

Development of Models that Predict Effects of Noise on People and Their Use in Machine and Engineered System Design

Patricia Davies

Purdue University, Department of Mechanical Engineering, West Lafayette, IN

Engineers need meaningful acoustic criteria for system and machine design optimization, and to enable them to make accurate comparisons of their own and competitors' products without running time-consuming subjective tests. Even though there is a strong understanding of how different sound characteristics affect the acceptability of a sound, most noise criteria in use in engineering today are based on relatively simple measures of noise. In this talk we will discuss how we might develop better criteria for a particular type of product, and the tensions between realism and introduction of intentional or unintentional biases when we conduct tests to gather data to develop these improved criteria. Also important for machine designers is the ability to listen to the sound of the machine yet to be built, or the sound of the machine with the modifications that you are about to implement. This ability to hear your machine supplements the acoustic criteria, the spectra, and other sound analysis outcomes. Sound simulations can be developed from first principle modeling, from measurements or, more usually, through a combination of both. The development of source-path models for product and system sound simulation will be discussed. We will also discuss some of the additional benefits of this approach to optimizing the acoustics of engineered systems and machines.



Patricia Davies is a professor of Mechanical Engineering at Purdue University. She became Director of the Ray W. Herrick Laboratories in 2005, which is a laboratory of over 100 graduate students and around 20 faculty focused on graduate student research with an emphasis on technology transfer. She also has a courtesy appointment in Psychological Sciences. Her research in vibrations and acoustics includes signal processing, nonlinear system identification, sound perception, and the impact of noise on people. A theme in her research is bridging the gap between experimental results and predictions from models based on current understanding of human, mechanical and/or material behavior. Applications include effects of transportation noise (sleep disturbance, annoyance), HVAC&R systems, diesel engines, seat-occupant systems, and energetic materials. Her research is sponsored by government agencies and industry. She is a member of a group of engineering and psychology professors at Purdue who conduct research on how people perceive and are affected by machines and engineered systems, and how to integrate that knowledge into engineered system design. Dr. Davies served as President of the Institute of Noise Control Engineering from 2008-2010 and is a Fellow of ASA and ASME. In fall 2016, she received the Per Brüel Gold Medal for Noise Control and Acoustics from the ASME.