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Bier, Henriette; Becker, Mirco; Drude, Jan Philipp

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Editorial CpA #6: Human-Robot Interaction for Carbon-free Architecture

Henriette Bier ^[1,2], Mirco Becker ^[3], and Jan Philipp Drude ^[3]

^[1] *Delft University of Technology (The Netherlands)*

^[2] *University of Sydney (Australia)*

^[3] *Leibniz University Hannover (Germany)*

Abstract

The Spool CpA #6 issue on Human-Robot Interaction for Carbon-free Architecture reviews current tendencies in autonomous construction and human-robotic interaction in architecture. It aims at affirming and/or challenging research agendas in the domain of architectural robots and attempts to answer questions about (i) the fundamental framing of post-carbon autonomous construction, (ii) the interdependencies between machines, humans, and materials, and (iii) the different implementation timeframes ranging from continuous transformation to leapfrogging.

Editorial

The Architecture, Engineering and Construction (AEC) industry is facing a threefold challenge involving the (i) digital transformation of all design and planning processes, (ii) automation of construction processes, and (iii) reconsideration of energy, process, and material use. This challenge involves issues of productivity, scalability, safety, labour skill shift, and environmental impact. There is a particular urgency in transferring effective solutions from research to building practice to meet significant carbon reduction goals by 2040.

These questions are addressed by various contributors from TU Delft, Leibniz University Hannover, and the University of Sydney by discussing themes ranging from numerical simulations to experimental studies involving mobile and miniaturized robotic approaches, human-robot collaboration, and various robotic building systems.

While Boyle is presenting coordination strategies for swarms of autonomous construction robots using an open-source simulation of abstracted termite-like swarm construction, Sardenberg et al. introduce continuously reconfigurable interlocking modular discrete structures that are assembled by mobile robots. Both explore opportunities in the field of collective robotic construction (CRC) using robots designed in tandem with specific materials and/or building blocks.

On a different trajectory, three contributions focus on approaches using industrial robots for implementing various tasks extending from domestic environments to workshop and fabrication scenarios. Reinhardt and Masuda explore action packages, robot motion, and Human-Robot Collaboration (HRC) in domestic environments, while Bier et al. and Aslaminezhad et al. are advancing architectural design to production methodologies based on computational and robotic techniques for architectural applications ranging from smaller to larger scale interventions.

All applications aim to meet current requirements and affordances while integrating sustainable and adaptive functionalities, which is further reflected in the concluding 'Dialog on Architecture' discussing applications presented during the Human-Robot Interaction for Carbon-free Architecture symposium in 2022.

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