Structural and thermal properties of non-reinforced additive manufactured concrete wall systems

Summary

The aim of this PhD project is to assess different types of additive manufactured cement concrete wall systems through building information model (BIM) input by testing their load bearing properties and thermal transmittance through 3D printing and respective post-analysis.

Research field:	Building and civil engineering and architecture
Supervisor:	Prof. Dr. Raido Puust
Availability:	This position is available.
Offered by:	School of Engineering Department of Civil Engineering and Architecture
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

3D printing solutions for construction has become a major discussion topic in recent years. Several prototypes exist, but limited research has been carried out in terms of their structural and thermal properties and how to ensure the integrity of the final 3D printed product (according to the designed properties). Designed properties (material properties) can be also used to guide the mixing procedure (needed material properties) through building information models (BIM) for a certain construction. To ensure the integrity, post-analysis enables to give additional knowledge to account for various conditions (e.g., climate conditions) during 3D printing.

Relevant questions which this PhD project could address:

- How to build up the information requirements for building information models to extract material properties for 3D printing according to design intent and predicted printing conditions (e.g., climate conditions)?
- Do the imperfections of manufacturing process impact load bearing properties of different wall types?
- Does finite element analysis (FEA) of a precise digitized twin help predict the failure location on a coarse surface?
- Is the analysis model of traditional concrete or masonry walls better suited for simplified structural analysis?
- Which wall type is viable in northern climate?

Applicants should fulfil the following requirements:

- University degree (MSc) in structural engineering and/or construction management
- Advanced computer literacy and programming skills (including: RobotStudio, Python)
- Previous knowledge (research history) of cement-based material properties
- Practical experience of ABB robotic arm (or similar)
- Skills in data analysis, mathematics, and statistics
- Ability for independent research as part of a team, interest in the presentation/publication of scientific results
- Good command of the English language

To get more information or to apply online, visit https://taltech.glowbase.com/positions/354 or scan the the code on the left with your smartphone.