Robotic additive construction of bar structures: Unified sequence and motion planning

YIJIANG HUANG, MIT
CAELAN GARRETT, MIT, NVIDIA Seattle Robotics Research Lab
IAN TING, Princeton University
STEFANA PARASCHO, Princeton University
CAITLIN MUELLER, MIT

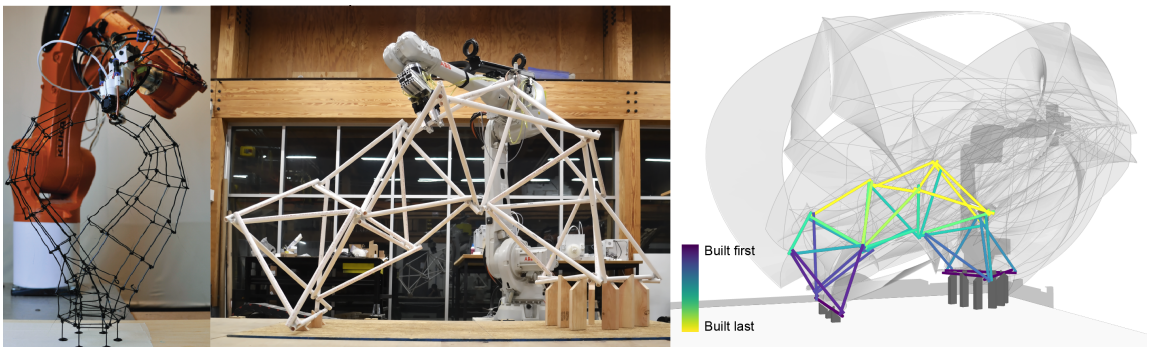

Fig. 1. *Left, Middle*: real built examples of a Klein bottle and a trussed arch structure, additively constructed by a robotic arm with spatial extrusion and assembly processes separately, with the sequence and motion planned by our algorithm. *Right*: full sequence and trajectories displayed for the trussed arch structure.

Additive robotic construction of building-scale discrete bar structures, such as trusses and space frames, is increasingly attractive due to the potential improvements in efficiency and design possibilities. However, programming complex robots to successfully complete construction tasks can be tedious and challenging. The key path planning challenge is, throughout the assembly process, satisfying both structural constraints that limit the deformation of the structure and geometric constraints that ensure the robot does not collide with the structure. Our recent work presented an automated planning approach for jointly finding a construction sequence and robot motion plan for large additive construction tasks that satisfies these requirements without any human intervention [Garrett et al. 2020; Huang et al. 2021].

ACM Reference Format:
Yijiang Huang, Caelan Garrett, Ian Ting, Stefana Parascho, and Caitlin Mueller. 2021. Robotic additive construction of bar structures: Unified sequence and motion planning. 1, 1 (October 2021), 1 page. https://doi.org/10.1145/nnnnnnn.nnnnnnn

REFERENCES

Caelan Reed Garrett, Yijiang Huang, Tomás Lozano-Pérez, and Caitlin Mueller. 2020. Scalable and Probabilistically Complete Planning for Robotic Spatial Extrusion. In *Robotics: Science and Systems XVI, Virtual Event / Corvalis, Oregon, USA, July 12-16, 2020.*

Yijiang Huang, Caelan Garrett, Ian Ting, Stefana Parascho, and Caitlin Mueller. 2021. Robotic additive construction of bar structures: Unified sequence and motion planning. *Construction Robotics* (2021). https://doi.org/10.1007/s41693-021-00062-z

Authors' addresses: Yijiang Huang, yijiangh@mit.edu, MIT; Caelan Garrett, MIT, and NVIDIA Seattle Robotics Research Lab; Ian Ting, Princeton University; Stefana Parascho, Princeton University; Caitlin Mueller, MIT.

2021. Manuscript submitted to ACM