Order Sequencing and Capacity Balancing in Synchronous Manufacturing

Author and presenter: Jan Riezebos, Faculty of Economics and Business, University of Groningen, P.O. Box 800, 9700 AV Groningen The Netherlands, Tel. +31 50 363 4853, Email: j.riezebos@rug.nl

Abstract:
Synchronous manufacturing aims at achieving the benefits of intermittent production lines in production situations that operate without lines. Benefits such as short and constant throughput times and predictable capacity loading can be acquired through an appropriate design of the synchronous manufacturing system and its control system. The order release mechanism is an essential part of this control system. It determines the sequence in which orders are released to the shop floor. As orders may differ in the amount and distribution of their capacity requirements over subsequent production stages, total capacity load may vary over time. If the available capacity per period is not flexible, capacity balancing becomes an issue in the order release decision. Human employees that work in such a system should be safeguarded from many unbalances in their working pattern. They are empowered and trained to contribute to several stages of production, but their motivation decreases rapidly if their working schedules do not give attention to stability issues. In practice, heuristics or rules of thumb are used to solve this problem, but their effectiveness is questioned. This paper examines the effectiveness of some new heuristics that are based on insights from assembly system design and work load control, and compare their performance with an optimal solution approach. The approaches are evaluated in a rolling schedule environment, and under different levels of capacity fluctuations and problem sizes. The results show that the performance of the heuristic solutions deteriorates if capacity fluctuations between the stages increase. If we measure both the amount and frequency of shortages over a long period of time in a rolling schedule environment, a quite simple rule that only takes the available capacity during the first stage into account outperforms more intelligent rules.