Concrete printing of a space truss by EPS assembly

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Abstract

This work is about the prototyping of mortar space trusses made with robotic extrusion (concrete 3D printing) mixed with EPS assembly of blocks. The principle has been presented in [1] to evaluate its relevance when applied to confined masonry. It consists in extruding mortar in channels formed by assembled EPS pyramids, see figure 1. The blocks are made by robotic hot wire cutting.

The printing is conducted by extrusion, following a free deposition method. This method differs from the two main proposed strategies for layered mortar extrusion in the litterature [2]. The most used approach can be called "extruded lace shaping", it consist in pumping a mortar with relatively high yield stress (around 1000 Pa) and shaping square laces through a nozzle without destructing the structuration. The other method, presented in [3], can be called "oriented lace pressing" and presses layers of fluid mortar (yield stress around 300 Pa) onto each other, that rapidly gain structural properties to sustain the following layers. Here the mortar lace is supported and shaped by the EPS channels, more plasticity is therefore expected. It falls freely in the channels, the falling being controlled by flow rate, viscosity, nozzle speed and height. Depending on the bars inclination, different deposition regimes have been used.

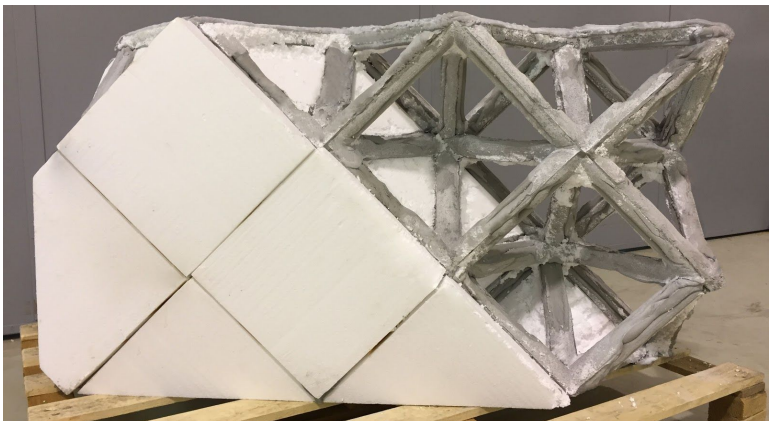

Figure 1 : Prototype of a 3D printed space struss

References

[1] R. Duballet, O. Baverel, J. Dirrenberger, *Space Truss Masonry Walls With Robotic Mortar Extrusion*, Structures, 2018 (*in press*)

[2] N. Roussel, *Rheological requirements for printable concretes*, Cement and Concrete Research 112, 76-85, 2018

[3] C. Gosselin, R. Duballet, P. Roux, N. Gaudillière, J. Dirrenberger, P. Morel, *Large-scale 3D printing of ultra-high performance concrete – a new processing route for architects and builders*, Materials & Design 100, 102–109, 2016.