INVESTIGATIONS OF INCORPORATING SOURCE DIRECTIVITY INTO ROOM ACOUSTICS COMPUTER MODELS TO IMPROVE AURALIZATIONS

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Room acoustics computer modeling and auralizations are useful tools when designing or modifying acoustically sensitive spaces. In this dissertation, the input parameter of source directivity has been studied in great detail to determine first its effect in room acoustics computer models and secondly how to better incorporate the directional source characteristics into these models to improve auralizations. To increase the accuracy of room acoustics computer models, the source directivity of real sources, such as musical instruments, must be included in the models.

The traditional method for incorporating source directivity into room acoustics computer models involves inputting the measured static directivity data taken every 10^{o} in a sphere-shaped pattern around the source. This data can be entered into the room acoustics software to create a directivity balloon, which is used in the ray tracing algorithm to simulate the room impulse response. The first study in this dissertation shows that using directional sources over an omni-directional source in room acoustics computer models produces significant differences both in terms of calculated room

acoustics parameters and auralizations. The room acoustics computer model was also validated in terms of accurately incorporating the input source directivity.

A recently proposed technique for creating auralizations using a multi-channel source representation has been investigated with numerous subjective studies, applied to both solo instruments and an orchestra. The method of multi-channel auralizations involves obtaining multi-channel anechoic recordings of short melodies from various instruments and creating individual channel auralizations. These auralizations are then combined to create a total multi-channel auralization. Through many subjective studies, this process was shown to be effective in terms of improving the realism and source width of the auralizations in a number of cases, and also modeling different source orientations. In addition, this approach was applied to modeling an entire orchestra with individual sources, in three different configurations, for the first time. This method shows great promise as a new technique for auralizing both solo instruments and an entire orchestra.