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Numerical and Experimental Investigation of the Generation of Wind Noise in Hearing Aids

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Abstract

Hearing aid users are often confronted with the problem of wind noise during outdoor activities. The microphones installed in the hearing aids cannot distinguish whether the deflection of the diaphragm is caused by acoustic or hydrodynamic pressure fluctuations. This results in unpleasant background noise, which superimposes the acoustic signal. A dual approach consisting of CFD simulations using Star-CCM+ and measurements in an anechoic wind tunnel was used to investigate geometric features such as the shape of the housing and the rocker-switch with regard to their influence on wind noise generation. Using additive manufactured hearing-aid-prototypes, the input-related time-pressure signal at the microphone membrane was measured in the experimental approach. In the simulation, the corresponding signal was calculated using Delayed Detached Eddy Simulation. A comparison of the obtained pressure spectra from simulation and experiment shows very good agreement in the characteristic low-frequency range. The visualization of the numerical results provides information on which fluid dynamic effects, such as boundary layer separation and vortex formation, lead to the generation of wind noise. The results obtained are useful for estimating the performance of hearing aid models under the influence of wind at an early stage of product development.

Keywords: Hearing Aid, Wind noise, Computational Fluid Dynamics

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