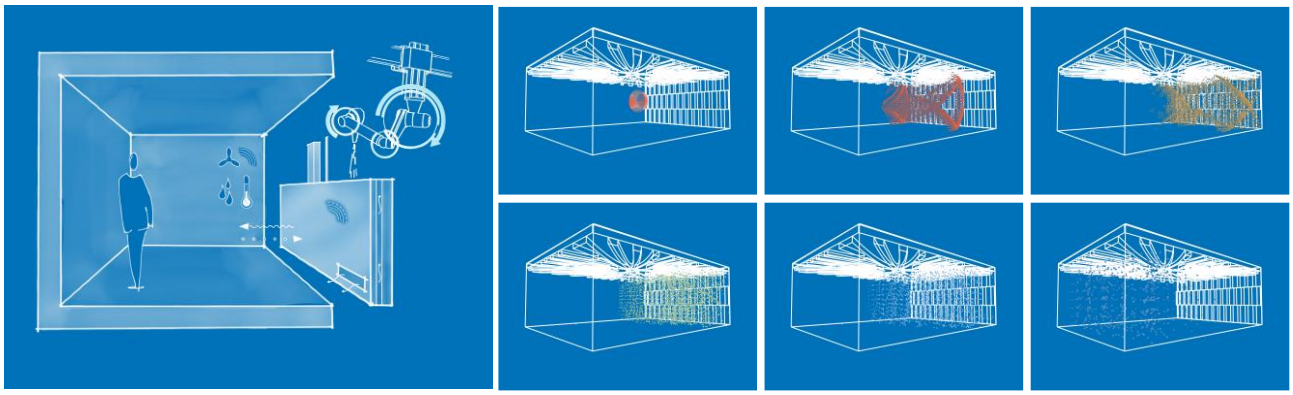
Chair of Building Technology and Climate Responsive Design
TUM School of Engineering and Design
Technical University of Munich

Announcement for Students of Architecture, RNB, & Civil Engineering

Master thesis

Topic

Design and Analysis of Additively Manufactured Elements and Patterns for Enhanced Room Acoustics



About us

Within a DFG-funded Collaborative Research Centre "**AMC – Additive Manufacturing in Construction**", we´re researching the "**Integration of Passive and Active Functions in Additively Manufactured Construction Elements**". The aim is to develop and test additively manufactured building components, that integrate multiple passive and active functions to improve building operation and environmental quality. It explores the potential of AM of building components to incorporate different performance features. The components are developed and optimized through a **simulation-based parametric design process** for integrated performance functionalities. This research introduces methods for robust performance using AM building components due to the integration of passive and active functions in their design, fabrication, and construction process.

Requirements

- Bachelor´s degree in civil engineering, architecture, or similar
- Current study in M.Sc. Resource Efficient and Sustainable Building or similar
- First experiences with CAD-Tools (preferable Rhino)
- Ideally first experiences with algorithmic modeling (Grasshopper) and/or coding (Python)
- Interest in acoustics and Additive Manufacturing
- Independent working

Tasks

- **Literature Review and State of the Art**: Thorough literature review on the building physics of room acoustics and state of the art of strategies to adapt room acoustics by using AM. This includes the influence on acoustics via materiality, porosity, shape, resonators, etc.
- **Analysis of Acoustic Properties:** Engage in a comparative study of the acoustic properties of materials used in AM, juxtaposing these properties with those reported from reliable sources. This task involves a close examination of the materials' effectiveness in acoustic applications and the properties essential for the analysis and simulations.

- **Room-Level Acoustic Simulations:** Design various elements to be produced through additive manufacturing (AM) techniques and conduct detailed simulations to assess their acoustic impacts within a room environment. The analysis should include the influence of surface/material choices, geometric patterns, and Helmholtz resonators on room elements like internal and external walls, ceilings, etc.
- **Approach Evaluation:** Explore and evaluate diverse acoustic approaches at the spatial level. This involves integrating both simulation-based methodologies and theoretical, analytical approaches to understand and improve acoustic behaviors in built environments.
- **Scientific Reporting and Solution Development**: Systematically document the findings, emphasizing the interplay between AM techniques, their acoustic properties, and their spatial effectiveness. Special attention should be given to the unique solutions offered by AM, particularly in designing and constructing specialized elements or patterns that enhance room acoustics. Aim to highlight the innovative contributions of AM techniques such as Selective Paste Intrusion (SPI) and Extrusion 3D Concrete Printing (E3DCP) in improving acoustic quality and providing tailored acoustic solutions.

We offer

- A multidisciplinary learning opportunity
- Firsthand experience to print with multiple additive manufacturing techniques
- Firsthand experience with acoustic testing equipment
- Knowledge development in room-level acoustic simulations

Application

We´re looking forward to your applications. Please send them via e-mail to:

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Supervision

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