

CONSTRUCTION ROBOTS

Elementary Technologies and Single-Task Construction Robots

Single-task construction robots (STCRs) are robots developed for use on the construction site. After the first experiments in large-scale prefabrication were successfully conducted in Japan, and the first products proved successful on the market, the main contractor, Shimizu (1975, Tokyo), set up a research group for on-site construction robots. The focus initially was set on simple systems able to execute single, specific construction tasks in a repetitive manner. Today STCRs are a worldwide research and development theme, and the tasks and application fields of STCRs expand continuously. Whereas the first approaches done in Japan built on relatively simple manipulators and mobile platforms used to distribute concrete, finish floors, install wall panels and move material, recently new forms of STCRs have emerged building on aerial approaches, additive manufacturing technologies, exoskeletons, swarm robotic approaches, self-assembling building structures and humanoid robot technology. This volume features 200 STCRs classified into 24 categories.

Thomas Bock is a professor of building realization and robotics at Technische Universität München (TUM). His research for the past 35 years has focused on automation and robotics in building construction, from the planning, prefabrication, on-site production and utilization phases to the reorganization and deconstruction of a building. His educational and professional experience is mostly from Europe, United States and Japan. He is a member of several boards of directors of international associations and of several international academies in Europe, the Americas and Asia. He consulted several international ministries and evaluates research projects for various international funding institutions. He holds honorary doctor and professor degrees, as well as fellowships and visiting professorships. Professor Bock serves on several editorial boards, heads various working commission and groups of international research organizations, and has authored and co-authored Cambridge University Handbook Series on Construction Robotics and more than 400 articles.

Thomas Linner is a research associate in building realization and robotics at Technische Universität München (TUM). During the last few years, he has supervised some major research projects, with a focus on the deployment of advanced technology in the building sector. He is a specialist in the area of automated production of building products as well as in the enhancement of the performance of building products by advanced technology. He completed his dissertation in the field of construction automation, focussing on automated/robotic on-site factories. Increasingly, the generation of innovation strategies, business models, value systems and innovative manufacturing organization methods complementary with advanced technology in construction is becoming the central issue in his research. Dr. Linner has been an invited speaker at universities such as the University of Tokyo and Cambridge University. He has received several prizes and grants, including a Japanese Center of Excellence Grant for research in Japan.

CAMBRIDGE HANDBOOKS ON CONSTRUCTION ROBOTICS

The Cambridge Handbooks on Construction Robotics series focuses on the implementation of automation and robot technology to renew the construction industry and arrest its declining productivity. The series is intended to give professionals, researchers, lecturers, and students basic conceptual and technical skills and implementation strategies to manage, research, or teach the implementation of advanced automation and robot technology-based processes and technologies in construction. Currently, the implementation of modern developments in product structures (modularity and design for manufacturing), organizational strategies (just in time, just in sequence, and pulling production), and informational aspects (computer-aided design/manufacturing or computer-integrated manufacturing) are lagging because of the lack of modern integrated machine technology in construction. The Cambridge Handbooks on Construction Robotics books discuss progress in robot systems theory and demonstrate their integration using real systematic applications and projections for off-site as well as on-site building production.

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ELEMENTARY TECHNOLOGIES AND SINGLE-TASK CONSTRUCTION ROBOTS

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Construction automation gained momentum in the 1970s and 1980s in Japan, where the foundations for real-world application of automation in off-site building manufacturing, single-task construction robots, and automated construction sites were laid. This book series carries on a research direction and technological development established within this “environment” in the 1980s under the name *Robot-Oriented Design*, which was a focal point of the doctoral thesis of Thomas Bock at the University of Tokyo in 1989. In the context of this doctoral thesis many personal and professional relationships with inventors, researchers, and developers in the scientific and professional fields related to the construction automation field were built up. The doctoral thesis that was written by Thomas Linner (*Automated and Robotic Construction: Integrated Automated Construction Sites*) in 2013 took those approaches further and expanded the documentation of concepts and projects. Both of these form the backbone of the knowledge presented in this book series.

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