Using pattern matching for tiling and packing problems

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Abstract

This paper describes a new placement method based on pattern matching for 2D tiling problems. Tiling problem can be considered as a special case of bin packing. In the proposed method, the representation of the figures and the board is based on directional chain codes. Contrary to other works that the area has been used for the board and the figures, the proposed method is based on usage of their boundaries instead. With this representation, consideration of the area has been replaced with that of the exact string matching. With the proposed knowledge representation, rotation and reflection of the figures can be considered easily. The results of a hybrid approach of genetic algorithm and simulated annealing have been shown. This new method, introduces a novel approach for handling and solving a variety of 2D-packing problems.

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1. Introduction

The tiling problem is to pack a checkerboard (bin) with small pieces. In doing so, the figures must not overlap and they must stay within the confines of the board. In this study, we consider a special case of these sorts of problems i.e., Tiling with polyminoes. Each polymino is a rectilinear polygon that, the length of each edge is a multiple of some predefined unit length.

Most of the previous works make some restrictions on the problem. Many of them use rectangular figures [1], whereas some others use specified or congruent polygons [2]. Tiling problem can be considered as a bin packing or cutting stock problem that the global minima are required. Bin packing and cutting stock problem