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# Integrating speech enhancement with subband active noise control to improve communication in hearing protectors

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## ABSTRACT

Many workers refuse to wear hearing protection devices (HPDs) because they would rather accept the health risks than sacrifice the ability to communicate with coworkers. Integrating active noise reduction (ANR) techniques with speech enhancement algorithms could solve these limitations of modern electronic HPDs. An adaptive delay feedforward subband structure has been implemented by forming parallel signal filtering and filter update paths for each frequency band. Subband ANR provides additional attenuation of environmental noise beyond that of passive HPDs within the lower frequencies associated with speech communication. The subband structure can also provide valuable information regarding the spectral content of the environmental noise that can be exploited to determine where additional power is needed in a communication channel to improve intelligibility. The system, initially developed in simulation, maintains a specified signal-to-noise ratio in each subband while simultaneously limiting the power added by the communication channel to below that associated with hearing damage. Speech Transmission Index models have been used to validate the improvements in speech intelligibility over typical passive and ANR communication headset designs. Preliminary results for a circumaural HPD constructed to implement the concept will be presented for comparison with the simulation. [Work supported by NIOSH (R01 OH008669).]

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