# Numerical calculation of individual head-related transfer functions of human listeners

Midterm evaluation

Harald Ziegelwanger

The geometry of the head and ears defines the listener-specific directional filtering of the incoming sound. The filtering is represented by the head-related transfer functions (HRTFs), which provide temporal and spectral features relevant for the localization of sound-sources. HRTFs can be acoustically measured or numerically calculated based on a geometric representation of the listener. While the acoustically measured HRTFs usually provide localization performance similar to that obtained in free-field listening, the performance obtained with numerically simulated HRTFs, however, heavily depends on the quality of the geometric and acoustic model of the listener used for the simulation. Numerical calculation of HRTFs has received much attention in recent years, however, previous studies lacked in the comparison of measured and calculated HRTFs, i.e. in the quantification of the similarity between HRTF sets.

In this presentation, the numerical methods to calculate HRTFs for the entire audible frequency range are reviewed and methods to analyze and evaluate calculated HRTFs efficiently for spectral cues in sagittal planes and for temporal cues in the horizontal plane are presented. Then the prerequisites for calculating listener-specific HRTFs with spectral features similar to that from acoustically measured HRTFs are discussed, which were systematically investigated with the introduced evaluation methods. Further, ideas on how to increase the calculation efficiency based on a non-uniform discretization of the geometry is proposed.