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The multi-objective optimization methods are traditionally based on Pareto dominance or relaxed forms of dominance in order to achieve a representation of the Pareto front. However, the performance of traditional optimization methods decreases for those problems with more than three objectives to optimize. The decomposition of a multi-objective problem is an approach that transforms a multi-objective problem into many single-objective optimization problems, avoiding the need of any dominance form. This chapter provides a short review of the general framework, current research trends and future research topics on decomposition methods.

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CHARACTERIZATION OF THE OPTIMIZATION PROCESS

Autor(es): Quiroz, Marcela; Cruz-Reyes, Laura; Torres-Jimenez, Jose; Gómez-Santillán, Claudia; Fraire-Huacuja, Héctor J.; Melin, Patricia

Recent works in experimental analysis of algorithms have identified the need to explain the observed performance. To understand the behavior of an algorithm it is necessary to characterize and study the factors that affect it. This work provides a summary of the main works related to the characterization of heuristic algorithms, by comparing the works done in understanding how and why algorithms follow certain behavior. The main objective of this research is to promote the improvement of the existing characterization methods and contribute to the development of methodologies for robust analysis of heuristic algorithms performance. In particular, this work studies the characterization of the optimization process of the Bin Packing Problem, exploring existing results from the literature, showing the need for further performance analysis.

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EXACT METHODS FOR THE VERTEX BISECTION PROBLEM

Autor(es): Fraire, Héctor; Terán-Villanueva, J. David; Castillo-García, Norberto; Gonzalez-Barbosa, Juan Javier; Rodríguez-del-Angel, Eduardo; Gómez-Rojas, Yazmín

In this chapter we approach the vertex bisection problem (VB), which is relevant in the context of communication networks. A literature review shows that the reported exact methods are restricted to solve particular graph cases. As a first step to solve the problem for general graphs using soft computing techniques, we propose two new integer-linear programming models and a new branch and bound algorithm (B&B). For the first time, the optimal solutions for an extensive set of standard instances were obtained.

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ON THE EXACT SOLUTION OF VSP FOR GENERAL AND STRUCTURED GRAPHS: MODELS AND ALGORITHMS

Autor(es): Castillo-García, Norberto; Fraire-Huacuja, Héctor Joaquín; Pazos-Rangel, Rodolfo A.; Martínez-Flores, José Antonio; González-Barbosa, Juan Javier; Carpio-Valadez, Juan Martín;

In this chapter the vertex separation problem (VSP) is approached. VSP is NP-hard with important applications in VLSI, computer language compiler design, and graph drawing, among others. In the literature there are several exact approaches to solve structured graphs and one work that proposes an integer linear programming (ILP) model for general graphs. Nevertheless, the model found in the literature generates a large number of variables and constraints, and the approaches for structured graphs assume that the structure of the graphs is known a priori. In this work we propose a new ILP model based on a precedence representation scheme, an algorithm to identify whether or not a graph has a Grid structure, and a new benchmark of scale-free instances. Experimental results show that our proposed ILP model improves the average computing time of the reference model in 79.38 %, and the algorithm that identifies Grid-structured graphs has an effectiveness of 100 %.

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