Active Noise Control in Biomedical Systems

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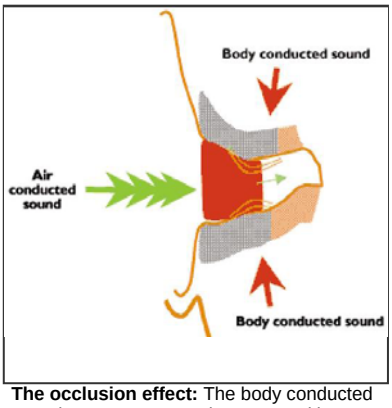
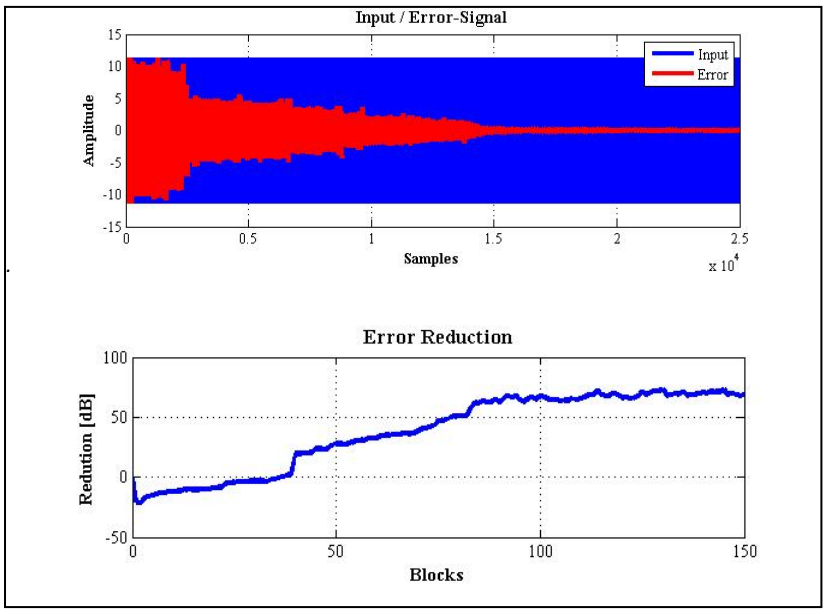


The occlusion effect: The body conducted sounds cannot escape the ear canal because it is occluded by the hearing aid

Problem description: Many hearing aid users complain about the sound quality of their own voice when wearing a hearing aid. The main reason of the complaint is the occlusion effect (OE). It occurs because the hearing aid occludes the pathway through the ear canal. The sound of one's own voice reaches the ear canal not only through the acoustic path from the mouth to the ear but also through the bony and cartilaginous tissues of the head. This second path combined with the occluded ear canal is the reason for the OE. Whereas normally the sound from this path just escapes the canal, it can't when the canal is occluded. Hearing aid users often describe their own voice as 'hollow' or as if they are 'talking in a barrel' when wearing the aid.

Goal: The idea of this project is to use theories about active noise control to reduce the OE. An adaptive filter is used to generate an anti signal which is played through the aid's loudspeaker. This anti signal cancels exactly the additional sounds and thus reduces the OE. As a result, the wearer feels less occluded when wearing the hearing aid. Multiple active noise control algorithms were evaluated. The strength and weakness of each algorithm were compared to find the optimal OE cancelling strategy.

Solution: Simulations with these algorithms showed their usability in this particular application. A recommendation of one algorithm based on its strength is provided. Finally, an existing firmware implementation was adapted to the information gained with the simulations.



Simulation Results