

# Design optimization in vibro-acoustic design of hearing instruments

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*Abstract: In the design of hearing instruments it is important to achieve as high gain as possible without causing oscillation in the device, due to feedback between the microphones and the receiver (loudspeaker). More gain enables to fit a larger hearing loss and more users can benefit from the hearing instrument.*

*Since the feedback path is very complex with many variables it is difficult to make the right "guess" for optimal configuration (material parameters, geometry, contact properties) of the hearing instrument parts.*

*Different approaches have been used for optimization of a validated FE model of a BTE (Behind The Ear) hearing instrument. Manual optimization where best guesses, derived from experience, hypothesis and experiments, have been analyzed together with commercial software tools, which runs the optimization in a systematic process. Abaqus Standard from Simulia was used to build the model and to run the analyses.*

*The outcome of the optimization process has been analyzed and compared with physical experiments. The outcome also tells which parameters are governing the feedback path and which parameters could be relaxed.*

*Keywords: Acoustics, Structural-Acoustics, Design, Optimization, Hearing Aids, Vibro-Acoustic, Feedback, Microphones, Receiver, Loudspeaker, Sound Tube, Hook, Ear, Hearing, Life Science, Medical, Hearing Instrument.*

## 1. Design optimization of a hearing instrument

### 1.1 Purpose of the optimizations

The purpose the optimization process is to minimize the feedback path between receiver (loudspeaker) and microphones so that the resulting gain in the hearing instrument is as high as possible.