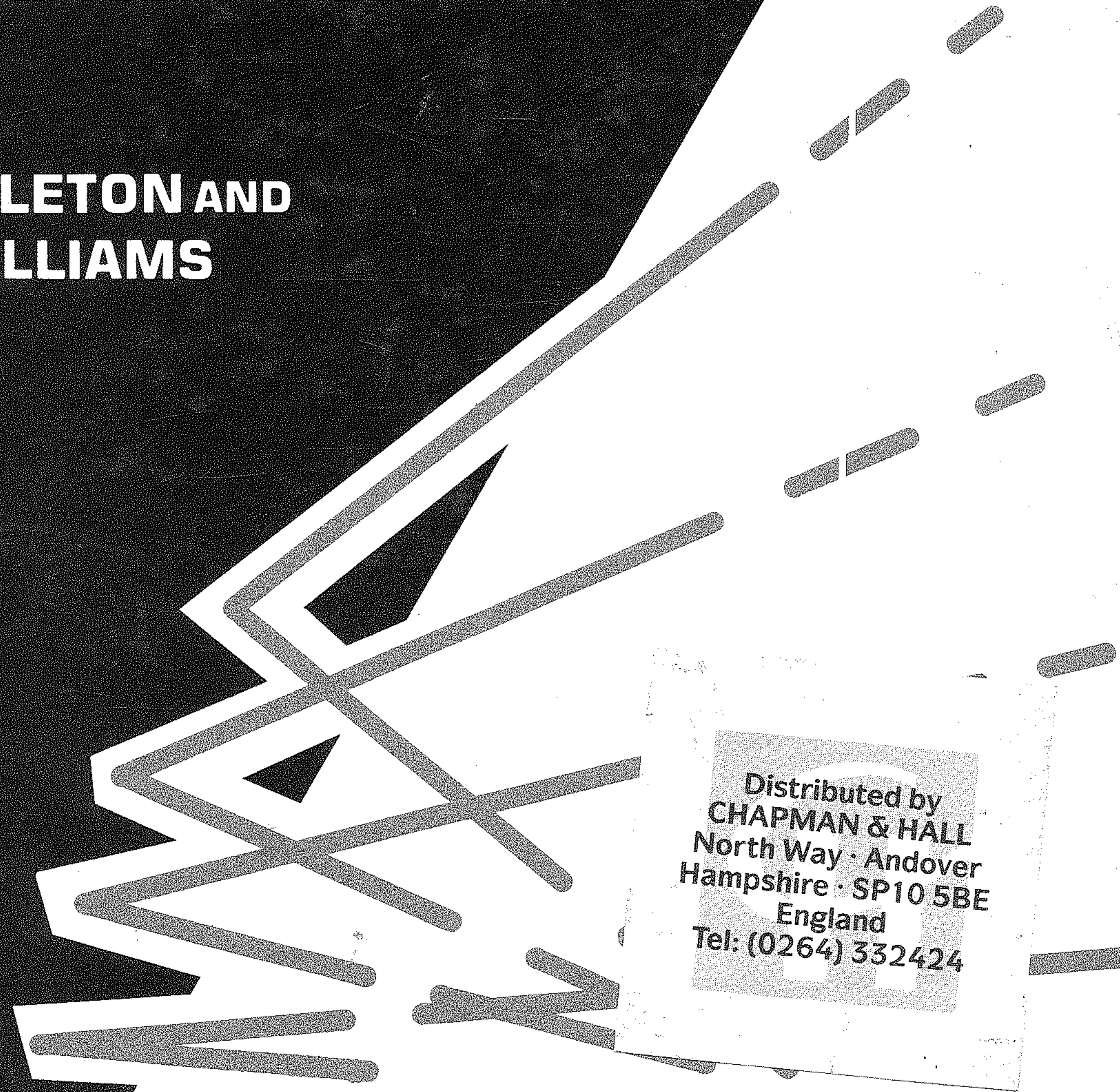


OPEN UNIVERSITY PRESS ROBOTICS SERIES
EDITED BY P.G. DAVEY



INDUSTRIAL ROBOT APPLICATIONS

