# Ph.D. in Information Technology:

# Thesis Defenses April 16th, 2021 online by TEAMS – at 16:00

Fai clic qui per partecipare alla riunione

**SCHETTINI TOMMASO – XXXIII cycle**

Advisor: Malucelli Federico
Co-Advisor: Ola Jabali

PhD Thesis Title : Demand-Driven Timetabling Optimization for Automated Metro Lines


Short Abstract:

With the recent growth of urban populations, efficiently managing transit systems has become a top priority to local authorities. The widespread adoption of automated transit systems, coupled with the increased availability of passenger demand-related information opens several avenues for innovatively managing transit systems.
In this thesis, we introduce an alternative demand-driven control paradigm, called Direct Timetabling.
In Direct Timetabling, we do not impose any structural constraints in the definition of the schedule of the trains and allow the use of short-turning. By using short-turning trains are not required to serve the line from terminal to terminal, but may turn and reverse their direction in certain stations of a line. This allows far more flexibility in the control decisions of the line, which is used to adapt to variations of passenger demand and yield a better service.
We formulate the problem of optimizing the schedule of a metro corridor with the direct timetabling paradigm and develop an exact algorithm using cut generation. We show through extensive computational experiments the effectiveness of the cut generation algorithm and demonstrate the benefits of the direct timetabling paradigm.
Then, we consider a special case of direct timetabling, which can be more efficiently solved under mild assumptions on the structure of the train schedule. We present an alternative formulation for the problem and an efficient exact algorithm based on Benders decomposition. Through the computational experiments, we demonstrate the effectiveness of the developed algorithm and evaluate the impact of the assumptions made on the structure of the schedule.
Lastly, we develop a direct timetabling strategy to handle the demand associated with a large event (e.g., a football match or a concert), which is served by a single station of a metro line. Such events cause a significant increase in demand at a single station. Thus, operating the ordinary timetabling of a line may lead to prolonged passenger waiting times. We develop a formulation for the problem and an efficient iterated local search heuristic. Through the computational experiments, we evaluate the effectiveness developed heuristic and show the utility of the proposed paradigm over an ordinary timetable.


Committee Members

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|---|---|
| Bruglieri Maurizio | Politecnico di Milano |
| Barrena Eva | Universidad Pablo de Olavide Sevilla |
| Gendreau Michel | Polytechnicque Montreal |