

The multi-purpose K -drones general routing problem

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In this talk, we present the multi-purpose K -drones general routing problem (MP K -DGRP). On this optimization problem, a fleet of multi-purpose drones, aerial vehicles that can both make deliveries and some imaging as well, have to jointly map a set of continuous areas and visit a set of nodes. The continuous areas that have to be mapped can correspond to flooded areas or regions with a disease outbreak or infrastructures to be inspected, while the delivery, e.g. of healthcare items, has to be performed on a set of nodes. The continuous areas to be imaged can be modeled as a set of lines so that each area is completely serviced if all the lines covering it are traversed. Thus, given a set of nodes and a set of lines, the problem is to design drone routes of shortest total length traversing the lines and visiting the nodes, while not exceeding the range limit (flight distance) and capacity (loading) of the drones. Unlike ground vehicles in classical routing problems, drones can enter a line through any of its points, service only a part of that line and then exit through another of its points ([1],[2]). The possibility of flying directly between any two points of the network offered by drones can lead to improved services and reduced costs, but it also increases the difficulty of the problem. To deal with this problem, the lines are discretized, allowing drones to enter and exit each line only at a finite set of points, thus obtaining an instance of the K -vehicles general routing problem (K -GRP). We present in this talk an integer programming formulation for the K -GRP and propose a matheuristic algorithm and a branch-and-cut procedure for its solution. Some computational experiments are shown to summarize the performance of both algorithms on a set of instances generated for this work.

References

- [1] J. Campbell, Á. Corberán, I. Plana, and J.M. Sanchis, "Drone Arc Routing Problems", *Networks* 72, 543-559, 2018.
- [2] J. Campbell, Á. Corberán, I. Plana, J.M. Sanchis, and P. Segura, "Solving the length constrained K -drones rural postman problem", *EJOR* 292(1), 60-72, 2021.