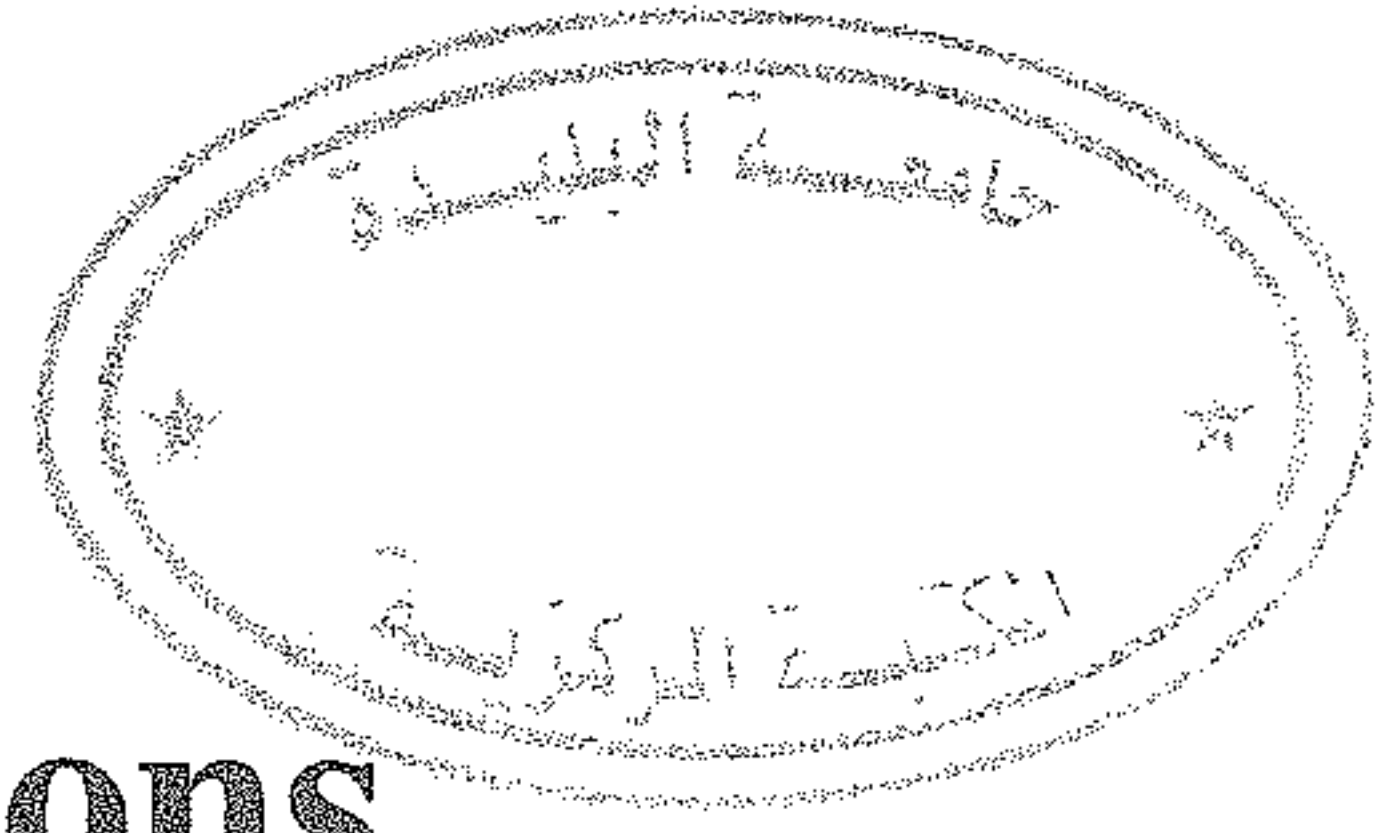
E. APPLETON AND
D.J. WILLIAMS



Distributed by
CHAPMAN & HALL
North Way · Andover
Hampshire · SP10 5BE
England
Tel: (0264) 332424

