
Opportunity

Seeking a licensing and development partner to scale into manufacturing.

Development Stage

Prototype built and demonstrated in the lab

Intellectual Property

Granted US
Patent No. 12,103,232 B 2

Publication

[Tafolla, Bryce Tyler, "3D printing reinforced concrete structures" \(2020\). Masters Theses. 8081.](#)

IDF#

19-MST-044

Three-Dimensional Printing Of Reinforced Concrete And Nozzle Therefor

Chenglin Wu, Genda Chen, Dimitri Feys, Guirong Yan, and Bryce Tyler Tafolla

PROBLEM STATEMENT

Three-dimensional printing has opened new possibilities in concrete construction, from complex geometries to faster builds with less labor. One bottleneck remains: reinforcement. Today's 3D concrete printers still depend on steel cages assembled before printing begins or on fiber admixtures blended into the concrete mix. Both approaches lock in the reinforcement design before a single layer of concrete is laid. That defeats the purpose of free-form printing and adds significant labor and setup cost. A concrete printing system is needed that can place reinforcement in any geometry during printing itself.

SOLUTION

Researchers at Missouri University of Science and Technology developed a 3D printing nozzle system that embeds configurable reinforcement directly into concrete as it is extruded. The system integrates a mechanical extruder, a reinforcement configurator, and a synchronized printing controller into a single print head. As concrete is extruded, the configurator simultaneously feeds and shapes metal wire or cable into a defined reinforcement geometry before it is set within the concrete. In the demonstrated embodiment, the configurator forms the reinforcement into a coil with adjustable pitch and length. A synchronized controller matches the concrete extrusion speed to the reinforcement feed rate so both materials bond properly during printing. A working prototype was built and used to print reinforced concrete beam members, demonstrating layered structures and intersecting reinforcement configurations in the finished beams.

VALUE PROPOSITION

This system eliminates the cage assembly and pre-installation labor that currently limit 3D concrete printing to simpler pre-planned forms. Architects and engineers can design the reinforcement pattern digitally and let the printer configure it in place. That reduces material cost and makes large-span slender structures practical where conventional methods cannot deliver them. The same nozzle platform also supports hollow reinforcement that serves as internal pipelines for thermal energy harvesting and dissipation, enabling multifunctional building envelopes.