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Topic: Scheduling Heuristics in Practice -- Flexible Flow Shops and Flow Shops with Reentry

ABSTRACT

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Efficient scheduling of industrial systems typically has a major impact on productivity levels. In this tutorial, we focus on the applications of scheduling heuristics in two different industries, both being of importance, namely steelmaking and microelectronics.

In steel production, the steelmaking-continuous casting (SCC) process is a bottleneck. Its scheduling has become more challenging over the years. We first describe the modeling of the essential features of an SCC process as a flexible flow shop with unrelated parallel machine environments, stage skipping, and maximum waiting time limits in between successive stages.   The objective is to minimize the total weighted waiting time, earliness, and tardiness. The problem can be formulated as a mixed integer program and we present an iterated greedy matheuristic that solves its subproblems to find a near-optimal solution. Through numerical experiments, we show the effectiveness of such an algorithm.

The microelectronics industry is conceptually very different from the steel making industry. The manufacturing processes in a wafer fab can be modeled as flow shops with re-entry, which are special cases of job shops with recirculation. The re-entries of the orders make the associated scheduling problems

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conceptually very difficult. We discuss the properties of the optimal schedules for various different objective functions.

We conclude this presentation with various other scheduling applications in industry that will deserve more research attention in the future.

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BIOGRAPHY

Michael Pinedo is Julius Schlesinger Professor of Operations Management at New York University's Stern School of Business. He received an Ir. degree in Mechanical Engineering from Delft University of Technology (in the Netherlands) in 1973 and a Ph.D. in Operations Research from the University of California at Berkeley in 1978. He has taught at Columbia University from 1982 till 1997 and at New York University since 1997. His research focuses on the modeling of service systems, and in the development of planning and scheduling systems, as well as systems for measuring operational risk. Over the last decade his research has focused on operational risk in financial services. He is co-editor of Creating Value in Financial Services: Strategies, Operations, and Technologies (Kluwer), and co-editor of Global Asset Management: Strategies, Risks, Processes, and Technologies (Palgrave/McMillan). He has co-authored the monograph Operations in Financial Services - Processes, Technologies, and Risks (NOW Publishers) together with Yuqian Xu. Professor Pinedo has been actively involved in industrial system development. He supervised the development of systems at Goldman Sachs, Siemens, and at Merck. Professor Pinedo is Department Editor of Production and Operations Management and of Service Science, and Associate Editor of Annals of Operations Research, the International Journal of Production Research, and of the Journal of Operational Risk,

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