16.1 Introduction

With so many different types of applications, it is not surprising that there is such a great variety of planning and scheduling models. Moreover, the numerous solution methods provide a host of procedures for the myriad of problems. Any given application typically requires its own type of planning and scheduling engine as well as customized user interfaces. The overall architecture of a system may therefore be very application-specific. The decision support systems that have been designed for planning and scheduling in the various industries tend to be quite different from one another.

Over the last decade there has been a tendency to build larger systems that have more capabilities and that are better integrated within the ERP system of the enterprise. Especially in the manufacturing world there has been a tendency to design and develop integrated systems with multiple functionalities. Especially in supply chain management the systems (and their underlying models) have become more and more elaborate. The dimensions according to which such a system can be measured include the number of facilities in the network as well as the various time horizons over which the system must optimize. Integration may occur in scope, space and time.
In service organizations the systems have become more and more integrated as well. In airlines, fleet scheduling systems and crew scheduling systems have become more and more integrated as well as interactive. In call centers, personnel scheduling systems interact with operator assignment and call routing systems.

The difficulties in the modeling, the design, and the development of large integrated systems lie typically in the coordination and integration of smaller modules with a narrower scope. There are many forms of integration and many types of interfaces between modules. For example, within a system a medium term planning module may have to interact with a short term scheduling module; a short term scheduling module may have to interact with reactive scheduling procedures. The models that have been discussed in the open literature and that are covered in this book tend to be narrow in scope; integration affects the modeling as well as the solution methods to be used. The difficulties often tend to lie on the interfaces between the different modeling paradigms.

Because of these forms of integration, the various modules in a system (that are designed to deal with different types of problems) must exchange data with one another. Since the solution method in one module often attempts to perform some form of local optimization in an iterative manner, it may be the case that the various modules must exchange data with one another regularly in order to solve their problems. Because the solution methods in the different modules of a system often attempt to optimize at different levels (with regard to the horizon, the level of detail, etc.), it may be the case that in the transfer of data between the modules the data have to undergo some form of transformation (e.g., aggregation).

16.2 Planning and Scheduling in Manufacturing

Many different planning and scheduling models in manufacturing have been analyzed in the literature in detail. Part II of this book focuses on some of the more important model categories, namely

(i) project planning and scheduling,
(ii) machine scheduling and job shop scheduling,
(iii) scheduling of flexible assembly systems,
(iv) economic lot scheduling, and
(v) planning and scheduling in supply chains.

Clearly, Part II does not cover all the planning and scheduling models in manufacturing that have been considered in the literature. Some of the more narrow areas in manufacturing with very special scheduling problems have not been covered in this book. Examples of such niche areas are:

(i) crane scheduling, and
(ii) scheduling of robotic cells.