



Handbook of Expert Systems in Manufacturing





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Editors

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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. But there are probably few sectors that have experienced as rapid a shift 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 marketplace. 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 vividly 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

Contents

Preface	xxi
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Section 1 Introduction to Expert Systems

Chapter 1. Introduction to Expert Systems

Introduction	3
Technology and Manufacturing	3
Manufacturing Activities	4
Author Biographical Data	6
	7

Chapter 2. Artificial Intelligence and Expert Systems: A Technological Primer

Introduction	8
Artificial Intelligence—From the Laboratory to Reality	6
What Is Artificial Intelligence?	8
Domains of Artificial Intelligence	9
The Human Expert	9
Expert Systems—Electronic Decision Makers	10
Conventional Systems and Expert Systems—A Comparison	12
Anatomy of an Expert System	12
The Inference Engine	14
The Knowledge Base	14
The Developer Interface	15
The Explanation Subsystem	16
The User Interface	16
Working Memory	17
Benefits From Using Expert Systems	17
Types of Expert Systems	17
Languages and Tools	20
How Expert Systems Are Used	21
Conclusion	22
Author Biographical Data	22

Chapter 3. Some Facts About Expert Systems	23
Introduction	23
Determining the Level of Expert System Complexity	24
Why Expert Systems Fail	25
Eight Steps to a Managed Project	27
Maintaining the Expert System	40
A Well-Managed Project	41
Author Biographical Data	41
Chapter 4. Manufacturing Survey	42
Introduction	42
Welding	44
Real-Time Process Diagnostics	45
Allocation, Scheduling, and Planning	47
Configuration	51
Inventory Control	52
CAE/CAD	53
Design	53
Conclusion	55
Author Biographical Data	55
 Section 2 Integration of AI Into Manufacturing	
Chapter 5. Integrating Knowledge-Based Systems in the Manufacturing Environment	58
Introduction	58
NOEMIE: Computer Hardware and Software Configuration	60
The Business Challenge	60
The Solution	62
The Approach	63
Results	63
MSDS: Material Safety Data Sheet Generation	64
The Business Challenge	65
The Solution	65
The Approach	66
The Results	66
Product Manager's Workbench: Packaging Design	67
The Business Challenge	67
The Solution	68
The Approach	70
The Results	71
CHROMA: Process Monitoring and Diagnostics	71
The Business Challenge	71
The Solution	72

Contents	ix
The Approach	72
Results	73
Conclusions	74
Acknowledgments	75
References	75
Author Biographical Data	76
Chapter 6. Data-Based Systems and Knowledge-Based Systems	77
Introduction	77
Some Background	78
Data, Knowledge, and Information	78
Data-Based vs. Knowledge-Based Systems: The Impact of Decision Knowledge on Information Processing	80
Application Areas	80
An Application Example—EDNA	82
Material Codes	84
Computer-Based Synergy	85
Other Applications	86
Conclusion	87
Author Biographical Data	87
Chapter 7. Workstation Integration of Expert Systems, Neural Networks, Image Processing, and Controls	89
Introduction	89
Technology Background	90
Applications Require Technology Integration	91
A Comparison of Neural Networks and Expert System Technology	92
Artificial Intelligence Laboratory	95
Integration Considerations	96
Potential Manufacturing Applications	98
Integrated AI Workstation	98
The Prototype Applications	102
Sputter Coating	102
Conclusions and Recommendations	106
Author Biographical Data	107
Section 3 Knowledge Engineering in a Manufacturing Environment	
Chapter 8. Knowledge Acquisition Issues in Manufacturing	110
Introduction	110
Conclusion	113
Author Biographical Data	114

