“An exact solution method and a lower bounding approach for row layout problems”

In the talk we consider row layout problems motivated by applications in real-world factory planning. Given a set of departments with positive lengths and pairwise transport weights between them, the aim of the Multi Row Facility Layout Problem (MRFLP) is to determine an arrangement of the departments in a given number of rows such that the weighted sum of the distances between the departments is minimized. An important special case is the Double Row Facility Layout Problem (DRFLP) that allows an arrangement of the departments on both sides of a path. We present new mixed-integer linear programming formulations for the (space-free) MRFLP with given assignment of the departments to the rows. These formulations are used in an enumeration scheme for solving the (space-free) MRFLP. In particular, we test all possible row assignments, where some assignments are excluded due to our new combinatorial investigations. This approach enables us to solve DRFLP instances with up to 16 departments and MRFLP instances with up to 5 rows and 13 departments in reasonable time. Even deriving good lower bounds on the optimal solution value of the MRFLP is a challenging problem. In the second part of this talk, we present combinatorial lower bounds, which can be computed very fast. These bounds generalize the star inequalities of the Minimum Linear Arrangement Problem. Furthermore, we exploit a connection of the MRFLP to the so called Parallel Identical Machine Scheduling Problem with Minimum Weighted Completion Time. Our lower bounds can be improved by combining them with a new distance-based mixed-integer linear programming model.