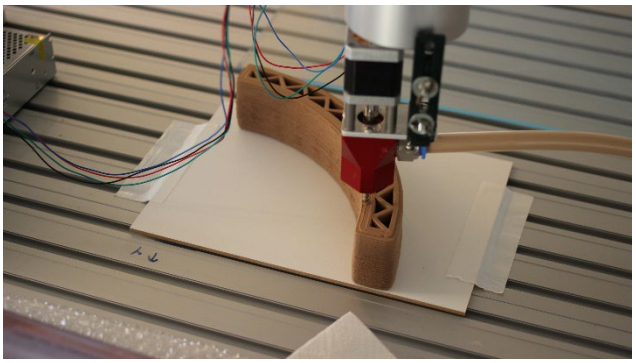
Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
Technical University of Munich

Master thesis

Collaborative robotic additive manufacturing

Description



The advent of extrusion-based concrete 3D printing is increasingly recognized as an important advancement within the Architecture, Engineering, and Construction (AEC) industry. This additive manufacturing method is instrumental in the digital transformation of construction practices. It employs a process wherein components are fabricated by robotic mechanisms, which are orchestrated based on digital blueprints. The integration of collaborative robotic systems into construction methods offers a promising solution to existing limitations, facilitating enhanced precision, efficiency, and scalability within building operations. The deployment of multiple fixed-arm robots has the potential to significantly augment the precision and velocity of additive manufacturing processes.

The principal aim of this project is to realize a system designed to optimize collaborative scanning and 3D printing endeavors, thereby augmenting operational speed and efficiency. This system utilizes two UR robots, anchored to a workbench, to execute the 3D printing of a predetermined geometry. These robots assume distinct roles, with one engaged in the printing process and the other dedicated to quality control and visual inspection through the application of a laser-based sensor. This approach underscores the potential of robotic collaboration in elevating the standards of additive manufacturing within the construction sector.

Links

https://www.cee.ed.tum.de/cms/labs/robotic-fabrication-lab/

Supervisors

Martin Slepicka (martin.slepicka@tum.de),
Stavros Nousias (stavros.nousias@tum.de),
Mohammad Reza Kolani (mohammadreza.kolani@tum.de),

CMS / TUM School of Engineering and Design / TU Munich,

References

[1] A. A. Rashid, S. A. Khan, S. G. Al-Ghamdi and M. Koç, "Additive manufacturing: Technology, applications, markets, and opportunities for the built environment," *Automation in Construction,* vol. 118, p. 103268, 2020.

[2] H. Takahashi and H. Miyashita, “Takahashi, H., & Miyashita, H. (2017, May). Expressive fused deposition modeling by controlling extruder height and extrusion amount,” *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems,* pp. 5065-5074, May 2017.