A Composite Dynamic Dispatching Rule for Scheduling Jobs with Release Dates on a Single Workstation

Ahmed ElMelegy
Contract Professor
Assistant Professor of Operations Management
College of Business Administration
Gulf University for Science and Technology
Mishrif, Kuwait
elmelegy.a@gust.edu.kw

Abstract

The sequencing of groups of jobs on a workstation, when each group is periodically released, is a common scheduling practice in manufacturing. When the objective is to minimize the sum of completion time, it becomes an NP-Hard problem. Solution to small instances of this problem, and most NP-Hard problems, can be found using integer programming algorithms such as branch-and-bound or cutting plane strategies. However large instances must settle for an approximate algorithm using some heuristic or dispatch rule.

In this paper, we present a composite dynamic dispatch rule named "Gap or No Gap" (GORNG) for tight schedules of large instances of the $1 \mid r_j \mid \Sigma C_j$ problem that performs better than other commonly used approaches. Our approach is novel in that it is counter-intuitive to keep a machine idle sometimes when work is available. We prove that in some cases it is better to force idle time rather than to schedule the next available job when the goal is to minimize the sum of the completion times of all jobs. The proposed Composite Dynamic Dispatching Rule (GORNG) was tested using four randomly generated datasets. The results prove that our rule consistently performed better than both the Gap (G) and the No Gap (NG) rule. In the four data sets, GORNG was better 75.00%, 72.73%, 85.16%, and 71.88% of the time with reference to our objective of minimizing the completion time.

Since most scheduling scenarios involve future demand that is not always known in advance, our proposed dispatch rule "Gap or No Gap" (GORNG) provides a better strategy with reference to the objective. Our proposed algorithm has important applications in practice. Operations Managers should realize that scheduling all unfinished jobs on hand does not guarantee an optimal solution all the time as there are certain instances where it is better to force idle time rather than scheduling all the unfinished jobs.

Keywords (12 font)
Scheduling, Release Dates, Single Workstation, Completion Time, Composite Dynamic Dispatching Rule.

Biography

Ahmed ElMelegy is an Assistant Professor of Operations Management at the College of Business Administration at Gulf University for Science and Technology. He holds a B.Sc. in Construction Engineering from Ain Shams University, an MBA with a specialization in Operations Management from the American University in Cairo, and a PhD. in Management Sciences with a specialization in Operations Management from Illinois Institute of Technology, USA. His teaching interests include Quantitative Methods, Operations Management, and Supply Chain Management. Ahmed's research focuses on Quality and Service Management, E-Services, Scheduling Algorithms, and Queuing Models.