Signal processing techniques for continuous monitoring of otoacoustic emissions in industrial environnement Abstract Forum Acousticum 2014

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Current health and safety actions to prevent occupational noise-induced hearing loss (NIHL) are based on average exposure-damage relationship. However, individual susceptibility is an important factor in a worker's actual risk to develop NIHL and is not accounted for at the moment.

The measurement of otoacoustic emissions (OAE) is proven to be a reliable tool to detect, at an early stage, the onset of NIHL. Nevertheless, individual field measurement of OAEs on industrial workers is very challenging in practice because loud ambient noise dramatically disturbs OAE measurement. Use of OAE measurement probes with high passive noise isolation allows the attenuation of most high frequency ambient noise, but is often insufficient for its low frequency content.

In the described research work, a new type of OAE system is designed to monitor continuously for slight changes in OAE levels on an individual worker. The system features a pair of intra-aural hearing protectors (earplugs) in each of which an external microphone, an internal microphone and a pair of miniature receivers are included. Adaptive noise reduction (ANR) processing on the OAE microphone signal is used to further improve the Signal-to-Noise ratio of the distortion product OAE (DPOAE) in frequencies where passive isolation remains insufficient. Experiments conducted on 8 test-subjects confirms that the developed OAE system would be suitable for the continuous monitoring of workers' hearing capabilities in industrial noises. Simulation of a further improved version of the DPOAE signal extraction algorithm shows an increase in results reliability and greater dynamic range than the previous version of the developed algorithm.