

Title: Simulation of a collaborative two-robot system for lattice assembly

Abstract:

This project explores a swarm robotics approach for automating the construction of discrete lattice structures. Truss lattices are of utility as high-strength, low-weight materials. Discretizing the structure into a set of voxel building blocks additionally enables the creation of endlessly reconfigurable architectures without modification to the feedstock. To fully realize the utility of these structures, methods for automating their assembly need to be developed. A potential strategy is to utilize a swarm of robots that are able to manipulate voxels and traverse the structure. In this project, a two-robot system for collaboratively manipulating voxels is explored in simulation using Drake. Because the functionality of each individual robot is limited, collaborative behavior is required to extend the addressable space of the entire system. Optimization-based and geometric approaches to designing state trajectories for the robotic system are explored and evaluated. Additionally, the robots' ability to track these trajectories is evaluated with a simulated position controller. Preliminary steps toward recreating this simulated behavior in hardware are presented.

Contributors: Miana Smith, Neil Gershenfeld

Affiliation: Center for Bits and Atoms, MIT