

# Integrated optimization of line planning and timetabling on high-speed railway network considering cross-line operation

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## ABSTRACT

With the implementation of cross-line operation in high-speed railway system, accessibility of cross-line passengers on the railway network has substantially improved. However, due to limitations of capacity, it is hard to schedule a conflict-free timetable based on a train line plan with many cross-line trains. In order to generate a feasible and optimal transportation plan, a novel methodology is introduced. The approach can simultaneously optimize both the line plans of cross-line trains and train timetable, aiming at having a trade-off between operating profit and direct service. Based on an event-activity network framework, a mixed integer programming model is established. Considering service quality would decline after optimizing line plan and train schedules, the objective of the model is set to minimize deviations from ideal schedules for main-line trains while maximize direct service frequency for cross-line passengers. To solve large-scale scenarios efficiently, an enhanced heuristic genetic algorithm is developed. Two smaller-scale cases are devised to validate the efficiency of the model and approach. Finally, the model and the algorithm are applied to a real-world scenario involving the Beijing-Shanghai High-speed Railway and its connecting lines. Also, comparative experiments, including a scenario without cross-line optimization, are conducted to evaluate the advantage of the proposed approach. The result shows the approach can help to quickly find a feasible solution and have a good balance between operating profit and passenger demand.

## ARTICLE INFO

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