2-670-5-1

2-670-5-1



Industrial Robot Applications

E. Appleton

D.J. Williams

HALSTED PRESS
John Wiley & Sons
New York – Toronto
and

OPEN UNIVERSITY PRESS
Milton Keynes

Contents

<i>Series Editor's Preface</i>	viii
<i>Acknowledgements</i>	ix
Chapter 1 Introduction	1
1.1 Definition	1
1.2 The robot industry	8
1.3 Statistics and exploitation	9
PART I	
Chapter 2 Production engineering for robot applications	20
– I. Robot system considerations	
2.1 Introduction	20
2.2 Classification and terminology of robotic systems	21
2.3 Robot choice	26
2.4 Performance testing	38
Chapter 3 Production engineering for robot applications	50
– II. Application design considerations	
3.1 General system design considerations	50
3.2 Environmental factors	50
3.3 Reliability	56
3.4 End-effectors	57
3.5 The application of sensors	74
3.6 Workplace layout for robot applications	85
3.7 Safety considerations	92
3.8 Robot application economics and financial justification	101

PART II

Chapter 4 Robot handling	112
4.1 Introduction	112
4.2 Industrial application	112
4.3 Advantages of robot handling	113
4.4 The handling task	113
4.5 Robot characteristics for handling	118
4.6 Robot handling case study – Machine tool loading and unloading the 600 groups's SCAMP system	122
Chapter 5 Robot assembly	129
5.1 Introduction	129
5.2 Application characteristics	129
5.3 Case study – the assembly of steering gear tie rods	140
5.4 Case study – the assembly of electronic components using an Adept	144
5.5 Future developments	149
Chapter 6 Robot welding	150
6.1 Introduction	150
6.2 The spot welding process	150
6.3 Robot spot welding	151
6.4 The robot task	152
6.5 Robot spot welding case study – automobile body assembly Ford Sierra line	153
6.6 The arc welding process	162
6.7 Robot MIG welding	162
6.8 The robot task	163
6.9 Robot arc welding case study – garden furniture manufacture G & C Home and Leisure Supplies Ltd	165
Chapter 7 Machining with robots	170
7.1 Introduction	170
7.2 Application characteristics	170
7.3 Case study – drilling and routing	173
7.4 Case study – cut-off and fettling of castings	177
7.5 Other machining operations	184
7.6 Future developments	185
Chapter 8 Spray painting applications	187
8.1 The spray painting process	187
8.2 Spray painting robot anatomy and characteristics	188
8.3 Programming techniques	193
8.4 Two typical commercial machines	196
8.5 Robot spray painting case study – interior and exterior of commercial vehicles Freight Rover Ltd	198

Chapter 9 Innovative robot applications	202
9.1 Introduction	202
9.2 Robot applications in the automation of manufacturing processes	202
9.3 Robot applications in assembly automation	206
9.4 Robot applications in inspection	209
9.5 Concluding comments	212
PART III IMPLEMENTATION	
A Practical Guide to Implementing an Initial Robot Application	214
A1.1 Introduction	214
A1.2 Preliminary discussions	214
A1.3 Making a start	215
A1.4 The plant survey	215
A1.5 Project management	221
<i>Index</i>	224

Industrial Robot Applications

Preface — P G Davey, Meta Machines Limited

Using robots successfully in manufacturing industry depends on the process of matching the tasks with the available tools. Here at last the engineer has a full account of how this is achieved.

The first chapters deal with production engineering considerations, assessing the requirements of both tasks and robots, and the matching process.

The core of the book contains a chapter-by-chapter coverage of all the major application areas featuring full **case studies** which provide the framework for detailed analysis of robot systems and discussion of their capabilities. Actual practice exemplifies points of principle throughout the book, and in addition to the engineering problems, cost, safety and social factors are always kept in view.

The final section on implementation provides straightforward guidance on the steps taken to effect a successful robot system installation. For anyone with a robotics application in mind this book will prove a tool well matched to the task.

Dr E Appleton and Dr D J Williams, of the Manufacturing Engineering Group at the University of Cambridge, UK, have run several highly successful courses for industry on this subject and have expanded their material here into a form available to the whole manufacturing community.

Available in the USA, Canada and Latin America from Halsted Press, a division of John Wiley & Sons, New York – Toronto



ISBN 0470-20893-7

Available in the UK and the rest of the world from Open University Press, Milton Keynes



ISBN 0 335 15406 0 (Cased)