Line planning and periodic timetabling in railway traffic

Christian Liebchen  Rolf H. Möhring  Elmar Swarat

www.math.tu-berlin.de/coga/projects/matheon/B5/

We established a cooperation with the underground division of Berliner Verkehrsbetriebe (BVG). Our computations lead to the 2005 timetable of Berlin Underground. To the best of our knowledge, this is the first timetable that has been computed with mathematical optimization techniques, and finally got into daily operation.

An important step is the visualization of results. To that end, we developed the network waiting time chart. Important transfers are represented by bold transfer arcs. In our example, long waiting times (> 5 min) are highlighted by red transfer arcs. One can observe easily that the number of (bold) red arcs decreased after mathematical optimization has been involved (right chart).

Our solution algorithms are essentially based on integer programming techniques. We identified short integral cycle bases of directed graphs to be particularly helpful for finding strong such IP formulations. We succeeded to draw the complete picture of seven subclasses of directed cycle bases.

Selected publications


Cooperation/Visibility

Inside MATHEON
B1 adaptation of interfaces, integration line planning/timetabling
⇒ NEW PROJECT B15
B8 investigation of cycle bases
F5 MATHEON Video
G5 talks in schools

External scientists
EU research project ARRIVAL,
Leon Peeters (Zurich), Romeo Rizzi (Trento)

Industry
Berliner Verkehrsbetriebe (BVG),
Deutsche Bahn AG (funded software development), intranetz GmbH, PTV AG

General Audience
two newspaper articles, radio interview, Adventskalender, Lange Nacht der Wiss.