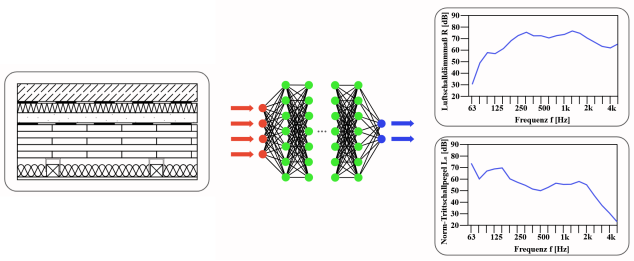
Chair of Vibroacoustics of Vehicles and Machines
School of Engineering and Design
Technical University of Munich

Master Thesis

Generative Design of Mass-Timber Floors

While timber construction is gaining popularity, developing building components that meet specified acoustic performance standards remains a significant challenge. Wooden floor systems typically consist of multiple layers, whose interactions yield complex sound insulation properties. In particular, impact sound represents a major source of annoyance in residential buildings, motivating the development of accurate and robust prediction methods. At present, reliable assessment often requires costly experimental validation. To address this limitation, a data-driven prediction tool is being developed that employs machine learning techniques to estimate the sound insulation characteristics of wooden floor systems based on laboratory measurement data.



Prediction scheme for airborne and impact sound insulation of a mass timber floor assembly.

Your Task

A comprehensive set of measurement data has been collected and integrated into a *MySQL* database. Using this dataset, feed-forward neural networks and tree-ensemble models were trained in an initial comparative study to predict airborne sound insulation. The next step inverts that prediction process to create a design aid that proposes floor assemblies that meet specified acoustic targets.
In this thesis, you will train a variational autoencoder (VAE) to learn compact latent representations from the compiled dataset. A predictor trained jointly with the VAE will map points in latent space to sound-insulation spectra. Candidate assemblies will be found by optimizing in latent space toward desired acoustic performance; the decoder will then reconstruct those candidates into full floor configurations. The objective is to produce physically plausible, acoustically appropriate floor-assembly designs.

The thesis is structured as follows. Details are open to discussion:
- WP1 – Feature engineering and VAE training
- WP2 – Validation of VAE reconstruction accuracy
- WP3 – Addition of latent space predictor and joint training
- WP4 – Latent space optimization

Please submit your application, including a brief statement of interest, your CV, and a transcript of records, to the contact listed below.

Your Skills

- Knowledge of Python/PyTorch
- Experience in probabilistic modeling and hyperparameter optimization
- High motivation and a structured working style

Contact

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