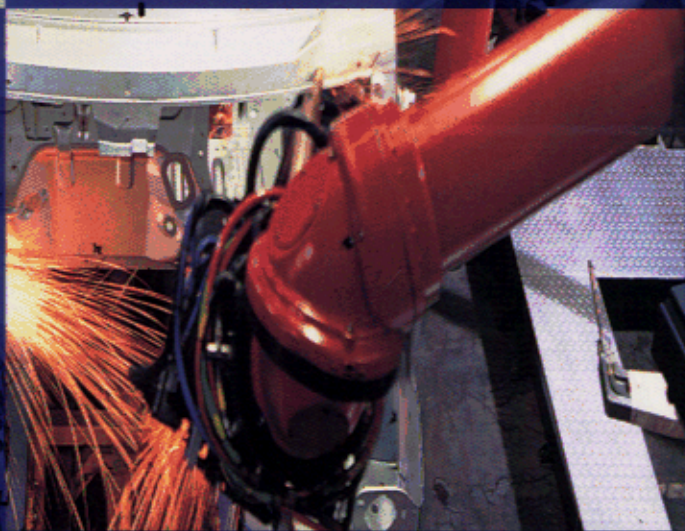


INDUSTRIAL ROBOTICS

Selection, Design, and Maintenance

- 
- ▲ **Assists potential industrial robot users in selection and methodology**
 - ▲ **Helps in implementing industrial robots to achieve maximum productivity**
 - ▲ **Emphasizes compliance with the most current robotic safety standards**
 - ▲ **Includes worldwide survey of industrial robotics companies**



HARRY COLESTOCK

Contents

Preface	ix
Acknowledgments	xi
1. Robots—Definitions and Classifications	1
Definitions	1
Robot Classifications	2
The Superintelligent Robot	2
The Intelligent Robot	2
The Nonintelligent Robot	2
Fixed Automation	3
References	4
2. Economic Productivity	5
Ways to Increase Productivity	12
References	13
3. Comparisons between Robots and Fixed Automation	15
Case 1—Assembly of Liquid Level Monoval	15
Option 1	16
Option 2	16
Manual Economic Comparisons	18
Option 1—Two Robots	18
Option 2—Fixed Automation	19
Case 2—Tending Die-Casting Machines	19
Option 1—General-Purpose Robot	19
Option 2—Fixed Automation	21
References	21

4.	Where to Use a Robot	23
	Human versus Robot Motion Times	23
	Problem Definition	25
	Case Studies	30
	Case 1—How Robots Are Used in the Composites Industry	31
	Case 2—Why Buy Robotic Vision from a Robot Supplier?	38
	Case 3—Robotic Sealing System Helps Lamson & Sessions	
	Increase Production Flexibility and Reduce Operating Costs	43
	Case 4—Survey of Robotic Seam Tracking Systems for	
	Gas Metal Arc Welding	50
	Case 5—Well-Dressed	54
	Case 6—Successful Robotic Laser Cutting Applications	58
	Case 7—How Small Shops Can Stay Competitive with	
	Robotic Solutions	62
	Case 8—Automotive Paint Shops: Quality from Technology	
	and Reducing Contamination	68
	Case 9—Kuntz Electroplating Develops a New Automated	
	Wheel Polishing Process	74
	Case 10—Robotic Dross Removal—Skimming More Profits	
	for the Hot Dip Steel Galvanizing Industry	82
	Case 11—Robots Impact Production at Mennie's	
	Machine Company, Inc.	88
	Case 12—Industry—Roller Bearings	92
	Case 13—Industry—Aluminum Die Castings and	
	Transmission Housings	95
	Case 14—Industry—Automotive Assembly Seam	
	Sealing of Cars	98
	Case 15—Industry—Personal Care	100
	Case 16—Industry—Mail Processing Industry	103
	Case 17—Industry—Bottling and Packaging	106
	Case 18—Industry—Tobacco Industry	108
	Case 19—Industry—Automotive Assembly	110
	Case 20—Industry—Automotive Subsupplier	112
	Case 21—Industry—Automotive	114
	Case 22—Industry—Custom Plastic Molders	116
	Case 23—Industry—Off-Road Equipment	118
	Case 24—Industry—Off-Highway Farm Tractors	121
	Case 25—Industry—Aerospace (Helicopters)	123
	Case 26—Industry—Motorcycle	127
	Case 27—Industry—Motorcycles	130
	Case 28—Industry—Motorcycle	133
	Case 29—Industry—Power Generation	135
	Case 30—Industry—Aluminum (Automotive) Wheels	138

Case 31—Industry—Plastic Injection Molding	141
Case 32—Industry—Textile Manufacturing	144
Case 33—Industry—Textile	146
Case 34—Diesel Engines for Heavy Tractors and Trucks	148
References	150
5. Upkeep of Industrial Robots	151
Design and Construction of Industrial Robots	151
Setup	152
Maintenance	152
Reference	152
6. Economic Justification	153
Payback Period	153
Return on Investment	154
Present Value of Future Earnings	154
Comparison of These Three Measures	155
The MAPI Formula	156
Assumptions	160
References	160
7. Effects of Legislation	161
References	163
8. Human Factors	165
References	166
9. Safety Standards for Industrial Robotics	169
The Robotic Industries Association (RIA)	169
Risk Assessment Software from RIA	170
National Robot Safety Conference Presentations	170
The Robot Safety Standard	172
R15.06-1999 Safety Standard	173
Current Issues the Affect the Old Standard	174
One-on-One with the Director of Standards Development	174
Safety Standards FAQs	177
Safety First: A Review of Robotic Safeguarding Devices and Issues	180
Robot Safety Begins with the Design Process	182
Risk Assessment	182
Safeguarding Technology—Availability and Implementation	182
Perimeter Guarding	183
Protection on the Inside	183

	The Solution	183
	Designing a Safe and Highly Productive System	184
	How to Stay Competitive	186
	Safety First, Last, and Always	186
10.	The Impact of Machine Vision on the Robotics Industry	187
	Machine Vision	187
	Categories of Machine Vision	188
	Code Reading	188
	Print Verification	188
	Robotic Guidance	189
	Dimensional Gauging	189
	Flaw Detection	189
11.	Summary and Conclusions	191
	Reasons for Robots	191
	Robot Application Comparisons	193
	Checklist	194
	Robot Applications	195
	Future Developments	196
	References	197
A.	A Survey of Industrial Robots	199
	Index	205