Chapter 9. Organization of Knowledge for an Expert System: The Step Between Acquisition and Representation of Knowledge	115
Introduction	115
The Crawford Slip Method (CSM)	116
How to Begin	116
Planning and Scoping the Proposed Expert System	118
CSM and HIPO	119
The CSM and the Story Board	121
Creating a Prototype	122
CSM and Interviews With Personnel	122
Working From Documentation	123
Organizing information	124
Other Sorting Methods Using CSM Slips	125
Conclusion	126
Author Biographical Data	126
 Section 4 Scheduling and Forecasting	
Chapter 10. Knowledge-Based Dynamic Scheduling in a Steel Plant	130
Introduction	130
The Steel-Making Process	131
The Problem	132
The Simplified Problem	135
The Human Approach	139
The Expert System Approach	140
The Method of Attack	141
Discussion of the Algorithm	142
Initialization	143
Conclusion	145
Author Biographical Data	150
 Chapter 11. Managing Complexity: AI in Batch Plant Scheduling	152
Introduction	152
Multiple Variables	154
Scheduling Incentives	155
Solution Systems Overview	157
LP Technology	157
Dynamic Programming	158
Statistical Methods and Queuing Theory	158
Artificial Intelligence	159
Technique Comparison	159
Traditional OR Tools	162
AI Methods	168
Modeling	168

The Flow of Information	172
Uniting the Solutions	174
Integrated AI	175
Distributed AI	175
Time-Critical AI	175
Scheduling Techniques	176
Advanced Computing Technology	176
Conclusion	177
Author Biographical Data	178
Chapter 12. LA-Z-BOY Implements Manufacturing and Shipping Scheduler	179
Introduction	179
It Starts With the Production Schedulers	180
Taking Advantage of the Mainframe	181
Moving Toward the Knowledge Based	182
KBMS Clarifies Manufacturing/Shipping Connection	183
Maximum Truckloads	185
Additional Benefits	186
Author Biographical Data	189
Chapter 13. Forecasting Demand for Manufacturing and Deployment	190
Introduction	190
Model Base Development	192
Deseasonalization of the Time Series	193
Baseline and Trend Estimation	193
Optimal Filtering Procedures	193
Analysis of Factor Effects	194
Multiple Regression	194
The Role of Expert Systems	195
Statistical Procedure Selection for Forecast Generation	195
Diagnostic Assessments for Model Correction	195
Expert Help for Use of System	196
Expert Corrections to Model for Subjective and Other Factors	196
Conclusion	197
Author Biographical Data	198
Chapter 14. CHRONOS: Facilities Management	199
Introduction	199
How Is the Job Done Today?	200
Object-Oriented Analysis	201
How Can Facilities Management Be Simplified Or Done Better?	202
How Is the New System To Be Implemented?	202
How Can It Be "Computerized"?	202
What Design Is Best?	203

Rules of Thumb Regarding Requirements	203
How Are Participants Involved in the New System Trained?	203
Conclusion	204
CHRONOS: A Real-Time Expert System Tool	204
Author Biographical Data	208
Chapter 15. Expert Simulation for On-Line Scheduling	209
Introduction	209
Expert Simulation for On-Line Scheduling	210
Expert Systems Approach	211
Simulation Concepts	216
Application	218
Advantages/Disadvantages	220
Conclusion	222
References	222
Author Biographical Data	223
 Section 5 Simulation, Process Modeling, and Resource Allocation	
 Chapter 16. Intelligent Simulation: The New Generation of Expert Systems	227
Introduction	227
Object-Oriented Simulation Versus Traditional Simulation	229
ISIM in a Chemical Engineering Environment	232
Overview of Applications of ISIM	234
ISIM Support Features for Process Manufacturing	236
Benefits	237
Conclusion	237
Author Biographical Data	238
 Chapter 17. Object-Oriented Knowledge-Based Approach to Process Modeling	239
Introduction	239
Traditional Modeling Methods	241
Expert Systems in Statistical Modeling	242
Anatomy of Intelligent Statistical Process Analyzer	243
The Model Development Algorithm	245
System Implementation	246
System Application	247
Control Extensions	248
Conclusion	248
Author Biographical Data	249

