

Research seminar

The Institute of Production and Logistics Management of Johannes Kepler University Linz invites you to the following talk:

A decomposition approach to a multi-commodity two-echelon distribution problem

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Online presentation: Zoom link available per request to fabien.tricoire@jku.at

Abstract: We study a complex distribution problem in a two-echelon supply chain where three sets of stakeholders are involved: suppliers, distribution centers and customers. Multiple commodities are collected from the suppliers and delivered to the customers through distribution centers for consolidation purposes. Each supplier has a given available quantity for each commodity and each customer has a demand for each commodity. We consider a single decision maker who manages all distribution centers and organizes the collection and delivery operations. The commodities are collected from suppliers and delivered to distribution centers through direct trips, and distributed from the distribution centers to customers with a fleet of vehicles performing routes. Direct deliveries from suppliers to customers are not allowed. Commodities are compatible, that is any vehicle can transport any set of commodities as long as its capacity is not exceeded. Multiple visits to a customer are allowed to reduce transportation costs. However, for the sake of customers convenience, a single commodity has to be delivered at once. The problem is named Multi-Commodity two-echelon Distribution Problem (MC2DP). The objective is to find a collection and delivery plan that minimizes the total transportation cost, satisfying customer demands, and not exceeding the available quantities at the suppliers and the vehicle capacities. The study of the problem is motivated by an application of short food supply chain with indirect sales to canteen, restaurants and supermarkets in the area of the French department of Isère.

We develop a solution approach to the MC2DP based on the decomposition in two subproblems, associated with the collection and delivery phases, respectively, and the sequential solution of the subproblems. Two sequential approaches to the solution of the MC2DP are presented, depending on which of the two subproblems is solved first. In both cases, the solution of the first subproblem determines the quantity of each commodity at each distribution center. The second subproblem takes this information as input. We also propose different strategies to guide the solution of the first subproblem in order to take into account the impact of its solution on the second subproblem. The two proposed sequential approaches and the different strategies are evaluated and compared both on randomly generated instances, with different characteristics (supplier locations, customer locations, maximum supply quantities, number of distribution centers), and on a case study for the collection and delivery of fresh food products (fruits and vegetables) through a short and local supply chain using a set of distribution centers located in the French department of Isère. The computational results show the impact of the instance characteristics on the solution approaches and strategies.

About the Speaker: Since September 2019, Claudia Archetti is Associate Professor in Operations Research at ESSEC Business School in Paris. She was previously Associate Professor at the University of Brescia. She teaches courses for undergraduate, master and PhD students in OR and logistics. The main areas of the scientific activity are: models and algorithms for vehicle routing problems; mixed integer mathematical programming models for the minimization of the sum of inventory and transportation costs in logistic networks; exact and heuristic algorithms for supply-chain management; reoptimization of combinatorial optimization problems.

Claudia Archetti has carried out the scientific activity in collaboration with Italian and foreign colleagues and published joint papers with some of the best researchers at the international level. She is author of more than 60 papers in international journals. She was Area Editor of Computers and Operations Research. She is Associate Editor of Transportation Science and of Networks and member of the Editorial Board of European Journal of Operational Research. Claudia Archetti is VIP3 of EURO, the Association of European Operational Research Societies, in charge of publications and communication.

Host: Fabien Tricoire and Prof. Sophie Parragh (PLM)