BOOK REVIEW

Frank Werner

Michael L. Pinedo (2005) Planning and Scheduling in Manufacturing and Services

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This book is an outgrowth of an earlier text 'Operations Scheduling with Applications in Manufacturing and Services' by X. Chao and M. Pinedo from 1999. The new version has been completely reorganized and extended in several directions. As the title indicates, the application areas considered in the book can be divided into two major parts: scheduling applications and services applications. This subdivision is rather useful since manufacturing and service models are very different. Planning and scheduling in service industries is often more concerned with capacity and yield management and in contrast to manufacturing systems, the number of resources may vary over time in service systems. As a consequence, algorithms used in service settings tend to be rather different from those used in manufacturing settings.

The book consists of four parts and six appendices, and it also contains a CD-ROM that gives several PowerPoint slides.

Part I (Chapters 1–3) is of introductory nature and presents some preliminaries. Nine examples that illustrate the role of planning and scheduling in real life situations are given. Chapters 2 and 3 describe the basic characteristics of the manufacturing and service models.

Part II (Chapters 4–8) covers five areas of planning and scheduling in manufacturing: project scheduling, machine scheduling, flexible assembly systems, economic lot scheduling as well as planning and scheduling in supply chains. As an example, the machine scheduling chapter (Chapter 5; 33 pages) gives first a few comments on single and parallel machine problems. It presents a mathematical programming formulation for the job shop scheduling problem with makespan

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minimization and focuses then only on two successful techniques for solving job shop scheduling problems: the shifting bottleneck heuristic and constraint programming techniques. It finishes with an introduction into the LEKIN job shop scheduling system.

Part III (Chapter 9–12) covers four areas in services: reservations and time-tabling, tournament scheduling, planning and scheduling in transportation as well as workforce scheduling. As an example, the chapter dealing with planning, scheduling, and timetabling in transportation (Chapter 11; 35 pages) discusses tanker scheduling, aircraft routing and scheduling as well as train timetabling problems. At the end, it gives an overview of products of Carmen Systems, a Swedish company developing particularly products for the airline industry.

Part IV (Chapters 13–15) deals with systems development and implementation issues. One chapter is dedicated to systems design and implementation (e.g. architecture of systems, databases, modules for generating plans and schedules, and user interfaces) while another chapter considers advanced concepts in systems design (e.g. robustness and reactive decision making, machine learning, scheduling engines, reconfigurable systems, and web-based planning and scheduling systems). The last chapter discusses very shortly some future research directions in the planning and scheduling area.

The book contains six appendices. One of them is dealing with mathematical programming formulations and applications. A second one gives a very brief introduction into exact optimization methods. A slightly larger appendix discusses some basic heuristic algorithms, e.g. priority dispatching rules, beam search and basic local search techniques. The remaining appendices deal with constraint programming methods, selected scheduling systems and the user guide to the LEKIN system for job shop scheduling.

The enclosed CD-ROM contains several slides. One set contains slides from academia designed by instructors from several universities. Another set presents slides from corporations (e.g. Carmen Systems, Dash Optimization and SAP). The CD-ROM also contains slides describing scheduling systems and optimization software, computational details of two examples from the book, minicases and an interesting movie from ILOG dealing with scheduling at the Paris airports. Obviously, the style of the slides is rather different but the additional material certainly gives the reader further insights into the presented topics.

Since there exists a huge number of planning and scheduling models, the selection for inclusion into the book has been made based on the insight the models provide, the methodologies needed for their analyses and their importance with regard to real-world applications. Nevertheless, this book covers a wide range of planning and scheduling areas and is broader than most other scheduling books but goes less into depth. It has a strong focus on applications and requires only prerequisite knowledge of an elementary course in operations research, e.g. given in the book by Hillier and Lieberman. The book is well organized and readable. It is written in an illustrative way and completely without proofs. In contrast to some other books, it is not required that the reader has detailed knowledge in complexity theory. The author tried to maintain consistency of notation in the different parts of the book. The description of the algorithms is very clear so that students can immediately implement particular algorithms.

It is worth to be mentioned that the author describes in each chapter either a case study or a particular system implementation rather in detail. What I also find rather useful is the discussion together with the comments and references at the end of each chapter. The chapters contain sufficiently many illustrative examples and end with some exercises. Here the presentation of the answers to the problems – at least partially – would be helpful in particular for students. Personally, I would prefer to put parts of the appendices (e.g. part A–D) to the end of Part I even in an extended way. The inclusion of some more advanced local search techniques such as e.g. iterated local search or ant colony algorithms might also be considered in future.

The structure of the book differs from the structure of other scheduling books that appeared during the last decade. Without any doubt, Pinedo's book certainly fills a gap in the literature. The book is appropriate in particular for advanced students in industrial engineering and operations research but also for graduate students in economics and business. It can also be recommended for instructors teaching a senior or master level course on planning and scheduling. In addition, this book gives a good (but more broad than deep) overview of current solution methods from an applications-oriented point of view and has certainly the potential to serve as a reference book for practitioners working in various planning and scheduling areas as well.