

BRIDGING THE GAP BETWEEN SCHEDULING NEEDS AND METHODS

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1.- INTRODUCTION

The current state of knowledge of the scheduling field has made some authors [1] question whether the scheduling task is context dependent or not, that is, whether the scheduling task exclusively depends on the characteristics of the production environment where it is carried out or it is a task that can be modeled regardless of the production environment where it takes place.

Despite the fact that every production environment has its own characteristics that make the scheduling task of a factory an activity different from the scheduling task of another factory, we believe that some characteristics of each production environment can be present in a number of factories and, therefore, that some general conclusions can be given about the scheduling task and the scheduling methodologies that could fit each type of production environment. Results from Romero-Silva *et al.* [2] as well as from the research from Tenhiälä [3] present a basis to state that we can propose general planning and scheduling methodologies that will support the scheduling task of different production environments. The proposal of such methodologies will help production practitioners as a guide for seeking and acquiring actual planning and scheduling tools for their companies that will fit their manufacturing environments.

Therefore, this paper will present a summary of the results found on Romero-Silva *et al.* [2] where a fit between the production environment and the most adequate methods to support the scheduling task is presented.

2.- MATCH BETWEEN SCHEDULING NEEDS AND METHODS

2.1.- FACTORIES WITH HIGH PRODUCTION AND SCHEDULING CAPABILITIES

As the factories in this group have a stable demand and an important amount of monitoring capabilities coming from their big companies, advanced scheduling techniques, such as, optimizing algorithms [4] and constraint satisfaction techniques [5], could be used to support their scheduling task. Companies that produce a high number of different products or that make considerable customization to standard products could benefit from more advanced scheduling techniques, particularly if they are faced with a constraint such as the sequence-dependent setup time constraint because the impact of this constraint is difficult to analyze without developing a complete schedule. In contrast, companies that offer a low number of products, despite having the ability to use advanced scheduling techniques, will be better served by using a more basic technique for scheduling support, such as, inventory management [6] for make-to-stock environments or queueing theory [7] for managing make-to-order environments.

The relative stability of the demand of these companies can also create an opportunity to use Discrete Simulation [8] as a support for the scheduling task. Production environments where there are not a big number of jobs to schedule and where the production processes are simple, namely, single machine or flow shops, can be scheduled by Discrete Simulation by generating different schedules and comparing among themselves to find the schedule that delivers the best performance. By using Discrete Simulation, companies could reduce the cost of implementing a scheduling tool, compared with implementing a “tailored” algorithm or a commercial APS.

2.2.- FACTORIES WITH DEMAND AND SCHEDULING UNCERTAINTY

Plants included in this group are not suitable to use an advanced scheduling methodology as a significant amount of their demand comes from “engineer-to-order” jobs, creating a difficulty on determining the exact routing of the jobs in advance and on knowing the actual processing times of such jobs. In addition, an uncertain rate of arrivals of jobs and outdated information could turn obsolete and unfeasible any schedule that could be generated.

However, sequencing rules [9, 10] have been found suitable for the dynamic and stochastic nature of these plants. Dispatching or sequencing rules have fewer informational requirements since the decisions are taken considering only the jobs that are waiting to be processed on one resource’s queue, adapting to data constraints of these companies. The most important advantage of using this methodology in this type of plants is the decision autonomy that each resource has, a characteristic that suits well with the dynamic nature of the demand.

Queueing theory is a methodology that can also support the scheduling effort on these plants. Results from queueing theory can help schedulers estimate mean performance parameters. Additionally, queueing networks can model complex scheduling environments where various types of jobs are demanded with certain probability and where on type of job can have different probabilistic routings.

Finally, Discrete Simulation can also be used as a tool for supporting the scheduling task of this group of factories because it can model the dynamic and stochastic nature of their production environments. Simulation can be used to analyze different general scenarios that the plant could face, such as, sudden spikes on demand, machine breakdowns and worker absenteeism.

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