ABSTRACT

Florian Fontan Artelys France (France)

Latest developments for mixed-integer nonlinear programming in Artelys Knitro

Artelys Knitro is a mathematical programming solver for nonlinear and mixed-integer nonlinear problems. As input, it accepts linear structures, quadratic structures and black-box functions, with if possible, their first and second-order derivatives. Knitro relies on derivative-based algorithms to find locally optimal solutions. Knitro finds the global optimum for convex problems. For non-convex problems, Knitro converges to a first order stationary point (e.g. local optimum) for continuous models and is a heuristic for mixed-integer problems. For nonlinear problems, Knitro includes two interior point algorithms, a sequential linear quadratic programming algorithm and a sequential quadratic programming (SQP) algorithm. For mixed-integer nonlinear problems, Knitro includes a nonlinear branch-and-bound algorithm, a Quesada-Grossman branch-and-bound algorithm and a mixed-integer sequential quadratic programming algorithm. Since Artelys Knitro 13.0, the nonlinear branch-and-bound has been fully rewritten. The new nonlinear branch-and-bound is parallel and deterministic. Cut generation and cut management have been greatly improved by adapting the ideas developed for mixed-integer linear programming. The portfolio of heuristics executed during the search has been extended. It also includes better branching strategies and a restart procedure. Finally, to improve the solutions for non-convex problems, two ways to use multi-start within the nonlinear branch-and-bound have been implemented. In this talk, we will present the algorithms implemented in Artelys Knitro for mixed-integer nonlinear problems, and detail the recent developments for the nonlinear branch-and-bound algorithms. We will show the improvements on the classical datasets for mixed-integer nonlinear problems.