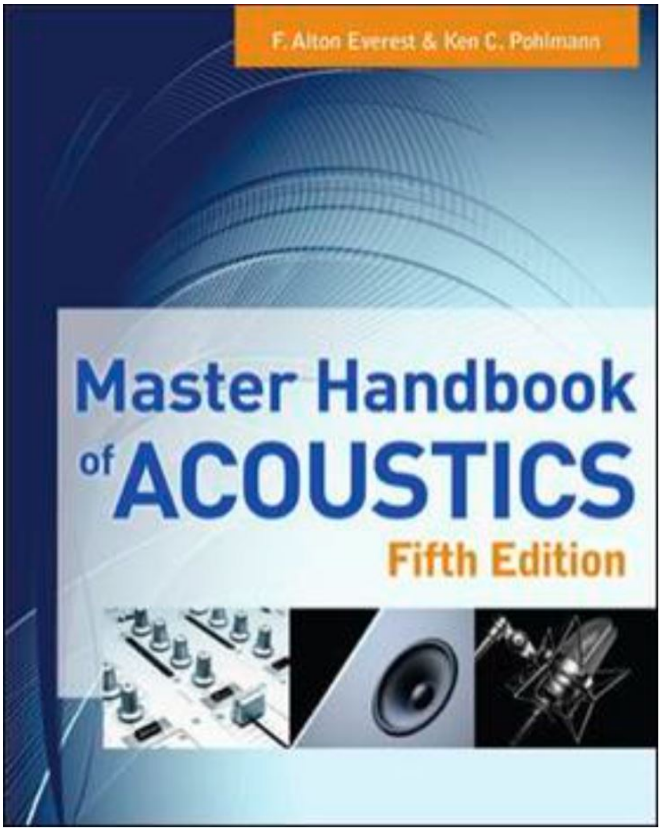

Acoustic Distortion

There have been extraordinary advances in the quality of the hardware in our audio systems, but less progress has been made in improving the quality of the acoustical pathway which all sound must travel from the loudspeaker to our ears. Once the sound has reached our ears there are still many psychoacoustical factors that determine how we perceive the sound. Much psychoacoustical research is now being vigorously pursued to understand how the mind perceives sound. Between the hardware and the perception of sound there is still that analog sound-transmission path in which many distortions arise. The remainder of this book is devoted to acoustic distortions and the new tools and computer programs which have appeared to measure and model them.

Room Optimizer

A computer program has been developed that allows automated selection of positions for listeners and loudspeakers within listening rooms. The criterion for optimum listener and loudspeaker positions within the room is the minimum standard deviation of the combined short- and long-term spectra. A cost parameter based on the standard deviation function was developed and used to monitor the quality of the short- and long-term spectra. Predictions of the spectra are carried out using an image source model. The optimization is carried out using a standard simplex routine. Some examples have been presented. All cases demonstrate the ability of the program to find the best positions for listener and loudspeakers within the room.

Auralization

Thus, we have described an approach using geometrical acoustics that generates the room impulse response of a virtual room. This impulse response can be postprocessed for several types of auralization including mono, stereo, 5.1, binaural, and ambisonic. We can also auralize real rooms if we measure their impulse response. Architectural drawings have evolved from plan and section, to 3D, to fully rendered image, to walk-throughs. Now we have the opportunity to also auralize the visually rendered environment. At this time high-quality auralizations are possible for fixed locations and walk throughs. Real-time auralizations can also be used for virtual reality applications. We might end with a bit of caution and reiterate that the geometrical acoustics methods presently used are generally more accurate at the higher frequencies and consequently the lower octaves cannot be accurately represented. There are efforts to combine geometrical and wave acoustics to extend the modeling to lower frequencies. Despite the many approximations involved, auralization is a very valid and useful tool, especially in the hands of experienced acousticians.