Workshop announcement

Vehicle Routing: Advances and Applications 2024

This workshop is about the state-of-the-art in vehicle routing. Four prominent international researchers in this field will give a lecture in which they discuss recent advances and relevant applications. The workshop is aimed at any researcher in operations research, with an interest in vehicle routing.

Date:	January 18, 2024
Location:	Erasmus University Rotterdam, campus Woudestein
Room:	Mandeville building, room T3-21
Costs:	Free of charge
Registration deadline:	Wednesday January 10
Registration:	Please register by sending an e-mail to Remy Spliet, spliet@ese.eur.nl.

Program:

13:30 **Opening**

13:35 **Kevin Dalmeijer** – Georgia Tech

Optimizing Autonomous Transfer Hub Networks:
Quantifying the Potential Impact of Self Driving Trucks

Joint work with: Chungjae Lee, Pascal Van Hentenryck and Peibo Zhang

Autonomous trucks are expected to fundamentally transform the freight transportation industry. In particular, Autonomous Transfer Hub Networks (ATHNs), which combine autonomous trucks on middle miles with human-driven trucks on the first and last miles, are seen as the most likely deployment pathway for this technology. In this talk, we present a framework to optimize ATHN operations and evaluate the benefits of autonomous trucking. A case study quantifies the potential impact of autonomous trucking and shows that ATHNs can have significant benefits over traditional transportation networks.

14:15 **Break**

14:30 **Michel Gendreau** – Polytechnique Montréal

Stochastic models for Production Routing Problems
with uncertain availability of vehicles

Joint work with: Alline Zanette, Walter Rei, and Jorge Mendoza

The Production Routing Problem (PRP), in which one performs the joint and simultaneous optimization of production (including set ups), inventory, distribution, and routing decisions, was introduced as a way of dealing with complex supply chain planning situations. In this talk, we examine variants of the PRP in which the availability of vehicles to perform planned routes is uncertain. WE present models and exact solution methods for such problems.

15:10 **Break**

15:30 **Pedro Munari** - Universidade Federal de São Carlos

The Bike Sharing Rebalancing Problem under Demand Uncertainty

Joint work with: Bruno P. Bruck and Walton P. Coutinho

Bike Sharing Systems (BSSs) are an excellent solution to improve urban mobility, offering a mode of transportation that is both economical and environmentally friendly. These systems are spread worldwide and help alleviate heavy traffic and reduce pollution, yielding direct and indirect benefits to the local population. Nonetheless, effectively managing these systems can pose practical challenges, as some stations often experience fluctuations in bike availability, resulting in surpluses or shortages and, occasionally, becoming full or empty. Rebalancing operations need to be regularly performed to restore the desired inventory levels at each station, and they are significantly affected by the unpredictable demand at stations. To aid decision-making in such situations, we introduce the Robust Bike Sharing Rebalancing Problem (RBRP), which combines the Vehicle Routing Problem with Robust Optimization techniques to enhance rebalancing operations in BSSs. We present two novel mixed-integer programming formulations and a tailored branch-and-cut algorithm for the RBRP. The first formulation is compact and based on the linearization of recursive equations, while the second relies on robust rounded capacity inequalities and feasibility cuts. Computational results using benchmark instances based on real-world data indicate the effectiveness of our approaches and highlight the benefits of using robust solutions to support decision-making in BSSs.

16:10 **Break**

16:30 **Sanne Wøhlk** – Aarhus University

A branch-and-cut algorithm for a skip pick-up and delivery problem

Joint work with: José M. Belenguer and Maximiliano Cubillos

In this study we present a branch-and-price algorithm for a skip pick-up and delivery problem. The study is motivated by a real-life problem in which full containers are transported from waste drop-off stations to treatment facilities where they are emptied, and then brought back to the original drop-off station. The transportation of the skips is done by trucks with the capacity of carrying two containers at a time. The planning problem is to assign trucks to the routes that perform the collection to satisfy a number of requests in a planning period. A truck route starts at the first pickup, the truck then performs a sequence of pickups, treatments, and deliveries, and the route ends at the last delivery. From the truck perspective, the three actions of pickup, treatment, and delivery can be performed in any order that respects the vehicle capacity of two and the route duration constraint, but for the single request, the three actions must be performed in the stated order. The problem is formulated as a mixed integer linear problem and several classes of valid inequalities are proposed and integrated into a branch-and-price algorithm.

17:10 **Close**

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