**The Sparse Finite Difference Time Domain Algortihm for Acoustically Large Problems**

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**Abstract.** Ray-tracing provides a scalable method for analyzing room acoustics, though much acoustical wave behavior particualrly at low frequencies is not implicit to this method[1]. Though generally computationally intensive, wave based acoustical modelling may provide more accurate results than ray based methods for low frequency room analysis[2]. The Finite-Difference Time-Domain [FDTD] method for solving partial differential equations presents a highly parallelizable geometric method for modelling room acoustics[3]. A hybrid method that combines FDTD and ray-tracing may be employed to utilise the benefits of both algorithms, though this may present complexities when combining data sets[4]. Generic FDTD implementation for acoustics generally requires full discretization of the geometric domain, though a potential area for new research may be the implementation of a sparse matrices based FDTD algorith[5]. This would be analogous to using a moving window to mask the relevant wave propagation area, only computing cells with relevant information.

**Keywords:** Acoustic Simulation, computational modelling, numerical wave modelling, sparse finite difference time domain (FDTD), large computational models.

**References**

1. Elorza DO (2005) Room acoustics modeling using the ray- tracing method : implementation and evaluation. University of Turku

2. Hill AJ (2012) Analysis , Modeling and Wide-Area Spatiotemporal Control of Low-Frequency Sound Reproduction.

3. Angus JAS, Caunce A (2010) A GPGPU Approach to Improved Acoustic Finite Difference Time Domain Calculations. 128th Audio Eng. Soc. Conv.

4. Mourik J Van, Murphy D (2013) Geometric and wave-based acoustic modelling using Blender. AES 49th Int Conf Audio Games 1–9.

5. Doerr C (2013) Sparse Finite Difference Time Domain Method. IEEE Photonics Technol Lett 25:1–1. doi: 10.1109/LPT.2013.2285181