ACOUST-HPC

HPC-supported acoustic modeling with impedance boundary conditions in the time domain

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In Short

- Optimization of room acoustics by optimizing room geometry.
- Time-domain simulations for accurate wall impedance modeling with high parallelization.
- High-dimensional optimization of acoustic parameters using HPC.
- Efficient HPC simulations for improved acoustic quality in real-world settings.

Current research is aimed at developing methods for optimizing room acoustics by considering both primary and secondary acoustic structures. This includes the optimization of loudspeaker positions and driver functions, as well as the geometry and boundary conditions of a room, with respect to key acoustic target parameters. This HPC project focuses on enhancing the room acoustic properties and refining the secondary room structure to improve the acoustic quality in real-world configurations.

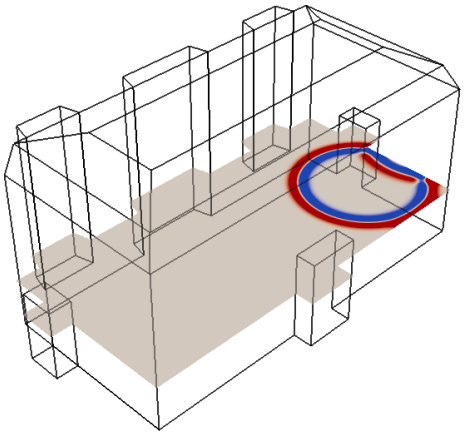

***Figure 1:** An exemplary realistic room configuration characterized by several geometric elements.*

First, the adaptation of a volume penalization approaches to represent wall impedances in time-domain simulations will be investigated. Experimental reference data will be integrated to ensure realistic wall impedance modeling. These time-domain methods are computationally demanding and require a high degree of parallelization. The simulations must accurately capture complex acoustic effects such as diffraction and reflections in realistic room environments.

Next, the framework for identifying wall impedances and geometric parameters will be further developed. The goal is to optimize the parameters with respect to various acoustic criteria and to adapt the room geometry. This optimization process is high-dimensional and requires significant computational resources to explore a wide range of simulations and determine the most effective solutions. Given the complexity of room acoustics and the large number of parameters involved, HPC platforms are essential for efficiently handling these computationally intensive tasks.

High-performance computing enables precise modeling and fine-tuning of room acoustics, ensuring significant improvements in acoustic quality across various room configurations within a reasonable time frame.

WWW

https://www.tu.berlin/ak/adjointsound

More Information

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