CIRRELT

Séminaire du CIRRELT Seminar

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Piecewise linearization of bivariate nonlinear functions: minimizing the number of pieces under a bounded approximation

Abstract: Mixed-Integer Non-Linear Problems (MINLP) are difficult problems to solve because of the non-linear functions and the existence of integer variables. One of the main ideas to solve such problems is to approximate them into Mixed-Integer Linear Problems (MILP) which are easier to solve, for example with solvers like Gurobi and CPLEX. This approximation of the problem can be done by replacing each non-linear function by a piecewise linear (PWL) function, in which case a solution of the approximated problem will give an "approximated solution" of the original problem. However, the solution of the MILP is not generally usable for the original problem: it can be a non feasible solution, or a "bad" approximation of a solution. Our work tackles the latter problem in the same way as recent works by Rebennack & Kallrath (2015) and Ngueveu (2019), that is by bounding the pointwise approximation error of the approximation of a non-linear function. In this talk, we establish an algorithm that approximates non-linear functions of two variables under a given approximation error, so that the quality of the approximated solution has guarantees. Additionnaly, it heuristically minimizes the number of pieces of the approximated non-linear functions so that the resulting MILP has less binary variables and constraints. Numerical experiments show that our algorithm produces PWL functions with in average less pieces than the state of the art.

Mardi / Tuesday

25 octobre 2022, 14h00

October 25th, 2022, 14:00

Salle / Room 5441

Pavillon André-Aisenstadt

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Responsable / Organizer

Margarida Carvalho