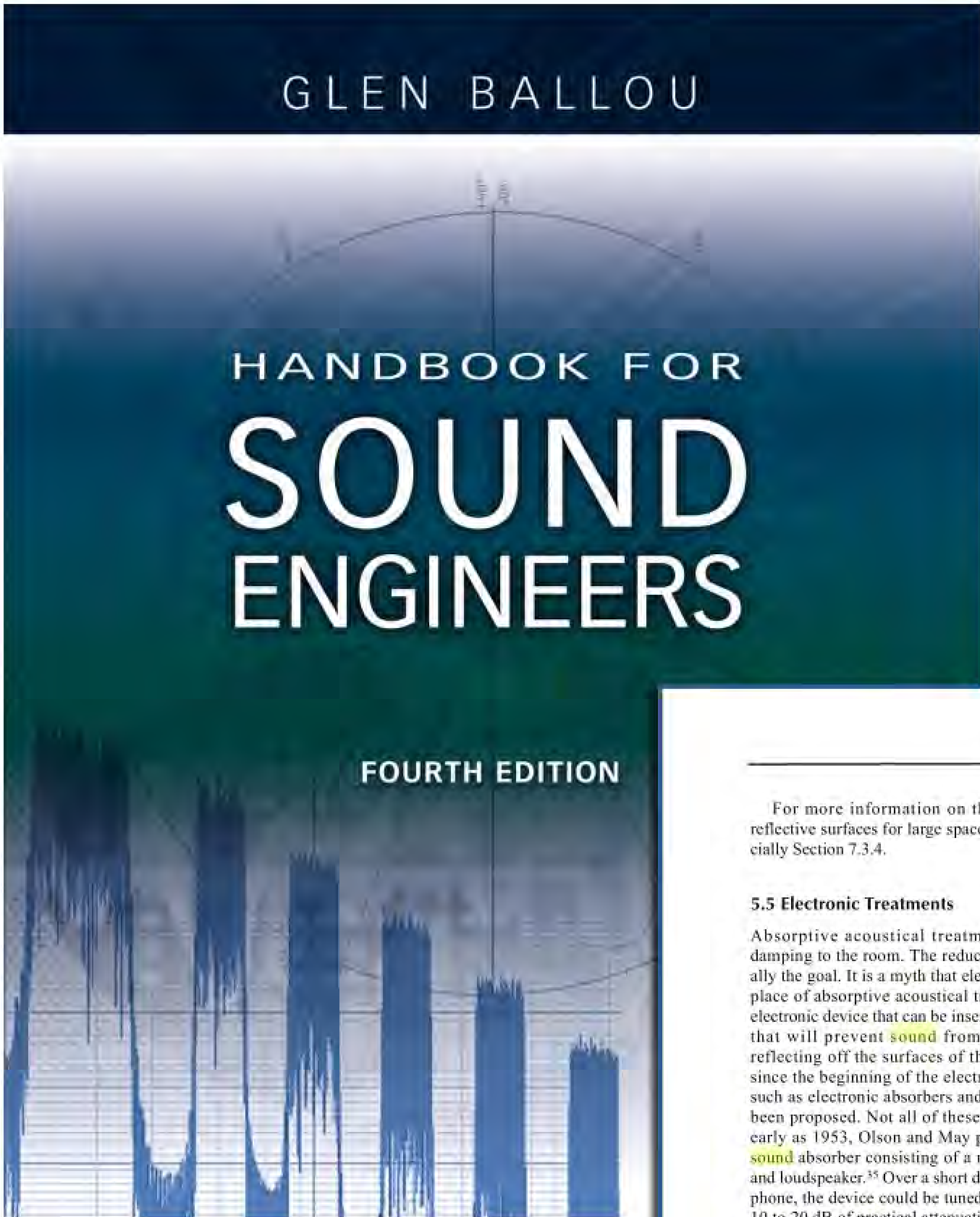

For more information on the design of usefully reflective surfaces for large spaces, see Chapter 7, especially Section 7.3.4.

