Directional Sensitivity-Based DOA Estimation Using a Fourier Series Model

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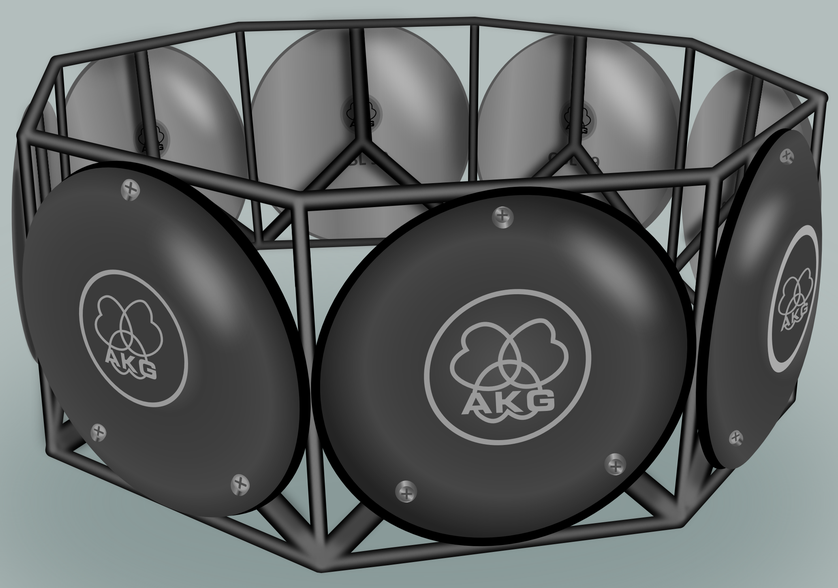
1 Introduction

Conventional *direction of arrival* (DOA) estimators are based on **time differences**. We investigate an approach only based on the **received power** at each microphone. This has a number of advantages:

- **Simpler hardware**
- **Simplified theory**
- **Smaller arrays**



2 Experiments

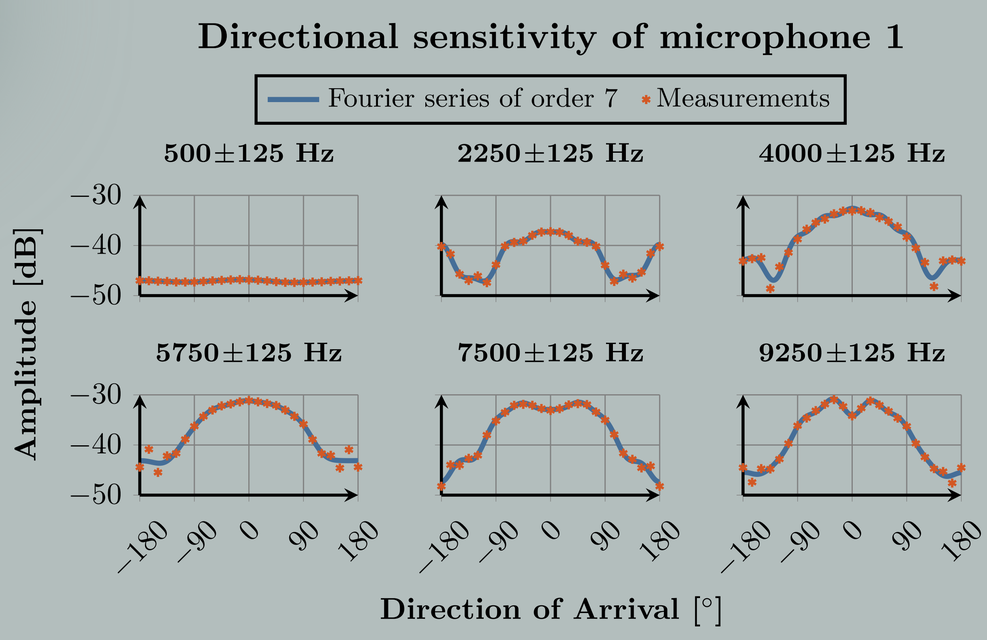
The sensor array used is a *uniform circular array* (UCA) in the form of an octagon with 8 microphones. Data was collected in an **anechoic** chamber at the Swedish Defence Research Agency (FOI) in Linköping, as well as in an **outdoor** scene.

