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Nonlinear optimization with Artelys Knitro in Julia

Tuesday, October 29, 2024 10:00 AM (30 minutes)

Introduction

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.

Recent developments in Artelys Knitro

For nonlinear continuous problems, Artelys Knitro includes two interior point algorithms, a sequential linear quadratic programming algorithm and a sequential quadratic programming (SQP) algorithm. For mixed-integer nonlinear problems, Artelys Knitro includes a nonlinear branch-and-bound algorithm, a Quesada-Grossman branch-and-bound algorithm, and a mixed-integer sequential quadratic programming algorithm. The new version Artelys Knitro 14.1 provides specific improvements on quadratic models (QP) and quadratically constrained quadratic models (QCQP), both convex and non-convex. On non-convex continuous models, users will notice similar solutions returned in shorter time thanks to the automatic termination of multistart when the probability of finding new local solutions is small. Furthermore, high quality solutions can be obtained on non-convex MINLP models thanks to a new behavior when activating multistart. Finally, Knitro Julia interface now supports newer versions of Julia 1.10.2+.

Tutorial in Julia

In this talk, we offer to present a tutorial of Artelys Knitro in Julia presenting both the modeling directly from the Knitro Julia interface (on a geometric application) or through JuMP (for hydropower plant optimization). The audience will be able to connect to a small server setup for the event with a Jupyter notebook without having to install anything on their laptop.

Bibliography

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3. Luteberget, B., Sartor, G. Feasibility Jump: an LP-free Lagrangian MIP heuristic. Math. Prog. Comp. 15, 365–388 (2023). [link]

4. R. H. Byrd, J. Nocedal, and R.A. Waltz (2006). KNITRO: An integrated package for nonlinear optimization, In G. di Pillo and M. Roma, editors, Large-Scale Nonlinear Optimization, pages 35–59. Springer. [link]

5. Github Artelys Knitro tutorials - https://github.com/Artelys/knitro-modeling-examples

6. Artelys website - https://www.artelys.com/news/artelys-knitro-14-1-delivers-very-quick-solutions-on-non-convex-models/

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