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Optimization of PCB component placement using genetic algorithm

Abstract

This paper focuses on optimization problems faced in automated assembly of Printed Circuit Board (PCB). In order to optimize the throughput rate of these automated machines, the time taken for the pick and place operation for each board has to be minimized. In this paper, the component placement sequence problem is modeled as a Traveling Salesman Problem (TSP) and is optimized by Genetic Algorithms (GAs). In this study, components are placed on PCB where the process of pick-up and placement occurs starting from an empty multi-headed placement machine moving to pick up the components from the feeder magazine. The number of components to be picked and placed can range from a minimum of one to a maximum of four, depending on its contribution to minimize tour distance. The difference in size of components is handled by the tool change process, which brings the optimization problem closer to real machine situation. The paper suggests GA as a better alternative to other heuristic solution approaches such as Variable Neighborhood Search (VNS) and local optimum search. GAs are more promising as a global and robust method of solution and it permits a simpler mathematical model to solve a component assembly problem. The tool change factor, which was not incorporated in previous studies have been included in the present paper for the first time.

Keywords — Component placement, genetic algorithms