Chapter 18. Randomized Heuristic Search Approach to Cutting Stock Problems

Introduction	251
Summary of the Method	251
Application of the Method to Paper Mill	252
Goals and Constraints	253
Method Description	254
Goal Identifier	255
Goal Selector	256
Adapter	256
Reducer	257
Numerical Example	257
Conclusions	259
Acknowledgment	264
References	265
Author Biographical Data	265

Section 6 Diagnostics

Chapter 19. A Fault-Tolerant Neural Network Applied to Nondestructive Inspection

Introduction	269
Neural Networks	269
Smart Structures: How to Monitor the Maintenance Health of Machinery	270
Introduction to Continuous Monitoring	273
General Schematic of a Smart Structure Application	274
Fault Tolerance	274
Potential Development Application of the Smart Structures Concept	275
Image Recognition: How to Locate the Problem	276
General Schematic of an Image Recognition Application	277
Potential Development Application of the Image Recognition Concept	278
Conclusion	278
References	279
Author Biographical Data	279

Chapter 20. Amethyst: Vibration-Based Condition Monitoring

Introduction	280
Traditional Diagnostic Methods	280
The Knowledge-Based Approach	282
Knowledge Engineering Methodology	285
The Expert System Shell	286
Violet	288
Structure of the Knowledge Base	291
Benefits of Using Amethyst	293

The Broader Impact	295
General AI Strategy	296
Conclusion	298
References	298
Author Biographical Data	299
Chapter 21. KLUE: A Diagnostic Expert System Tool for Manufacturing	300
Introduction	300
Issues of Knowledge Representation and Control	301
Requirements for Manufacturing Diagnostic Expert Systems	304
The Knowledge Representation and Environment of KLUE	306
Overview	306
Implementation	309
Conclusion	312
Author Biographical Data	313
Section 7 Process Control and Planning	
Chapter 22. A Real-Time Expert System in the Area of Energy Management	316
Introduction	316
The SOCCS Host	317
The Real-Time Data	318
The SOCCS Database	318
Overview of the SOCCS Alarm Advisor (SAA)	318
SAA Real-Time Requirements and Constraints	320
SAA Architecture	321
SAA Internal Models	322
SAA Processing Phases	324
SAA Performance and Size	326
Conclusion	327
Innovations	327
Criteria for Successful Deployment	327
Payoff	327
Development and Deployment Timeline	328
Future Development Plans	328
Author Biographical Data	329
Chapter 23. COOKER: What's Happened Since?	330
Introduction	330
COOKER	331
The Next Expert System	332
The Next Six Expert Systems	333
What Happened?	334
Future Plans	335

Conclusion	336
Author Biographical Data	337
Chapter 24. CABPRO Case Study	338
Introduction	338
CABPRO	339
Conclusion	346
Author Biographical Data	347
Chapter 25. Expert System for Automatic Generation of Printed Wiring Assembly Process Plans	348
Introduction	348
Suitability of Knowledge-Based System	352
Research Objectives and Goals	354
Scope of Research	354
The Hughes PWA Application	355
The Hughes Process Planning Environment	355
The Motivation	356
HICLASS Rules	356
Information Requirement	358
HICLASS PWA Network	359
Modus Operandi	360
Network Organization	362
State of Implementation	364
Integrating Application Networks	366
Benefits of the PWA Network	366
Limitations	367
Research Results	367
Overview	367
Going Beyond Surface Knowledge	369
Process Characterization	371
Process Elements	371
Process Element Relations	373
Modeling Taxonomies	374
Modeling Component Mounting	374
Modeling Soldering	376
Process Characterization via Frames	378
Product Definition	381
Basic Constituents Frames	382
Product Definition via Frames	382
Physical Relationships	385
Frames and Taxonomies	387
Planning Generation	388
Conclusion	392
References	394
Author Biographical Data	395

