

## Literature Critique #1

Date Due: Month Day, Year

By: FirstName M.I. LastName (suffix if applicable)

Garetti, M., Pozzetti, A., & Tavecchio, R. (1996). Production scheduling in SMT electronic boards assembly. *Production Planning and Control*, 7 (2), 197-204.

This article discusses the complex scheduling problem faced during surface mount technology (SMT) electronic boards assembly. Developing a good production schedule can increase the performance of the entire production system. Thus, this paper examines the results of research carried out for the development of a production planning system for managing SMT assembly lines with variable printed circuit board (PCB) mixes.

The model was set up based on a predetermined production load to meet the requirements of a weekly production plan, using only automatic component-inserting machines. The production system is made up of identical machines working in parallel with only one routing for each board. The assembly times varied according to the board types and the set up time is calculated as “the time required by the operator to place all component types on the feeders.” It is clear that this scheduling problem contains a sequencing problem within it; and it has both deterministic and non-deterministic portions as well. The major focus of the system aims at minimizing the makespan for the assigned production.

In order to achieve the minimization of the makespan, the setup and idle times of the bottleneck machine has to be reduced. Reduction of setup time occurred by developing PCB mixes that could be produced without any need for setup. This meant that a setup was only necessary when changing over from one ‘no setup mix’ (NS mix) to another. After assuming that the bottleneck machine type (machine type with the highest workload) for the NS mix was the same as the one for the whole examined period, the limitation of idle time on this bottleneck machine type became the next task of importance.

There are 2 consecutive steps in the scheduling system: 1) generation of NS mixes and 2) sequencing of NS mixes. The generation of the NS mixes can be achieved by either maximization of machine productivity or minimization of machine setups. Sequencing of NS mixes can be achieved by minimizing the maximum operating time for the machine or minimizing the setup time of the system.

In this research, the generation of the NS mixes was divided into three modules: generation of the feasible mixes, determination of the optimum quantities for each feasible mix, and choice of the no setup mixes. At the end of this phase, the mixes that share all electronic components on all the machine types and those mixes that could be produced simultaneously (while fulfilling the constraint forced by the limited machine component-storage capacity) were now grouped together. Next, the scheduling procedure forms a number of sequences equal to the number of NS mixes to define a possible starting point. Then, the best sequence is chosen.

What really impressed me about this article was how Garetti, Pozzetti, and Tavecchio used various minimization techniques to actually achieve a reduced makespan for this complex PCB assembly problem. After realizing the scheduling problem would be too time-consuming to do in the traditional manner, they developed a heuristic procedure to achieve the main goal (by first achieving several sub-goals along the way); and they were successful at it. Another thing that impressed me was how they clearly illustrated an application example, which highlighted the behavior of the scheduling system at the end of the article.