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Scouting Textile and Clothing Design, Prototyping, and Manufacturing Processes Through Customized Additive Manufacturing Tools

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Abstract

Additive manufacturing (AM) in the textile, and clothing sector is in the infancy stage from an academic and industrial perspective. Current research focuses on 3D printing (3DP) fabric-like structures, 3DP over non-prestretched textiles, and 4DP for textiles and garments. These solutions result in polymer fabric-like structures or polymer-textile composites far from achieving functionality, comfort, breathability, sustainability, and circularity in the fashion industry. Even if the Technology Readiness Level of AM is high, there is a lack of optimized tools and processes for the textile and clothing sector. Through a literature review integrated with multiple case studies, the research aims to give an overview about the technological viability, usability, and scalability of the current solutions within the processes of 3DP/4DP garments' design, prototyping, and manufacturing. The gathered insights pave the way for the realization of a demonstrator robotic AM system as part of an interdisciplinary Circularity Fashion-Tech Lab established to research, test, and validate Industry 4.0 and 5.0 principles with a design-driven perspective.

Keywords: Fashion-Tech, Collaborative Robotics, Additive Manufacturing, 4D printing, Industry 5.0