3 Model Learning

The power $P_{m,n}$ measured by microphone m at frequency bin n can be expressed as

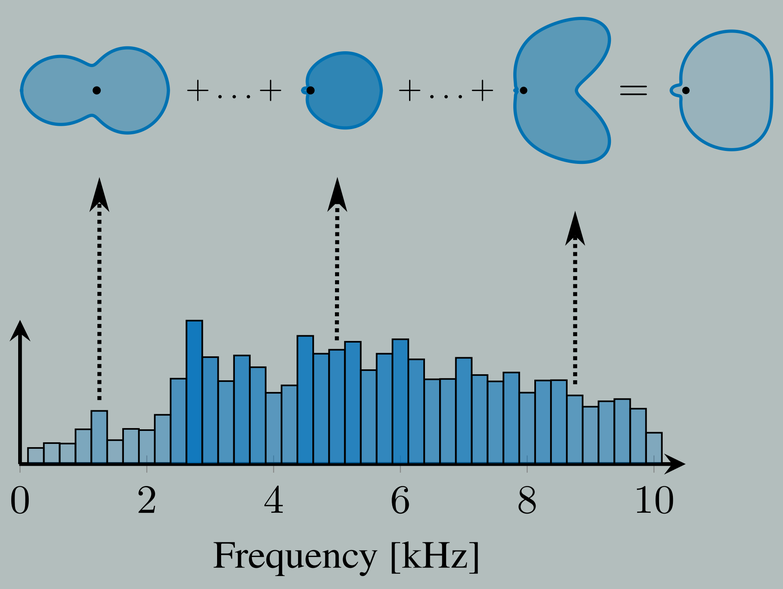
$$P_{m,n}(\psi) = \alpha_m + g_{m,n} + h_{m,n}(\psi, \boldsymbol{\theta}) + e_{m,n}$$

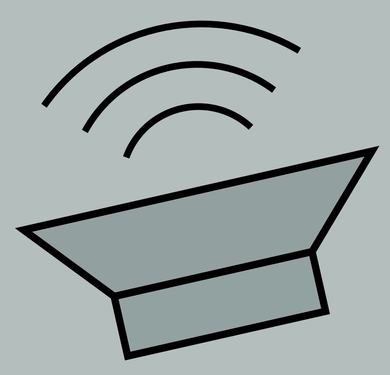
The directional sensitivity $h_{m,n}(\psi, \boldsymbol{\theta})$ is learnt using a *Fourier series* (FS) model



4 DOA Estimation

In the estimation step, the **frequency content** of the signal is calculated and used as a weight vector to form the estimated **directional sensitivity** of the received signal

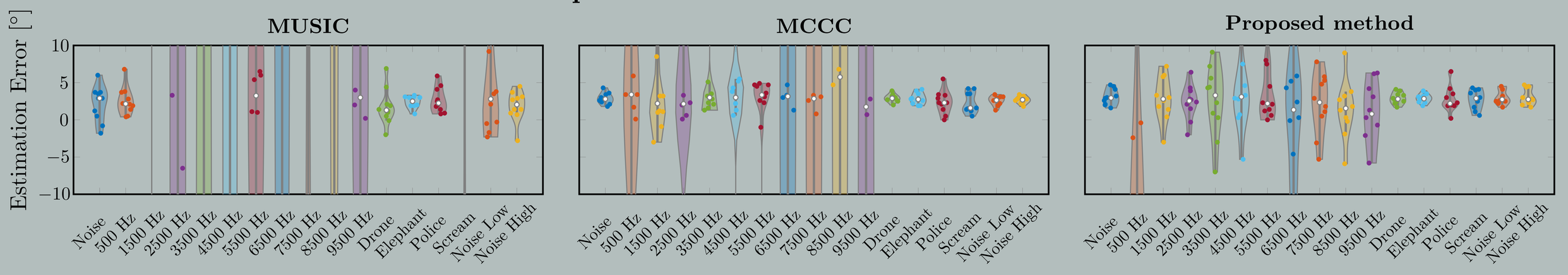




6 Contributions

- DOA estimation with **high accuracy** on signals with frequency content above 1500 Hz.
- The microphone array can be made **arbitrary small**.

5 Results



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