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Robotic 3D Printing of Lattice Structures[1] JASMINE KIM, Southern Methodist University, DANIEL MARSHALL, KAM-MING MARK TAM, CAITLIN MUELLER, Massachusetts Institute of Technology — Lattice structures are known to be amongst the strongest materials per weight, however, previous scholarship upon lattices has only considered uniform lattices; new digital fabrication technologies allow for irregular lattices which are even more optimized for strength to weight ratios. In order to prevent the overuse of materials in construction, the MIT Digital Structures Group are researching the concept of digitally fabricated lattice structures. Using a Kuka Robotic Arm with a modified PLA (Polylatic-acid) extruder, we are able to print octahedral lattices, initially as small blocks that can be stress tested, and ultimately as something that can take the weight of the human body. Although 3D printing may provide a new technological method for future architectural structuring, it currently faces geometric and stability issues to print perfect form of lattice. To overcome these challenges, the research focuses on computation, structural design, and force testing. After iterations of load testing and finite element analysis comparison, it is identified that three point joint algorithm performs better than the one point joint algorithm overall. The specimens hold up to 500 times its weight in three point bending test and 1000 times in pure compression. These results prove potentials of lattice structure printing for practical usage in the future.

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