Session 5: Energy

Chair: Evrim Ursavas

Stefano Fazi (Delft University of Technology) - The Multi-trip Container Drayage problem with Empty Containers Management in a Dry-port Setting

We study a typical daily drayage problem concerning the last-mile logistics of several inland container supply chains of major seaports. A set of trucks available at a dry-port has to fulfill shippers' requests of containers within time windows and, to do so, can perform multiple trips during the day. A request may entail picking up or delivering containers at the dry-port or the seaport. Demand for empty containers can be satisfied by using the available stock at the dry-port or retrieving them at a local empty depot or street-turning. Besides minimizing routing costs, the challenge is synchronizing the trucks' trips to retrieve empty containers at the dry-port, whose stock can dynamically change over time. After modelling the problem mathematically, we develop an exact column-and-row generation approach embedded in a branch-and-price framework. To accelerate the resolution of the pricing problem, we propose effective strategies to combine a set of tailored pricing algorithms. These strategies perform well on a set of adapted Solomon's instances up to 100 nodes and against a standard branch-and-cut solver. Finally, experiments on real-world instances, inspired by a Port of Rotterdam region case study, provide insights into current planning practices.

Albert Schrotenboer (Eindhoven University of Technology) - Dynamic production and static distribution of green hydrogen: A combined MDP and MIP approach

In this talk, we consider control strategies for a joint production and distribution system that occurs at a green hydrogen production facility. The amount of green hydrogen is stochastic due to its dependency on renewable sources, but the distribution towards customers must be performed in a predictable and static manner. We therefore combine MDP methodology to dynamically control the production process, while we utilize MIP methodology to create static distribution plans. Specifically, the solution of the MIP defines the states, actions, and transitions within the MDP. We present a joint solution approach that is based on penalizing features apparent in the solution structure of the MIP, so that the joint MDP and MIP costs are minimized.

Ilke Bakir (University of Groningen) - An Integrated Optimization Framework for Multi-Component Predictive Analytics in Wind Farm Operations & Maintenance

Recent years have seen an unprecedented growth in the use of sensor data to guide wind farm operations and maintenance. Emerging sensor-driven approaches typically focus on optimal maintenance procedures for single turbine systems, or model multiple turbines in wind farms as single component entities. In reality, turbines are composed of multiple components that dynamically interact throughout their lifetime. These interactions are central for realistic assessment and control of turbine failure risks. In this work, an integrated framework that combines (i) real-time degradation models used for predicting remaining life distribution of each component, with (ii) mixed-integer optimization models and solution algorithms used for identifying optimal wind farm maintenance and operations is proposed. Maintenance decisions identify optimal times to repair every component, which in turn, determine the failure risk of the turbines. More specifically, optimization models that characterize a turbine's failure time as the first time that one of its constituent components fail - a systems reliability concept called *competing risk* is developed. The resulting turbine failures impact the optimization of wind farm operations and revenue. Extensive experiments conducted for multiple wind farms with 300 wind turbines - 1200 components - showcases the performance of the proposed framework over conventional methods.