Hybrid Model For Reverberant Indoor Radio Channels Using Rays and Graphs

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Abstract:

Ray-tracing tools allow for deterministic simulation of the channel response. Studies show that these tools work well when the channel impulse response consists only a few distinct components. However, measurements of the channel impulse response in indoor environments exhibit a diffuse tail. This diffuse tail is difficult to include in ray-tracing tools due to the computational complexity.
We propose a hybrid model to include deterministic components and the diffuse tail by combining ray-tracing and the propagation graph. The recursive structure of the propagation graph allows for a computationally efficient calculation of the channel transfer function considering infinitely many components. We use ray-tracing and the theory of room electromagnetics to obtain the parameter settings for the propagation graph. Thus the proposed hybrid model does not require new or additional parameter settings in comparison to ray-tracing. Simulation results show good agreement with measurements with respect to the inclusion of the diffuse tail in both the delay power spectrum and the azimuth delay power spectrum.