

Combinatorial Optimization of Various Placement Machines for PCB Assembly Lines

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Abstract

Surface Mount Technology (SMT) has been widely used in the electronic assembly industry's printed circuit board (PCB) assembly line. The assembly line consists of several stages, including solder paste printing, component placement, reflow, and inspection. Compared with other processes, component placement is a vital process. However, the placement machine in the component placement process is more expensive and is a bottleneck process in most cases. Therefore, properly utilizing the machine is crucial for optimizing the entire PCB assembly system. Due to the excessively high equipment configuration cost in the past, the combinatorial optimization problem of the different placement machines (including chip size, height, the accuracy) was less considered. As a result, the machine will be underutilized because the past combination mode cannot efficiently fulfill the placement requirements when demand or design changes. Nowadays, the placement machine towards modular design lets the configuration time be less time-consuming than traditional. It only takes a few working days to complete the multi-line reconfiguration. Therefore, this research will consider multi-level capacity planning, referring to the domestic electronic assembly industry. Comprehensively provide a suitable machine combination according to market demand. Proposed a matheuristic methodology that product and component assignments are carried out through the mathematical model, and the heuristic algorithm quickly solve the large-scale machine combination problem. This research combines theory and practical applications, hoping to effectively improve PCB assembly lines to reduce idle waste, thereby enhancing the competitiveness of the electronic assembly industry.

Keywords

Surface mount technology, printed circuit board, combinatorial optimization, capacity planning and matheuristic.

Biographies

James C. Chen is Professor in the Department of Industrial Engineering and Engineering Management at National Tsing-Hua University (NTHU), Taiwan. Prior to his current position, he was Chair Professor in the Department of Industrial Management at National Taiwan University of Science and Technology, Professor in the Department of Industrial and Systems Engineering at Chung Yuan Christian University, and a researcher at Industrial Technology Research Institute, Taiwan. He received a B.S. in Industrial Engineering from NTHU, Taiwan, an M.S. in

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