

Binary linear programming formulations for a two-stage dual bin packing problem for wood reuse

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The increasing demand for raw materials such as wood is undoubtedly contributing to the depletion of natural resources and global warming. To curb this phenomenon, a more sustainable and circular wood management could be developed by intelligently handling wood waste. This wood waste can be in the form of beams or pallets and could be considered as wooden slats. They could be combined, assembled, and glued to build Cross-Laminated Timber (CLT) panels for the construction industry.

We aim to develop optimization techniques to recycle raw wood waste by providing assembly schemes to create CLT panels. The goal is to minimize the waste, which is the wood that could not be reused in the CLT panels.

We conducted a literature review to identify the closest problems in the field of operations research and to name our problem accordingly. The skiving stock problem and the dual bin packing problem, which are not dual versions of the cutting stock/bin packing problems, are the two closest problems. The present work addresses for the very first time an exact case of the two-stage two-dimensional dual bin packing problem (E-2S-2D-DBPP) in the context of wood reuse.

We propose a description of the problem and two mathematical formulations with cuts. Then, we compare them and present the results of several numerical experiments based on realistic instances from the wood industry. We also identify the size limit of the instances for which the problem can still be solved in a reasonable amount of time.

