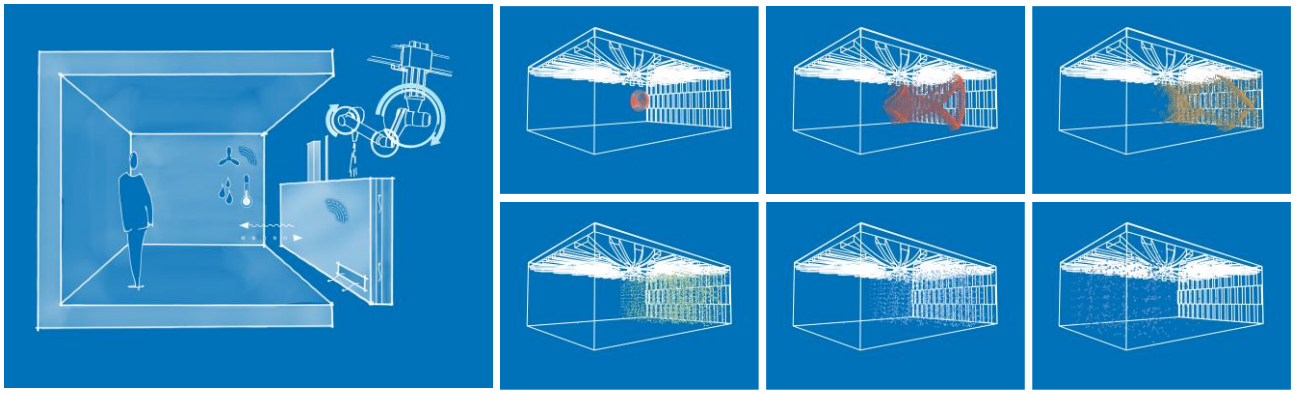
Chair of Building Technology and Climate Responsive Design
TUM School of Engineering and Design
Technical University of Munich

Announcement for Students of Architecture, RNB, & Civil Engineering

Master thesis

Topic

Investigating the Material Acoustics of Additively Manufactured Elements



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
- Interest in acoustics and Additive Manufacturing
- Independent working

Tasks

- **Literature Review and State of the Art**: Thorough literature review on the building physics of acoustics and state of the art of acoustics in AM.

- **Establishing a Performance Catalog:** Develop a detailed catalog that compares and contrasts the acoustic properties of different materials used in additive manufacturing (AM) techniques like Extrusion 3D Concrete Printing (E3DCP) and Selective Paste Intrusion (SPI). Focus on analyzing at least two material types for each technique, with an emphasis on identifying materials that significantly enhance acoustic quality. Undertake additional research to evaluate and recommend new materials or compositions that could improve acoustic performance in AM applications.

- **Manufacturing of Test Specimens:** Design and coordinate the manufacturing of test specimens together with researchers at AMC Lab in Achering, with a focus on exploring diverse porous material compositions suitable for E3DCP and SPI applications. Receive basic training in operating 3D printing equipment and handling materials specific to these printing techniques, provided by supervisors at the AMC Lab in Achering. Document the manufacturing process, including any challenges and solutions encountered, to contribute to a practical understanding of AM in acoustic applications.

- **Acoustic Property Experiments:** Conduct comprehensive experiments to measure the sound absorption coefficient and other relevant acoustic properties of the manufactured samples, using techniques such as the impedance tube. Engage in self-directed learning to deepen understanding of these experimental methods, supplemented by basic training on the necessary equipment provided by the laboratory. Analyze the relationship between material composition, manufacturing technique, and the resultant acoustic properties.

- **Scientific Reporting:** Systematically document and analyze the findings from all experiments and research activities. Emphasize the correlation between material composition, manufacturing technique, and key acoustic properties such as absorption coefficients and scattering. Produce a comprehensive report that not only presents data and analysis but also discusses the implications of the findings in the context of additive manufacturing and room acoustics.

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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