REDUCING JOB THROUGHPUT TIME

Using Horizontal Scheduling and Simultaneous Manufacturing

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Abstract: This paper is concerned with reducing job throughput time in job-shop like manufacturing systems using a Horizontal Scheduling approach. We follow this approach because we aim at compressing job throughput time to a minimum. To further enhance this objective we apply Simultaneous Manufacturing through the widespread use of batch overlapping. For this we use a mechanism called Job Scheduling Pattern, which in addition to be particularly effective in reducing job throughput time, maintains operating simplicity and calls for reduced manufacturing coordination.

Key words: Batch Scheduling, Horizontal Scheduling, and Simultaneous Manufacturing

Under today's highly competitive markets it is important to provide good service to customers and, at the same time, reduce costs in manufacturing. One clear contribution on these lines is to manufacture job orders within the shortest time that is reasonably possible, keeping work in process low. This has a direct effect on profitability, since fast turnover of short-term investment is achieved, and, of course, on fast deliveries, which is an important requisite for customer satisfaction. Our approach is oriented towards achieving very short manufacturing throughput times of customer orders.

In traditional batch production, a job is considered as a set of identical parts that are always processed as a whole. In cases where the batch size is large, this can become too great a penalty to the full duration of job processing. So, the performance of the manufacturing system, mainly

regarding job throughput time and accomplishment of job due dates can become highly poor. This operating weakness can be highly reduced through Horizontal Scheduling and batch overlapping. These strategies are explored in our approach.

Batch overlapping means transferring work from a machine, which is processing an operation of the job, to another machine, for processing the next operation, before the entire batch has been finished on the previous machine. This is done under a controlled overlapping procedure where the size of transfer batches and batch transfer timings can be established.

We strongly explore the possibility of different batch overlapping schemes for shortening flow times and finding good schedules. Actually, we focus on the quality of scheduling in shortening job throughput times towards meeting job due dates.

Under Horizontal Scheduling, a job is schedule first in all the required processors before another job is considered for scheduling, having in consideration existing manufacturing processors and their availability. Therefore, priority to execute a job already started is given aiming at further reducing job throughput times.

The scheduling approach combining these factors for reducing job throughput times has been named as Simultaneous Manufacturing. In our scheduling approach, a mechanism was developed for implementing SM in a user-controlled manner.

A mechanism, which allows implementing Horizontal Scheduling and SM in our work, is what we call Job Scheduling Patterns (JSP). A JSP is a virtual schedule of a given job, based on both Horizontal Scheduling, and batch overlapping. A JSP is one of several possible alternative schedules, for a given job, under an empty manufacturing system, i.e. with all processors considered available, in an unspecified time horizon. A job can have several JSP, which can be generated for better exploring the utilization of manufacturing processors or machines.

A Horizontal Scheduling method was developed and named Scheduling Plan Generator (SPG). With basis on the JSP this method can be applied to obtain a scheduling plan. It can be seen as a powerful tool to aid users to improve detailed shop floor scheduling in complex manufacturing environments, integrating both fabrication of parts and their assembly into customer ordered products.