Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

HOCHSCHULE BREMEN
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Beamforming for Localization and Cancellation of Noise Sources using 3D Microphone Array

ABSTRACT - Masterthesis

In array systems, signals are processed with respect to spatial geometry of the microphones and sources. In addition to typical time and frequency characterizations of acoustic sources and receivers, positions and spatial paths must be known and incorporated into the processing.

The signals recorded by a 3D array containing 8 microphones mounted on a vehicle, are processed to localize dominant noise sources around the array such as the engine and filter them without distorting the signals of interest like the muzzle blast of gunshot.

Acoustic Beamforming is the technique used for this purpose to localize and filter noise of specific bandwidth. The spatial position of each individual source is determined from the time difference of arrivals (TDoA) of acoustic waves at each of the microphones. Depending on the speed of the vehicle, the bandwidth of stochastic signals may also vary. Hence, the filter needs to be adapted to these changes in frequencies to cancel them with certain precision.

The main aim of the master thesis is to implement suitable signal processing algorithms to steer the beamformer to a desired direction of interest in a 3D space (defined by range, azimuth and elevation) with minimal interference from surrounding acoustic noise sources. Analysis and simulations are carried out in MATLAB.