Handbook of Expert Systems in Manufacturing



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Rex Maus Jessica Keyes

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Preface

The business community has embraced expert systems as a technology that brings with it competitive and strategic advantages. Nearly 80 percent of the Fortune 500 has dabbled in and dallied over this newfound art. Expert systems have been built in industrial sectors as diverse as marketing, banking, insurance, securities, and retail. Fut there are probably few sectors that have experienced as rapid a shape of the sectors and the sectors are probably few sectors.

towards this technology as manufacturing.

There are two major reasons for this. First, manufacturing is labor-intensive. Companies, in their quest for both quality and timeliness, are continually struggling with a workforce that is unprepared and inconsistent in skill level. For these firms, the idea of "cloning" top-achieving experts and distributing this expertise companywide is irresistible. Second, there are few sectors of our economy that are as complicated as the multifaceted face of manufacturing. From design to assembly to material handling to inventory control to testing, the tasks that form the manufacturing puzzle must be perfectly performed and integrated for a firm to compete in an increasingly global market-place. The use of expert systems to structure and assist in these tasks serves to provide a consistency and speed-up in time-to-market that gives a great boost to a firm's competitive advantage.

It is with this in mind that Handbook of Expert Systems in Manufacturing was written. And it wasn't written just for the technically proficient among us. You need not possess any prior experience in expert system technology, or even any computer experience. You need only an open mind and an interest in manufacturing technology. This multiposition readership was kept vivdly in mind when we decided on a format for this handbook. A picture is worth a thousand words. Think of each case history in this book as a picture of a working manufacturing expert system. And with this picture as blueprint, we hope our readers will soon follow the lead of our many contributors and

venture forth into this strategic technology.

To facilitate the use of the handbook by the reader, the chapters are arranged in ten sections. The first section, "Introduction to Expert Systems," serves as the foundation for the rest of the book. It gives the reader a bird's-eye view of the technology and how it can fit into the manufacturing industry. Not only does this section give you the whys and wherefores of the exciting link between AI and Manufacturing,

this section also gives you nuts and bolts information about how you

can start using AI in your company.

Sections Two through Ten are the reason why this book was published. These sections contain the fascinating accounts of expert system and neural net manufacturing applications from the top developers in the manufacturing and AI industries. These contributors were hand-selected to showcase their innovative use of this intriguing technology.

Section Two contains some interesting insights into how you can successfully integrate AI into the typical manufacturing environment. Section Three gives some hard and fast rules for performing the knowledge acquisition process. In Section Four, you'll get a good perspective on the use of this technology in the area of scheduling and forecasting. In Section Five, you'll see how two of our contributors link the exotic worlds of simulations, process modelling, resource allocation, and AI. Perhaps the most popular use of AI is in plant or machine diagnostics. In Section Six, you'll find out how to use expert systems and neural nets in some rather unique diagnostic applications.

In Section Seven, we'll see how AI can really pay off in process control and planning. The most creative use of AI is in the area of design, and in Section Eight we'll read two accounts that shed some new light on the meaning of CAD. In Section Nine, we'll tackle the quality and safety bogie. Finally, we'll tie it all together with some systems that assist manufacturers to customize, price, and package their products.

In the competitive 1990s, manufacturing companies will need some leverage to get ahead. The tried and true is just plain tired. The AI

approach may be just what the doctor ordered.

We owe much to the individuals who wrote individual chapters for this *Handbook of Expert Systems in Manufacturing*. Each of these contributors dedicated considerable time and effort to this project and offered much advice regarding the direction this handbook should take. The pooled efforts of these contributors, each of whom is a recognized authority within either the expert system or manufacturing community, has led to the creation of what we all agree is the definitive resource on manufacturing expert systems.

We would also like to thank our editors and friends at McGraw-Hill who encouraged and assisted us each step along the way. Special mention is given to Gail Nalven, Bob Hauserman, and Theron Shreve,

who gave selflessly of their time and experience.

Much of the credit for turning assorted floppy diskettes and paper into a real book goes to Sherry Cain, who is a whiz with desktop publishing.

> Rex Maus Jessica Keyes

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