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MATHEURISTIC APPROACH TO SOLVE HETEROGENEOUS FLEET VEHICLE ROUTING PROBLEM WITH BALANCE OF ROUTES AND LOAD

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Contents

Matheuristic approach to solve a Heterogeneous Fleet Vehicle Routing Problem with balance of routes and load.

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Abstract

We propose an approach method based on mathematical models to solve a Heterogeneous fleet vehicle routing problem (HFVRP) with balance in the duration of each route and also in the capacity used by trucks, being also desirable a maximization of the transported load, calling this new extension HFVRP-BRL. The search procedure involves columns generation, a set-partitioning formulation, correction of selected potential routes and routing process. Computational results are presented for real instances[1].

Keywords : *Matheuristic, Columns Generation, HFVRP, Routing Problem, Routes Balance, Balance of load, Max load.*

1. Introduction

Transport management is one of the most recurrent problems that the company must deal in fulfilling some of its strategic objectives. In many cases, the significance lies in that resources are limited and the transport costs represent a high percentage of the goods value, among the 5% and 20% of the total costs [3], this is necessary to find the best way to planning the daily products distribution. For some authors, one of the problems encountered in the management development is the lack of powerful methodologies and tools to facilitate the logistics design in real life [4].

In this context, one of the most important VRPs extensions is the Heterogeneous fleet vehicle routing problem (HFVRP), a problem that involves with vehicles of different capacity provides the ability to find, for some cases, best solutions for real life problems [5]. Similarly, the most VRP Researchers focuses on the homogeneous fleet, but in practice the VRP with heterogeneous fleet are more common[6]. Today, the researchers put their efforts to solve this kind of problems in an efficient way. In the HFVRP, most researchers built heuristic and goal-heuristic algorithms to deal with the complexity of the NP-Hard problems. The exact algorithm is less studied, and although even this can produce a high-quality solution, the huge expenditure of time to solve big problems is an obstacle. Procedures can be grouped into two main phases: construction of the initial solution, and solution improvement. It is well recognized that a good initial solution leads to a good result. While there are many proposed algorithms that are efficient and can provide good solutions, these systems do not guarantee the optimum. Any adaptation or construction of a new algorithm is still a challenge for researchers who are interested in the Heterogeneous VRP's study. [7].

One of the most used solution methods is Column Generation Approach (GC), Taillard et al. [16] presented a heuristic based on this method for the resolution of a HFVRP. This method is a popular technique used for solving larger linear programming problems, which consists in splitting the given problem into two problems: the master problem and the subproblem. This allows one to simplify the original problem with only a subset of variables in the master problem. In the same way, Choi et al. [17] applies a similar heuristic for a HVRPTW (Time windows) resolution. Following the same line, Yousefikhoshbakht et al. [18] applied a similar scheme for the solution of an Open HFVRP. Seixas [19] studies a column generation approach for a HFVRPTW Multi-trip with hours restrictions. Ceselli et al. [20], worked on Rich-VRP by GC problems. Many heuristics have been used for the resolution of this problem, but still work on the balance between routes in terms of capacity used and distance could not be found.