New results on the K–Drones Arc Routing Problem

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The Length Constrained K-Drones Rural Postman Problem (LC K-DRPP) is a continuous optimization problem where a set of curved or straight lines of a network have to be traversed by a fleet of homogeneous drones starting at a given point and with autonomy constrained to a given limit L, with total minimum cost. Drones can fly directly between any two points and are therefore not restricted to travel over the lines, but they can enter and exit a line through any of its points, possibly servicing only a portion of that line.

When a LC K-DRPP instance is digitized, by expressing each line with a polygonal chain, if we assume that drones can only enter and exit a line through the points of the chain we obtain an instance of the Length Constrained K-vehicles Rural Postman Problem (LC K-RPP). Although this discrete optimization (arc routing) problem could be solved with combinatorial techniques, if the number of points in each polygonal chain is very large, the LC K-RPP instance is so large that it can not be addressed. We implement a procedure that generates smaller LC K-RPP instances with few but "significant" points for each continuous line.

In this talk, we present a formulation for the LC K-RPP with two binary variables representing the first and second traversals of each edge by each drone. We study the polyhedron associated with the solutions of a relaxed formulation, obtaining its dimension and proving that several families of inequalities induce facets of it. These inequalities are incorporated to a branch-and-cut algorithm for the LC K-RPP that is the main routine of an iterative algorithm that finds good solutions for the original LC K-DRPP. Extensive computational results are reported.