

Contents

1	Augmented Reality for Manufacturing	1
1.1	Virtual Reality	1
1.2	Reality Virtuality Continuum	2
1.3	Augmented Reality: An Alternate Human–Computer Interaction	2
1.4	Virtual Manufacturing	3
1.4.1	Virtual Manufacturing Systems	6
1.4.2	Organization of Virtual Manufacturing Systems	6
1.4.3	Components of Virtual Manufacturing Systems	7
1.4.4	Control of Virtual Manufacturing Systems	8
1.5	Development of Virtual Manufacturing System Using Augmented Reality	12
1.5.1	Machine Tool Database	12
1.5.2	Tools Database	15
1.5.3	Jigs and Fixture Database	15
1.5.4	Fluids	15
1.5.5	Parameters Related to Intangible Functions	17
1.5.6	3D Graphic Models for Virtual Manufacturing	17
1.5.7	VMS Graphical User Interface	18
1.5.8	Inference Engines	20
1.5.9	AR for Discrete Manufacturing	21
1.6	Object-Oriented Analysis and Design	21
1.6.1	Object-Oriented Analysis	22
1.6.2	Object-Oriented Design	22
1.6.3	Object-Oriented Programming	23
1.6.4	Unified Modeling Language	24
1.7	Computer-Aided Software Engineering Tools for Augmented Reality	25
1.8	Software Development Tools for Augmented Reality	26

1.9	Software Requirement specification For Discrete Manufacturing	27
1.9.1	Purpose	27
1.9.2	The Concept	30
1.9.3	Scope	34
1.9.4	System Overview	34
1.9.5	Overall System Description	37
1.9.6	Project Functions	37
1.9.7	System Interfaces	38
1.9.8	Requirements Specification	48
1.10	Operation of the VMS.	49
1.11	Computer Hardware Configuration for Virtual Manufacturing	50
1.12	Communication Methodology for Virtual Manufacturing	54
	Bibliography	55
2	Manufacturing Processes and Systems.	57
2.1	An Overview of Discrete Manufacturing Processes.	57
2.2	Discrete Manufacturing Systems.	59
2.2.1	Job Shop	60
2.2.2	Project Shop.	61
2.2.3	Cellular Manufacturing	61
2.2.4	Flow Line	61
2.2.5	Continuous Manufacturing System	63
2.2.6	Flexible Manufacturing System	63
2.2.7	Assembly System	64
2.3	Production Planning and Control	65
2.4	Virtual Reality for Manufacturing Systems and Processes	66
2.5	A Survey of the CNC Controller and Their Applications.	66
	Bibliography	88
3	Automation and Control in Manufacturing	91
3.1	Modern Control Systems	91
3.2	Mathematical Models for the Control System	91
3.3	Control Methodologies for Discrete Manufacturing Systems	91
3.3.1	Computer Numerical Control	92
3.3.2	Programmed Control of Industrial Manipulators, Gantries and Conveyors.	92
3.3.3	Programmable Logic Controllers	93
3.3.4	Embedded Systems	93
3.3.5	Mechatronics Based Application.	93

3.3.6	Supervisory Control and Data Acquisition System	94
	Bibliography	94
4	Augmented Reality for Sensors, Transducers and Actuators	97
4.1	Introduction	97
4.2	Sensors and Transducers Types and Usage	97
4.3	Actuators Types and Usage	97
4.4	Augmented Reality for Sensors, Transducers and Actuators.	99
4.5	System Integration Methodology	102
	Bibliography	126
5	Augmented Reality for Computer Numerical Control-Based Applications	127
5.1	Introduction to CNC-Based Applications.	127
5.2	Components of Machine Tools for Augmented Reality Design	131
5.3	Standards Pertaining to Augmented Reality for CNC-Based Machinery	131
5.4	Augmented Reality Design for CNC-Based Discrete Manufacturing Processes	133
5.4.1	EIA RS274 D Standard	134
5.4.2	Explanation of Functions	134
5.4.3	Other Functions	138
5.4.4	Selected G and M Code Command Set	138
5.4.5	American Standard Code for Information Interchange (ASCII)	140
5.4.6	Unicode	140
5.5	Interpreter Design for CNC Operation.	140
5.6	Interpreter Operation.	143
5.6.1	Rapid Movement	146
5.6.2	Linear Interpolation.	147
5.6.3	Circular Interpolation	149
5.6.4	Parabolic Interpolation.	150
5.7	A Description of Development of AR for Metal-Cutting Machines.	152
5.7.1	Developing AR for CNC Milling Operation.	152
5.7.2	Developing AR for Turning Operation	215
5.7.3	Developing AR for Drilling Operation	243
5.7.4	Developing AR for Sawing Operation.	244
5.8	Developing AR for CNC CMM	257
5.9	Interface Design for System Integration	275
	Bibliography	300