5.5 Electronic Treatments

Absorptive acoustical treatments effectively add damping to the room. The reduction of decay is generally the goal. It is a myth that electronics can be used in place of absorptive acoustical treatments. There is no electronic device that can be inserted into the signal path that will prevent sound from a loudspeaker from reflecting off the surfaces of the room. Nonetheless, since the beginning of the electroacoustic era, devices such as electronic absorbers and room equalizers have been proposed. Not all of these are without merit. As early as 1953, Olson and May proposed an electronic sound absorber consisting of a microphone, amplifier, and loudspeaker.[35] Over a short distance from the microphone, the device could be tuned to achieve as much as 10 to 20 dB of practical attenuation over a 1 to 2 octave range of low frequencies. Olson and May proposed that their electronic sound absorbers could be used to reduce noise at the ears of airline passengers and factory workers. Unfortunately, the ineffectiveness of this type of absorber over larger distances made it impractical for use in architectural applications. The concept, however, paved the way for future developments.

The invention of the parametric equalizer (PEQ) brought a new wave of hope for electroacoustical treatments. Unfortunately, the insertion of a PEQ into the signal chain, even to reduce narrowband problems in small rooms, usually caused more harm than good. Because of the variability of the sound pressure distribution in a small room, the desired effect of the PEQ was usually limited to a small area of the room. Additionally, phase anomalies usually made the treatment sound unnatural. The use of a PEQ to tune a recording studio control room, for example, came and went quickly and for good reason.

The age of digital signal processing, combined with the availability of high-quality audio equipment to a wider range of users, such as home theater owners, ushered in a new hope for electroacoustical treatments. The most recent devices, while sometimes referred to as room equalization (as in previous decades), are often referred to as digital room correction, or DRC. The most important improvement of these devices over their analog ancestors is their ability to address sound problems occurring in the time/phase domains. The latest in DRC systems are able to address minimum-phase problems, such as axial room modes (see Chapter 6). These problems often manifest themselves not as amplitude problems (which are what would be addressed in the use of analog equalizers), but as decay problems. More modern DRC systems, such as those developed by Wilson et al, that incorporate the latest in digital signal processing, can now actually add the damping that is required to address minimum-phase low-frequency problems.[36] Additionally, many DRC systems require that the room response be measured at multiple listening locations in the room so that algorithms can be used to determine corrections that can benefit a larger area of the room.

The same advances in signal processing have also brought about wider applications for the original electronic sound absorber of Olson and May. Bag End has developed the E-Trap, an electronic bass trap that offers the ability to add significant and measurable damping at two different low frequencies.[37]

While DRC devices and electronic traps offer much in the way of being able to actually address the problems with the loudspeaker-room interface, they cannot be expected to be more than electronic tweaks. They cannot replace a good acoustical room design with proper incorporation of nonelectronic treatments. They can provide some damping, particularly in the lowest octave or two where in many rooms it is often impractical—if not impossible—to incorporate porous or resonant absorbers.

5.6 Acoustical Treatments and Life Safety

The most important consideration when selecting acoustical treatments is safety. Most often, common sense should prevail. For example, asbestos acoustical treatments—which were quite popular several decades ago—should be avoided because of the inherent health risks associated with handling asbestos materials and breathing its fibers. Acoustical treatments will have to meet any applicable building codes and safety standards to be used in a particular facility. Specific installations may also dictate that specific materials be avoided because of allergies or special use of the facility—e.g., health care or correctional facilities. Since many acoustical treatments will be hung from walls and ceilings, only the manufacturer-approved mounting methods should be used to prevent injury from falling objects. The two most common health and safety concerns for acoustical treatment materials are flammability and breathability.

Acoustical treatments must not only meet the applicable fire safety codes, but, in general, should not be flammable. The flammability of an interior finish such