Minisymposium 1 - Discrete Optimization

Discrete Methods for tackling nonlinear mixed integer optimization problems in chemical engineering

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Many optimization problems in chemical engineering give rise to non-convex nonlinear mixed-integer optimization problems. While many tools for generating locally optimal solutions are nowadays available, determining a globally optimal solution still remains a challenging task. In this talk an approach to tackle such instances is introduced that mostly resorts to techniques from discrete optimization. A hierarchy of mixed-integer linear problems is defined that contain all solutions of the original instance. For this, the nonlinear terms occuring in the original formulation are polyhedrally relaxed respecting local and global properties in the domain. A key step of this approach is to identify combinatorial substructures like stable sets or nonlinear flow conservation conditions that are given by the constraints of the original nonlinear model. A linear description of those substructures leads to valid inequalities that strengthen the linear relaxations. The capability of this approach is demonstrated by considering two different applications coming from chemical engineering.