COMPUTING CRAFT
Manufacturing Cob Structures Using Robotically Controlled 3d Printing

Concluding remarks

Introduction

Material exploration

3D printing equipment

Material extrusion system

Geometry and performance explorations

Future work
Cob

Subsoil

Straw

Water

Cob house in Dartington village in England. (CobBauge, 2018)
Where Can You Build with Cob?

Regions with abundant clay in soil
ODA Countries and Territories

DAC List of ODA Recipients
- Least Developed Countries
- Other Low Income Countries
- Lower Middle Income Countries and Territories
- Upper Middle Income Countries and Territories
The investigation was conducted in three stages:

• Investigate the current knowledge base of craft-based cob-construction.
• Conduct initial geometrical and performance exploration through small-scale modelling.
• Conduct a full-scale feasibility test for a cob building element (building a wall/module).
The scheme of large scale robotic 3D printing set up (Gosselin et al. 2016)
Material Exploration

Subsoil properties

Cob recipes are location-dependent.

On-site testing is always required.

80 % fine aggregate (sand, silt) + 20 % Clay

Cob recipe (by weight)

Subsoil 78% + water content 20 % + Straw 2 %

3D printing Equipment

Rhinoceros

grasshopper

KUKA prc
parametric robot control for grasshopper
3D printing Equipment
Material extrusion system

Air-assisted Extrusion system
3D printing Equipment
Material extrusion system

B
Mechanical Extrusion system
(3D potter 7- Linear ram extruder)
3D printing Equipment

Challenges

Constant extrusion
Continuous flow
Higher speeds
Larger scale
Freedom of movement
Material extrusion system
Material extrusion system
Material extrusion system
Geometry and performance explorations
Geometry exploration

Small scale (1:4)

Simple geometries
Geometry Exploration

Small scale (1:4)

Complex geometry A
Geometry Exploration

Small scale (1:4)

Complex geometry B
Performance Exploration

Thermal conductivity (W/mK)

• The heat flow rate through a material.

• Lower thermal conductivity is normally desired. Good practice: 0.6 W/mK.

• The heat flow meter used is a Netzsch HFM 446.
Performance Exploration

Thermal conductivity

- Presence of air gap(s) lowered the conductivity of the solid 3D printed cob samples.

- Straw filling in the air gap(s) further lowered the thermal conductivity
Geometry Exploration

Bigger scale (1:1)
Geometry Exploration

Bigger scale (1:1)
Publications


Future work

• Apply the technology in developing countries.
• Explore new material configurations.
• Explore new design and geometric opportunities.
• Conduct further performance testing (e.g. structural etc. on 1:1 scale).
Thank you!
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