

Development and Evaluation of an Industrial Prototype for Supporting Real-Time Train Dispatching Decisions

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Abstract

This talk presents preliminary results on an on-going industrial project dedicated to the coupling of the ICONIS RM6 (Integrated CONTROL and Information System) product, developed by Alstom Ferroviaria S.P.A. to monitor and control railway traffic in stations and railway lines, and the optimization software AGLIBRARY (Alternative Graph LIBRARY), developed by Roma Tre University to optimize the real-time performance of railway traffic. The aim of this project is the development of an intelligent decision support system for reducing dispatchers' workload and for guiding them toward near-optimal train re-timing, re-ordering and re-routing decisions. The problem is formulated by using microscopic information on train travel times and on the status of the network, at the level of block sections and signals. The outcome of AGLIBRARY is a detailed and conflict-free train schedule, being able to avoid deadlocks and to minimize train delays. The conflict resolution procedure adopted to design a global conflict-free schedule alternates a scheduling phase with fixed routes to a search for better alternative routes. The first phase is solved by a branch and bound algorithm, truncated after a time limit of computation, while train rerouting is solved by a tabu search algorithm. The test bed, provided by Alstom Ferroviaria S.P.A., is based on a UK railway network nearby London. Computational experiments, based on instances with multiple train delays and network disruptions demonstrates that near-optimal solutions can be found by AGLIBRARY within very short computation times, compatible with real-time operations.

Keywords

Railway Operations Management, Mixed-Integer Linear Programming, Branch and Bound, Tabu Search.

Biography

Andrea D'Ariano is currently Assistant Professor in Operations Research at Roma Tre University. In April 2008, he got the PhD title at Delft University of Technology, Department of Transport and Planning. His research interests include scheduling theory and its applications, specially to public transport and service management. His intensive research work was acknowledged by TRAIL Research School, International Association of Railway Operations Research, INFORMS Railway Applications Section, IEEE as best papers; by IEEE Intelligent Transportation Systems Society as best PhD thesis; by Italian Association of Operations Research as best Master thesis.

Paolo D'Ariano is a Research Assistant at Roma Tre University. Here he got a bachelor in Computer Science Engineering and, recently, also a master in Automation and Management Engineering. Since May 2010, he gained industrial experience in optimization and simulation software for aviation and railways.

Marcella Samà is a PhD student at Roma Tre University working on complex real-world traffic control problems. In February 2012, she got a bachelor in Computer Science Engineering and a master in Automation and Management Engineering at the same University, final grade 110/110 cum Laude. She is main author of peer reviewed journal, such as Transportation Research Part E, and conference papers.

Dario Pacciarelli is Professor of Operations Research at Roma Tre University. His main research interests are in the scheduling theory. The contributions are to the design of optimization models algorithms and systems, and to the complexity analysis of algorithms and problems in this context. Applications work is in railway traffic management and production scheduling. He has published numerous research papers in top journals such as Operation Research, Transportation Science, Transportation Research Part B-C-E, and the European Journal of Operational Research. He was involved, often as coordinator, in several National and European research projects.