Modeling of a Jecklin Disk for Stereophonic Recordings

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Abstract

The Jecklin Disk [1] is a sound absorbing disk placed between two omnidirectional microphones, and is used to cast an acoustic shadow from one microphone to the other (Figure 1). The Jecklin Disk is used to recreate some of the frequency-response, time and amplitude variations human listeners' experience, but in such a way that the recording also produces a useful stereo image through loudspeakers [2]. Conventional binaural or dummy head recordings are not as convincing when played back over speakers; headphone playback is needed. Being able to model the acoustic shadow caused by diffraction around the disk is highly desirable. It would allow the refinement of the baffle's size and construction, and the optimization of the microphone's placement. Such a model was constructed using COMSOL Multiphysics. In the first instance, sound propagation through 5m of air was modeled by solving the classical wave equation available within the Mathematic module. It assumed that the sound waves originated from an omnidirectional point source, and that the source was continually emitting at a frequency of 3kHz. Figure 2 shows how the amplitude of the sound wave varied with arc-length - 5m from the point source. A Jecklin Disk with a width of 3cm and a radius of 15cm was introduced to the model, and disk was placed from 2.5m from the point source. Figure 3 show how the amplitude of the sound wave varied with distance. Figure 3 clearly shows the diffraction pattern about the Jecklin disk and more importantly the acoustic shadow the Jecklin Disk casts. With the presence of a Jecklin Disk, figure 4 shows how the amplitude of the sound wave varied with arc-length - 5m from the point source. Comparing Figure 2 to Figure 4, one can clearly observe the diffraction pattern and acoustic shadow cast by the Jecklin disk. The finite element results matched those obtained experimentally within an anechoic chamber. The model may be used to optimize the size and construction of the Jecklin Disk, and the positions of the microphones.

Reference

1. Jecklin, Jürg, "A Different Way to Record Classical Music," Journal of the Audio Engineering Society, Volume 29, Issue 5, pp. 329-332; May 1981.

2. Johnsson, Roger; Nykänen, Arne, "Comparison of Speech Intelligibility in Artificial Head and Jecklin Disc Recordings," Audio Engineering Society Paper 8386; 130th Audio Engineering Society Convention, London, May 2011.

Figures used in the abstract

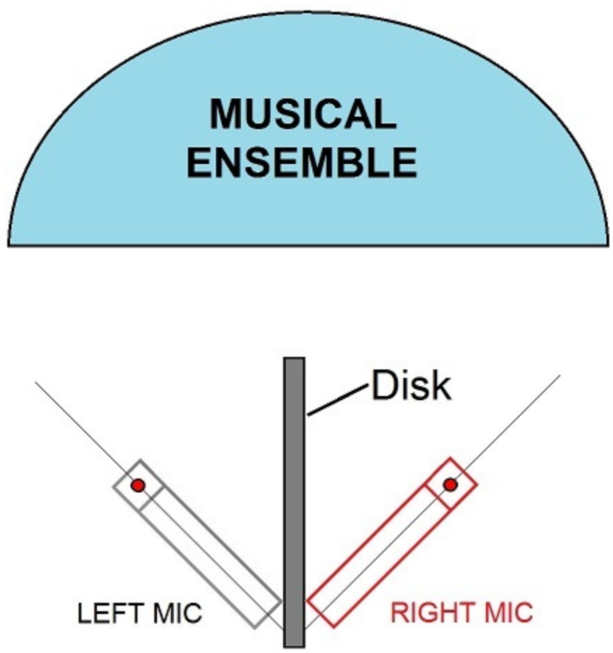

Figure 1: Stereophonic Recording with a Jecklin Disk.

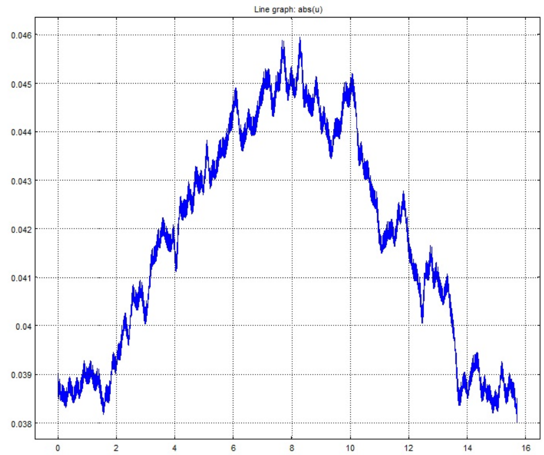

Figure 2: Sound Wave Amplitude versus Arc-Length, 5m from Source (without a Jecklin Disk).

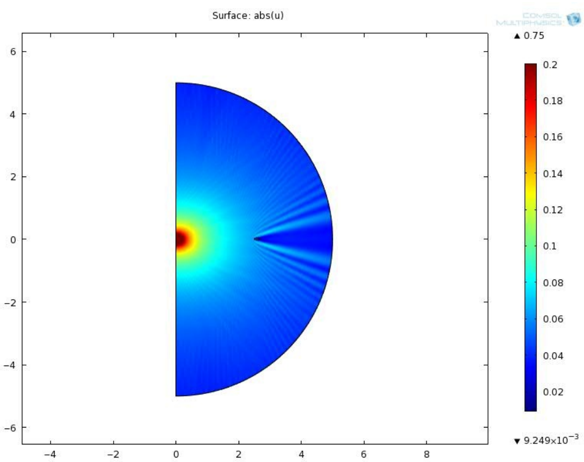

Figure 3: Sound Wave Amplitude versus Distance (with a Jecklin Disk).

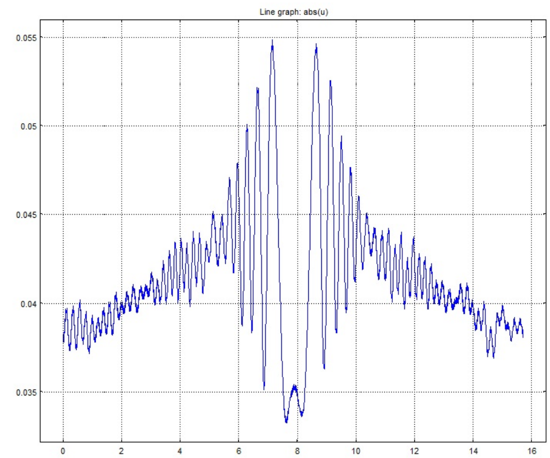

Figure 4: Sound Wave Amplitude versus Arc-Length, 5m from Source (with a Jecklin Disk).