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Development of a digital system for impulse noise generation and characterization on research of noise induced hearing loss (NIHL)

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Abstract

Over 30 million Americans suffer from noise induced hearing loss (NIHL). Current governmental regulation of workplace noise focuses on the Equal Energy Hypothesis (EEH) which states that equal amounts of sound energy will produce equal amounts of hearing loss. However, many research projects demonstrated that different types of noise, even with equal sound energies, produce different amounts of hearing loss. Our research is focused on replicating noise encountered in the workplace in order to better study the effects of such noise. A digital noise exposure system has been developed which is capable of replicating impulse and continuous Gaussian noise, and it can be used to study NIHL in a chinchilla model. Impulse noise with peak sound pressure level (SPL) up to 160 dB can be produced, which effectively mimics the noise generated by a military weapon (e.g. M-16 rifle). In addition, continuous Gaussian noise with peak SPL up to 140 dB can be created, which is well above the 85 dB recommended exposure limit established by the National Institute for Occupational Safety and Health (NIOSH). The system also allows us to weight the sound according to the relative soundness as perceived by the human ear. This weighting creates a more accurate parameter by which to analyze results. This allows for the study of the effects of gradually increasing exposure levels on hearing. In summary, the digital noise exposure system replicates environmental noise allowing researchers to study hearing loss in a controlled situation.

Biography

Dr. Jun Qin is an Assistant Professor in the Biomedical Engineering Program and the Department of Electrical and Computer Engineering at Southern Illinois University Carbondale. He obtained his Ph.D. degree from Duke University in 2008. His research focuses on noise detection and measurement, complex noise induced hearing loss, sensor and instrumentation, data acquisition, and ultrasonic applications. Dr. Qin's scientific work has been published in prestigious journals and proceedings. He is a member of professional associations and serves as a paper reviewer for several international journals and proceedings.