

Application of Variable Neighborhood Search on IC Substrate Drilling Path Problem

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ABSTRACT

A considerable amount of companies in Taiwan are original equipment manufacturing (OEM) companies. IC substrate industry is among the top in the world. However, in a highly competitive global market, competitiveness is vital to the survival of companies. Competitiveness can be improved through improvement of product quality and rapid delivery. In the manufacturing process of IC substrates, drilling operation is usually to most time-consuming step. Around 1,000 IC substrates can be produced from a single piece of copper clad laminate (CCL). There are less 100 holes that needed to be drilled on each IC substrates. The number of holes to be drilled on a piece of CCL can easily be over ten thousands. Planning a drilling path to cover such great amount of holes significantly affects operation time. Under mass production, its impact is further magnified. Therefore this is the goal of this study to develop more effective methods to solve drilling path optimization problem.

Incorporating massive number of holes and the repeating design pattern on a piece of CCL, the variable neighborhood search (VNS) method is applied to combine with the two search algorithms from Liu (2009), single-substrate and two-substrate, and the two algorithms from Wu (2010), single-substrate-sequential and various-link. With the same test instances, it is shown that developed VNS-based algorithms outperform the others. Overall, the various-link method with variable neighborhood search provides solutions with the best quality within reasonable run time.

Keyword: IC substrate Drilling path problem Variable Neighborhood Search
Traveling salesman problem (TSP)