1:20

4pNS2. Strategies for improving speech intelligibility and warning signal detection in communication headsets/hearing protectors. Anthony J. Brammer, Eric R. Bernstein, and Gongqiang Yu (Ergonomics Technol. Ctr., UConn Health Ctr., 263 Farmington Ave., Farmington, CT 06030-2017, brammer@uchc.edu)

Strategies for improving speech understanding and warning signal detection when wearing communication headsets/hearing protectors (HPDs) in environmental noise must accommodate sounds from different sources at different times. A subband signal processing approach would appear desirable, with a delayless structure essential for active noise reduction (ANR). The requirements for communication channel and ANR controllers differ, owing to the different bandwidths required for speech and warning signals, and for ANR. Subbands for optimizing speech signal-to-noise ratios are commonly fractional-octave bandwidth, while computational efficiency favors linear subbands for ANR. Increasing the number of subbands reduces computational cost for the latter but the advantage is less apparent for communication signal control. Possibilities exist for harmonizing subband filter structures by constructing models of speech intelligibility using computationally efficient bandwidths. In contrast, algorithms for detecting warning sounds tend to be governed more by audibility than bandwidth considerations. The issues will be discussed using a simulation of a circumaural HPD that can replicate word scores obtained by a subject when subject-specific transfer functions are employed. Where available, results from physical devices and subjects will be included, as well as the consequences of differences in individual auditory abilities. [Work supported by NIOSH grant R01 OH008669.]

1:40

4pNS3. A perceptually motivated active noise cancellation system for hearing impaired listeners: An overview. Buye Xu, Jinjun Xiao, and Tao Zhang (Signal Processing Res., Starkey Hearing Technologies, 6600 Washington Ave. S, Eden Prairie, MN 55344, buye_xu@starkey.com)

Nowadays most hearing impaired (HI) patients are fitted with either open-fitting or vented-fitting hearing aids (HAs) to reduce the occlusion effect. In an environment where strong low-frequency ambient noise is present, significant noise energy can directly leak into the ear canal bypassing noise reduction algorithms in the HAs and may reduce speech intelligibility and listening comfort for HA users. One way to mitigate such an issue without occluding the ear canal is to implement an active noise cancellation (ANC) system inside the ear canal. Traditional ANC systems are designed to minimize the total sound pressure level in the ear canal. However, this may not necessarily lead to an optimal solution from the perceptual perspective (e.g., loudness may be reduced instead of being minimized as a result). In this paper, a perceptually motivated feedback ANC system is presented: a spectral shaping filter is applied to the residual error signal to minimize the loudness for HI listeners. In addition, implications of the practical constraints introduced by the HAs are discussed based on acoustic simulations and experimental results.

2:00

4pNS4. A better frequency domain adaptive algorithm for active noise control in a short duct. Jing Lu and Xiaojun Qiu (Inst. of Acoust., Nanjing Univ., Hankou Rd. 22th, Nanjing 210093, China, lujing@nju.edu.cn)

For the feedforward active noise control in a short duct, the noncausality of the whole system is often inevitable, since the reference sensor needs to be placed very close to the control source, and the acoustic transmission delay between them is often surpassed by the inherent AD/DA and anti-aliasing filters latency in the controller. The commonly used normalized frequency domain LMS algorithm possesses the benefit of fast convergence speed, but suffers from deteriorated steady-state performance when used in non-causal circumstances. In this paper, an efficient modification of the normalized frequency domain LMS algorithm is proposed, which can significantly improve wide-band noise reduction level in non-causal circumstances. Both simulations and experiments demonstrate the superiority of the proposed algorithm.

2:20

4pNS5. Local and global active noise control using a parametric array loudspeaker. Nobuo Tanaka (Tokyo Metropolitan Univ., 6-6 Asahigaoka, Hino-shi, Tokyo 191-0065, Japan, ntanaka@sd.tmu.ac.jp)

This paper deals with local as well as global active noise control (ANC) using a parametric array loudspeaker (PAL) possessing intriguing properties: sharp directivity, low sound pressure decay by distance, capability of steering directivity, etc. After briefing some properties of a PAL necessary for ANC, this paper presents pinpoint control using a PAL for suppressing the sound pressure at a designated location, hence local control. It is shown that unlike conventional ANC in which a voice coil loudspeaker is used, the pinpoint control may achieve the sound pressure suppression without causing spillover. Using the same sound control source, PAL, this paper then refers to global control, termed trivial control in the art, enabling one to generate a global zone of quiet. The trivial control strategy falls into a category of acoustic power control based on a trivial condition requiring the collocation of a primary source and a control source. The trivial condition formerly avoided because of literally trivial may be implemented due to the property of a PAL, thereby enhancing the control effect, theoretically infinity. Two kinds of control strategy are then demonstrated with a view to fulfilling the trivial condition for global control.

2:40

4pNS6. Virtual mechanical impedance approach for the active structural acoustic control of panels. Alain Berry, Marc Michau, Philippe Micheau (Mech. Eng., Université de Sherbrooke, 5907 Laurent, Sherbrooke, QC J1N 3Z2, Canada, alain.berry@usherbrooke.ca), and Philippe Herzog (Laboratoire de Mécanique et d'Acoustique, Marseille, France)

This work investigates harmonic Active Structural Acoustic Control of flexural panels using structural, collocated and dual actuator-sensor pairs. Two types of transducer technologies are envisioned: (1) thin piezoelectric actuators and sensors; (2) electrodynamic inertial actuators and transverse velocity sensors. The control strategy is to locally impose a complex, virtual mechanical impedance to the structure via a linear relation between the actuator input and sensor output of each pair, at each frequency of interest. This virtual