



An Improved Invasive Weed Optimization Algorithm for the One-Dimensional Cutting Stock Problem

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Abstract

The one-dimensional cutting stock problem (1D-CSP) is a classic NP-hard combinatorial optimization problem commonly occurring across manufacturing applications, such as metal cutting, paper production, and wood processing. The objective involves determining optimal ways for cutting a sheet of material into smaller pieces while minimizing material waste.

In this study we introduce an improved Invasive Weed Optimization (IWO) algorithm for solving the 1D-CSP. Our proposed approach integrates the IWO's exploration capabilities with constructive "Best-Fit" heuristics and variable-neighborhood search (VNS) for local optimization to effectively balance exploration and exploitation during the optimization process. An adaptive spatial dispersion mechanism and competitive exclusion are incorporated so as to improve both solution quality and convergence performance.

Computational experiments on benchmark instances show that the proposed method can produce high-quality solutions within reasonable computation times while minimizing material waste, leading directly to reducing stock units subject to specified constraints.

Keywords: Cutting stock problem, invasive weed optimization, constrained optimization, bio-inspired metaheuristic, variable neighborhood search, adaptive spatial dispersion.

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