

Contents

Acknowledgements	vii
Preface	viii
1. Flexible assembly	1
1.1 Introduction	1
1.2 Economic importance of assembly	1
1.3 Definition of assembly	3
1.4 Historical survey	3
1.5 Definition of an assembly cell	6
1.6 Robotized flexible assembly cell components	8
1.7 Current research areas	11
1.8 Integrated control of a flexible assembly cell	20
1.9 Specifications of an automatic assembly plan generator	24
1.10 Typical case studies	25
2. State of the art	29
2.1 Introduction	29
2.2 Assembly modelling	30
2.3 Solution strategies	66
2.4 Description formalisms of assembly sequences	85
2.5 Conclusions	94
3. Assembly modelling	95
3.1 Introduction	95
3.2 Geometrical information	96
3.3 Component information	103
3.4 Final assembly information	111
3.5 Topological information	113
3.6 Technological information	144
3.7 Processing oblique assembly directions	145
3.8 Processing complex assembly directions	147
3.9 Conclusions	149

4. Basic principles of the proposed approach	151
4.1 Introduction	151
4.2 Classification of assembly sequences	152
4.3 General methodology	155
4.4 Conclusions	162
5. Automatic and systematic generation of precedence constraints	163
5.1 Introduction	163
5.2 Realizability conditions of an assembly operation	163
5.3 Precedence operators	166
5.4 Sources of precedence constraints	170
5.5 User-friendliness of the precedence constraint formalism	172
5.6 Automatic and systematic generation of precedence constraints	175
5.7 Conclusions	199
6. Generation and choice of assembly plans	203
6.1 Introduction	203
6.2 Precedence constraint-based reduction of the number of assembly sequences	204
6.3 Choice criteria	204
6.4 Displaying selected assembly plans	212
6.5 Conclusions	236
7. Conclusions	239
7.1 Summary of the major contributions of this book	239
7.2 Guidelines for future developments	242
Appendix A Generation of assembly sequences and trees	245
Appendix B GRAFCET syntax	258
References	261
Index	275