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AN ANT COLONY ALGORITHM FOR IMPROVING SHIP STABILITY IN THE CONTAINERSHIP STOWAGE PROBLEM

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This paper approaches the containership stowage problem. It is an NP-hard minimization problem whose goal is to find optimal plans for stowing containers into a containership with low operational costs, subject to a set of structural and operational constraints. In this work, we apply to this problem an ant-based hyperheuristic algorithm for the first time, according to our literature review. Ant colony and hyperheuristic algorithms have been successfully used in others application domains. We start from the initial solution, based in relaxed ILP model; then, we look for the global ship stability of the overall stowage plan by using a hyperheuristic approach. Besides, we reduce the handling time of the containers to be loaded on the ship. The validation of the proposed approach is performed by solving some pseudo-randomly generated instances constructed through ranges based in real-life values obtained from the literature.

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CELLULAR PROCESSING ALGORITHMS

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In this chapter we propose a new class of cellular algorithms. There exists a variety of cellular algorithm approaches but most of them do not structure the search process. In this work we propose a cellular processing approach to solve optimization problems. The main components of these algorithms are: the processing cells (PCells), the communication between PCells, and the global and local stagnation detection. The great flexibility and simplicity of this approach permits pseudo-parallelization of one or several different metaheuristics. To validate our approach, the linear ordering problem with cumulative costs (LOPCC) was used to describe two cellular processing algorithms, whose performance was tested with standard instances. The experimental results show that the cellular processing algorithms increase solution quality up to 3.6% and reduce time consumption up to 20% versus the monolithic approach. Also the performance of these algorithms is statistically similar to those of the state-of-the-art solutions, and they were able to find 38 new best-known solutions (i.e., not previously found by other algorithms) for the instances used. Finally, it is important to point out that these encouraging results indicate that the field of cellular processing algorithms is a new and rich research area.

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CONSTRUCTIVE ALGORITHM FOR A BENCHMARK IN SHIP STOWAGE PLANNING

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The efficiency of a maritime container terminal mainly depends on the process of handling containers, especially during the ships loading process. A good stowage planning facilitates these processes. This paper deals with the containership stowage problem, referred to as the Master Bay Plan Problem (MBPP). It is a NP-hard minimization problem whose goal is to find optimal plans for stowing containers into a containership with a low containership operation cost, subject to a set of structural and operational restrictions. For MBPP, data are not available for confidentiality reasons. The lack of a performance evaluation benchmark of solution algorithms for MBPP raises the need for a generation of instances. Due to this limitation, we present a generation scheme of instances for the MBPP, which is based random generation according on selected sets of parameters. The parameters are variable within certain ranges to characterize the vessel and containers; the ranges are real-life values taken from the literature. A constructive loading heuristic for stowing containers into a containership is proposed in this paper to have reference solutions. An instance set, its known-best solutions and the generator are available on-line.

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EVOLVING BIN PACKING HEURISTIC USING MICRO-DIFFERENTIAL EVOLUTION WITH INDIRECT REPRESENTATION

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