Database of single-channel and binaural room impulse responses of a 64-channel loudspeaker array

Abstract

A freely available database of measured single-channel and binaural room impulse responses (RIRs and BRIRs) of a 64-channel loudspeaker array of rectangular shape under varying room acoustical conditions is presented. The RIRs have been measured at three receiver positions for four different room acoustical configurations. Corresponding BRIRs for head-orientations in the range of ±80° in 2° steps with a KEMAR manikin have been captured for a subset of seven combinations of position and room acoustical configurations. The data is provided in the Spatially Oriented Format for Acoustics (SOFA). It can be used to study the influence of the listening room on multichannel audio reproduction. As an application, RIRs for the synthesis of a sound field by Wave Field Synthesis are shown.

Motivation

The influence of the listening room on audio reproduction is a topic of ongoing research [1]. Established reproduction techniques such as two-channel stereophonic or 5.1 surround sound are regularly subject to room-in-room situations. New multichannel techniques such as Wave Field Synthesis (WFS) [2, 3] require an anechoic environment. Perceptual consequences of the alteration of the sound field by reflections are not fully comprehended. The presented dataset allows for the study of the influence of the listening room on multichannel audio reproduction. Differing from recently published data [4], impulse responses have been captured for different room configurations by changing the setup of absorptive material in the room.

Room and loudspeaker array setup

- Audio Lab of the Institute of Communications Engineering, University of Rostock
- room of shoebox geometry, 5 m × 5.75 m and 3 m height
- room acoustics conditions:
  - no absorptions in the room
  - broadband absorbers at walls and in front of the windows, in total: 15.48 m²
  - additional absorbers of pyramid-shaped foam with 7 cm depth (total surface area 8 m²) placed below the broadband absorbers at the walls and in front of the remaining window surfaces.
- loudspeaker array:
  - 64 loudspeakers Neumann KH 120 A
  - mounted on a square truss construction with edge length 4 m
  - mean loudspeaker spacing 23.4 cm

Room-in-room situations. New multichannel techniques such as Wave Field Synthesis (WFS) [2, 3] require an anechoic environment. Perceptual consequences of the alteration of the sound field by reflections are not fully comprehended. The presented dataset allows for the study of the influence of the listening room on multichannel audio reproduction. Differing from recently published data [4], impulse responses have been captured for different room configurations by changing the setup of absorptive material in the room.

Measurements

- BRIRs have been acquired with a KEMAR manikin 45BA with large ears (type KB0065 and KB0066) and G.R.A.S. 40AD pressure microphones. The head of the manikin was rotated horizontally above the torso from ±80° in 2° steps
- RIRs have been measured with an omnidirectional 1/4" microphone (iSEMcon EMX-7150)
- linear sine sweeps with bass emphasis of 21° (BRIRs) and 22° (RIRs) samples length at sampling rate 44.1 kHz
- receiver positions at array centre, room centre and one off-centre position
- RIRs available for all combinations of receiver position and absorber configuration, BRIRs only for a subset of these combinations
- additional measurement with an omnidirectional source: reverberation time of the room for all absorber setups

Free database

The data is freely available for download at

http://dx.doi.org/10.14279/depositonce-87

under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 license. It is published in the Spatially Oriented Format for Acoustics (SOFA) [5].

References


Table: Measured combinations of receiver positions and absorber configurations for BRIRs

<table>
<thead>
<tr>
<th></th>
<th>no absorbers</th>
<th>without ceiling absorbers</th>
<th>all broadband absorbers</th>
<th>additional absorbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>centre of room</td>
<td></td>
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<tr>
<td>centre of array</td>
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<tr>
<td>off-centre position</td>
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