

A Branch-and-Cut Algorithm for the Distance-Constrained Close-Enough Arc Routing Problem

José M. Sanchis

Dept. de Matemática Aplicada, Universidad Politécnica de Valencia, Spain

Email: jmsanchis@mat.upv.es

Ángel Corberán

Dept. d'Estadística i Investigació Operativa, Universitat de València, Spain

Isaac Plana

Dept. de Matemáticas para la Economía y la Empresa, Universitat de València, Spain

Miguel Reula

Dept. d'Estadística i Investigació Operativa, Universitat de València, Spain

Arc routing problems consist basically of finding one or several routes traversing a given set of arcs and/or edges that must be served. The Close-Enough Arc Routing Problem (CEARP), also known as Generalized Directed Rural Postman Problem (GDRPP), considers that each customer is not located in a specific arc, but can be served whenever the vehicle traverses any arc of a prefixed subset. Actually, the idea is that each customer is served when the vehicle gets closer than a certain distance. Some examples of real-life applications include routing for meter reading. In this application, a vehicle with a receiver travels through a series of neighborhoods. If the vehicle gets within a certain distance of a meter, the receiver is able to record the gas, water, or electricity consumption. Therefore, the vehicle does not need to traverse every street, but only a few, in order to be close enough to each meter. In this paper we deal with an extension of this problem, the Distance-Constrained CEARP or Distance-Constrained GDRPP, in which a fleet of vehicles is available. The vehicles have to leave from and return to the depot, and the length of their routes must not exceed a maximum distance.

We propose a formulation for this problem and study a relaxation of its associated polyhedron. We present some families of valid inequalities that we use in the implementation of a branch-and-cut algorithm for solving the problem. Extensive computational experiments have been performed on a set of benchmark instances and the results are compared with those obtained with the algorithms proposed in the Literature.