- 6 Augmented Reality for Industrial Manipulators, Gantries and Conveyors 303**
 - 6.1 Introduction to Industrial Manipulators, Gantries and Conveyors 303
 - 6.2 Components of Industrial Manipulators Gantries and Conveyors for Augmented Reality 303
 - 6.3 Standards Pertaining to Augmented Reality for Industrial Manipulator, Gantry and Cranes. 305
 - 6.4 Augmented Reality Design for Industrial Manipulator. 306
 - 6.4.1 SLIM Command Set for Industrial Manipulator 307
 - 6.4.2 Software Compiler Design Based on JIS SILM 310
 - 6.5 Augmented Reality Design for Gantry Crane. 354
 - 6.5.1 Interpreter Design for Gantry Crane 354
 - 6.6 Augmented Reality Design for Conveyors 371
 - 6.6.1 Interpreter Design for Conveyors 382
 - 6.7 Interface Design for System Integration 429
 - Bibliography 436

- 7 Virtual Reality Design for Programmable Logic Controller Based Applications 437**
 - 7.1 Introduction 437
 - 7.2 Programmable Logic Controller 437
 - 7.3 Programming PLCs. 437
 - 7.3.1 Basic Instructions Adopted for PLC Simulation 438
 - 7.4 Proxy HCI for PLC-Based Processes 441
 - 7.5 Development of PLC Simulator Using Object-Oriented Design. 441
 - 7.6 Programmable Logic Controller Simulation Software 454
 - 7.7 A Section of Software Code 459
 - 7.8 Interface Design for System Integration 506
 - Bibliography 507

- 8 Augmented Reality for Embedded Systems 509**
 - 8.1 Embedded System Characteristics. 509
 - 8.2 Real-Time Operating Systems 509
 - 8.3 Embedded Systems in Augmented Reality Environment 510
 - 8.4 Augmented Reality Model for Embedded System. 510
 - 8.5 Interface Design for System Integration 529
 - Bibliography 532

- 9 Augmented Reality for Supervisory Control and Data Acquisition-Based Application. 533**
 - 9.1 Characteristics of SCADA-Based System 533
 - 9.2 Augmented Reality for SCADA-Based System 533

9.3	Interface Design for Systems Integration	548
	Bibliography	550
10	Augmented Reality for Mechatronics-Based Applications.	551
10.1	Characteristics of Mechatronics-Based Application.	551
10.2	Augmented Reality for Mechatronics Applications	552
10.3	System Integration Methodology	552
	Bibliography	556
11	Virtual Manufacturing for Discrete Manufacturing Systems	557
11.1	Introduction	557
11.2	Components of the VMS	558
11.2.1	Factory Layout	561
11.2.2	Discrete Manufacturing Processes	562
11.2.3	Pick and Place Technology	562
11.2.4	Costing	562
11.2.5	Accounts and Finance	563
11.2.6	Sales	568
11.2.7	Inventory Management	571
11.2.8	Procurement	574
11.2.9	Process Planning	576
11.2.10	Quality Assurance	580
11.2.11	Scheduling	581
11.2.12	Management Information System	583
11.3	Virtual Manufacturing System	584
11.3.1	VMS Design	584
11.3.2	VMS Planner	584
11.3.3	VMS Monitor	586
11.3.4	VMS Fault Diagnostic	586
11.3.5	VMS Training	587
11.3.6	VMS Quality Assurance	588
11.3.7	VMS Assembly	588
11.3.8	VMS Business	590
11.3.9	VMS Vender	591
11.3.10	VMS Administrator	593
11.3.11	VMS Programs	597
11.3.12	VMS Videos	597
11.3.13	VMS Help	597
11.4	AR Design of Virtual Manufacturing Facility	599
11.5	System Integration for Virtual Manufacturing Facility.	703
	Bibliography	749

- 12 The Future of Virtual Manufacturing Using Augmented Reality Technology** 751
 - 12.1 The Technological Excellence 751
 - 12.2 Adoption of Standard Products. 756
 - 12.3 The Cost Factor 756
 - 12.4 The Prospects for a Dynamic Business Environment. 757
 - Bibliography 762

- Appendices** 763

- Index** 797



<http://www.springer.com/978-0-85729-185-1>

Virtual Manufacturing

Khan, W.A.; Raouf, A.; Cheng, K.

2011, XVIII, 802 p. With online files/update., Hardcover

ISBN: 978-0-85729-185-1