1. **Auralization**
   1. **Binaural Impulse Responses**

Constructing a Binaural Impulse Response (BIR) from a source to a receiver needs transfer functions from source to the listener. Therefore, a set of head related impulse responses (HRIRs) in time domain or corresponding head related transfer functions (HRTFs) in frequency domain are used for spatial perception and source panning in space. To apply HRTF filters we convolve an audio signal with these filter as shown Figure **4.1**. For free field reproduction the attenuation of sound field due to distance between source and receiver is also required to be included in filter chain by applying a delay in Dirac function with energy decrease by law.

|  |
| --- |
| C:\Users\heimes\Downloads\BlockDiag(2).png |
| **Figure 1:** Flow diagram of Construction of BRIR |

* 1. **HRTF Databases**

HRTF Databases include data set for several positions around the dummy head. Mostly HRTF datasets are available with resolution of 1° in azimuth and elevation directions and normalized at one meter distance from source. These HRTFs are approximated for the far-field conditions. In auralization applications with small distances between source and listener far field HRTF datasets are not the right choice as these datasets are defined for plane waves from a specific direction whereas distances below one meter cannot be assumed.

* 1. **Headphone Equalization**

For presentation of binaural signals to the listeners, normally, headphones are used as it is easy to provide necessary separation of left and right channels. It is, however, problematic to use different types of headphones since they have different transfer functions. Therefore, the transfer functions of the headphones are recorded, and corresponding correction filters are calculated by inverting the recorded transfer function as shown in Figure **4.2**. In this way the frequency response with the equalization of the headphone will become flat and make the binaural reproduction through headphones plausible.

|  |
| --- |
|  |
| **Figure 2:** Arrangement for reproducing binaural signals[2] |