Chapter 26. The USS Blast Furnace Advisor	396
Introduction	396
Blast Furnace Advisor	397
Conclusion	402
Author Biographical Data	402
Chapter 27. A Hierarchical Planning Knowledge System Applied to Manufacturing Processes	404
Introduction	404
Previous Work Developed in Process Planning Systems	405
Manufacturing Processes Associated With the Production of PCBs	406
Architecture of CPMAPS II	410
CPMAPS II Planning Modules	410
Generic Process Planning Module	410
Workunit Process Planning Module	412
An Example	414
Conclusions	415
Acknowledgments	416
References	416
Author Biographical Data	417
Section 8 Design	
Chapter 28. Expert Systems for Engineering Design and Manufacturing	420
Introduction	420
The Need for Integration of Expert Systems with CAD/CAM	421
Applications in Design and Manufacturing	422
Integration Architecture	425
An Example	427
Conclusions	430
Author Biographical Data	431
Chapter 29. An Expert System for Designing and Processing Autobody Parts	432
Introduction	432
Expert System Shells	433
Selection of an Expert System Development Shell	434
Structuring the Knowledge Base	435
Building and Testing the Expert System	439
Consultations	443
Expanding the Prototype Expert System	444
Conclusion	445
Author Biographical Data	445
Acknowledgment	445

Section 9 Quality and Safety

Chapter 30. Lubrizol Material Safety Data Sheet System	448
Introduction	448
Building the Material Safety Data Sheet System	449
Conclusion	453
Author Biographical Data	454
Chapter 31. An Expert System for Quality Control in Manufacturing	455
Introduction	455
Project History	456
General AI History	456
Prototype Selection	458
Prototype Development	458
Production	459
The Software Development Approach	460
Testing and Evaluation Protocol	464
Outcome and Conclusions	464
References	465
Author Biographical Data	465
Chapter 32. Software Architecture to Support Total-Quality Companies	467
Introduction	467
The Problem	468
The Data Minimization Principle	469
The Replacement Principle	469
The Corporate Action Principle	469
The Commitment-Not-Concept Exchange Principle	469
A Way of Finding a Solution	470
The New Unit of Competition Principle	470
The Fractal Social Process Principle	470
The Locus of Work Is in the People Not in the Systems Principle	471
The Evolution of Meetings from Places-to-Do-Work to Places-to-Report-Status Principle	471
The Scientific Requisites of Finding a Solution: A Model of All Quality Approaches	473
The Compensation-for-National-Neuroses Principle	473
The Total-Quality Paradigm of Doing Business: A Matrix of All Quality Approaches	473
The Principles Shared by All Quality Approaches	475
The Solution	476
The Organizational Development Contribution	477
The Swedish and European Contribution	477
The American Contribution	478

Making a Start on This Daunting Task	479
An Initial Software Architecture for Support of Total-Quality Ways of Doing Business	482
The Work Already Done on Such an Architecture	483
The Minimal Input Principle	484
The Knowledge Architecture Needed to Support These Achieved Functions	484
Author Biographical Data	486
 Section 10 Pricing, Packaging, and Customizing	
Chapter 33. The Quotation Assistant at PMI Food Equipment Group	490
Introduction	490
The Quotation Assistant	491
Conclusion	495
Author Biographical Data	495
 Chapter 34. Product Lot Selection Advisor	 497
Introduction	497
General Development Methodology	498
How Many Iterations?	500
Tools Used During Development	502
Vital Statistics	502
Basic Application Operation	503
Conclusion	504
Author Biographical Data	505
 Chapter 35. Packaging AdvisorTM: An Expert System for Rigid-Plastic Food Package Design	 506
Introduction	506
The Business Environment	507
The Food Package Design Problem	508
The Development Process	509
The System	510
How the System Was Used	512
The Results	514
Conclusions	514
Author Biographical Data	514
 Chapter 36. Neural Nets for Custom Formulation	 515
Introduction	515
The Formulation Task	516
The Formulation Challenge	517
Current Formulation Approaches	517
A Better Way: Neural Nets	518
The Nature of Neural Nets	520