

Contents

<i>Acknowledgements</i>	<i>page vii</i>
1 Introduction	<i>page 1</i>
1.1 History and Development of the STCR Approach	2
1.2 Strengths and Weaknesses of the STCR Approach	4
1.3 Analysis and Classification Framework	6
1.4 Analysis of Composition of STCRs	8
1.4.1 Basics of Robot Composition	8
1.4.2 Robot Composition and STCRs	8
1.4.3 Symbols and Representations of Kinematic Structure of STCRs	9
1.4.4 Comparison of Kinematic Structures of STCRs	10
1.4.5 Future Research Tasks Related to STCR Robot Composition	13
2 Single-Task Construction Robots by Category	14
2.1 Automated Site-Measuring and Construction Progress Monitoring	14
2.1.1 Mobile Robots	14
2.1.2 Aerial Robots	18
2.2 Earth and Foundation Work Robots	23
2.3 Robotized Conventional Construction Machines	31
2.4 Reinforcement Production and Positioning Robots	39
2.5 Automated/Robotic 3D Concrete Structure Production on the Site	46
2.6 Automated/Robotic 3D Truss/Steel Structure Assembly on the Site	58
2.7 Bricklaying Robots	62
2.8 Concrete Distribution Robots	77
2.9 Concrete Levelling and Compaction Robots	86
2.10 Concrete Finishing Robots	94
2.11 Site Logistics Robots	109

2.12	Aerial Robots for Building Structure Assembly	123
2.13	Swarm Robotics and Self-Assembling Building Structures	128
2.14	Robots for Positioning of Components (Crane End-Effectors)	139
2.15	Steel Welding Robots	146
2.16	Facade Installation Robots	155
2.17	Tile Setting and Floor Finishing Robots	175
2.18	Facade Coating and Painting Robots	184
2.19	Humanoid Construction Robots	196
2.20	Exoskeletons, Wearable Robots, and Assistive Devices	202
2.21	Interior Finishing Robots	215
2.22	Fireproof Coating Robots	237
2.23	Service, Maintenance, and Inspection Robots	243
2.24	Renovation and Recycling Robots	274
3	Transition and Technological Reorientation towards Integrated On-Site Manufacturing	291
3.1	Development and Refinement of Automated On-Site Logistics	292
3.2	Development of Climbing Robots	293
3.3	Refinement of Site-Cover Technology	295
3.4	Introduction of Simulation and Real-Time Monitoring Technology in Construction	295
3.5	Introduction of Robot-Oriented Design Strategies in Construction	297
3.6	First Concepts for Integrated Sites: Cooperating STCRs	297
3.7	First Concepts for Integrated Sites: Factory Approach	299
4	From Stand-Alone Solutions to Systems Integrated by Structured Environments	302
	<i>References</i>	305
	<i>Glossary</i>	315
	<i>Index</i>	327