed a new concept - 'recoverable robustness'. Involving mathematics, theoretic modelling and competitive analysis, this is a way of measuring the robustness and recoverability of plans. Second, new models and methods using complex algorithms were created to help operators with delay management. Finally, the team created a central repository for the collection and exchange of real-world data.

The ARRIVAL system was used to draw up a new timetable for the Dutch national railway system, which handles around 5 500 trains each day and is now seen as one of Europe's most efficient railway networks.

In Berlin, waiting time between underground trains was cut from 4 to 2 minutes when the ARRIVAL algorithms were adopted.

According to reports, other countries are also planning to adopt the technology, with trials in Italy having reduced delays by 25 percent.

The results could also be applied in other areas requiring scheduling, such as road traffic navigation systems, industrial workflow systems, e-commerce, grid computing networks and healthcare.

The partners behind ARRIVAL represented 12 universities (from Germany, Greece, Italy, the Netherlands, Spain and Switzerland) and the French railway operator SNCF (Société Nationale des Chemins de fer Français).

More information: ARRIVAL
arrival.cti.gr/index.php/Main/HomePage

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