ABSTRACT

Martin Schmidt Trier University (Germany)

Block Decomposition of Large-Scale MINLPs and (Penalty) Alternating Direction Methods: Some Theory, the Feasibility Pump, and Applications

Mixed-integer nonlinear optimization problems (MINLPs) serve as a powerful and versatile modeling tool today. However, it is well known that they are hard to solve both in theory and practice. In this talk we focus on exemplary applications in the field of gas transport, data science, finance, and bilevel optimization. The respective MINLP models contain many different and further challenging aspects such as partial differential equations, cardinality constraints, or equilibrium conditions. Since they all are of large scale, it is almost impossible to solve the corresponding instances to global optimality in practice. Fortunately, many of them possess a certain type of block-structure that can be used to decompose these models and to "solve" them using tailored (penalty) alternating direction methods. We introduce these methods and discuss their convergence properties. Furthermore, we highlight how these properties can be used to provide theory for the feasibility pump, which is maybe the most successful primal heuristic in the field of mixed-integer (non)linear optimization. Finally, we discuss the above mentioned applications, show how to find suitable block decompositions, and present numerical results to gain some insight on the practical power of these methods.