Dataset from a microphone array measurement of a rotating line source

Simon Jekosch and Ennes Sarradj

Institute of Fluid Mechanics and Engineering Acoustics
Technical University Berlin
Einsteinufer 25, 10587 Berlin, Germany

December 10, 2021

1 Overview

The following instruction gives a summary of an microphone array measurement conducted at the TU Berlin in March 2021. The setup consists of a rotating line source and a sunflower array with 64 microphones as well as a laser trigger. The rotating line source is made of 8 Visaton BF37 speakers on a 800 mm rod. Figure 1 shows a Photograph of the line source. The given data set contains 8 measurement files with different source characteristics and rotational speeds. Overall about 100 different cases were measured. Additional data can be provided on request.

2 Microphone array

The array consists of 64 microphones which are ordered in a single sunflower spiral [1]. The spiral parameter H which defines the radial distribution of the microphones is chosen to be 1.0 and the parameter V defining the azimuthal distribution of points is set to 5.0. The parameters are chosen according to Sarradj [2]. The array aperture of the array is $d_{spiral} = 1.5\,\mathrm{m}$. The array is shown in Figure 2. The type of microphones used is GRAS 40PL-1 Short CCP and the distance between the array center and the fan was from 0.391 m to 0.991 m.

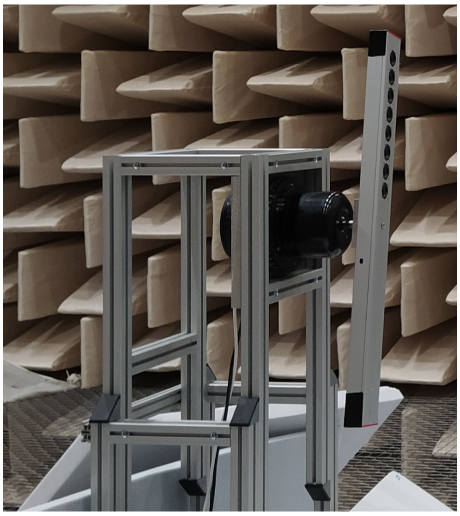


Figure 1: A photograph of the rotating line source.

3 Rotating line source

The revolution per minutes of the line source are set by a control voltage between 0V and 10V. At 0V the line source is not moving and at 10V the source reaches a rotational speed of approximately 400 revolutions per minute. A Sketch of the front view of the fan as well as the side view of the setup is shown in Figure 3.

4 Purpose of the measurement

The measurement is conducted to localize the sound distribution and directivity of a rotating source using multichannel microphone measurements [3]. The spiral Array configuration was chosen to test an extension of the virtual rotating array method for arbitrary microphone configurations [4].

5 Measurement data

The measurement time is 40 s with a sampling frequency of 51200 Hz. The sound pressure data is stored in the channels 0 to 63. The trigger-per-revolution signal was synchronized to the pressure measurement and is stored in channel 64. The trigger data has a peak to 70 when the laser is hitting the reflector and is 0 elsewhere. The trigger point is marked by the rising slope of the trigger signal. An exemplary trigger signal is shown in Figure 4. All data is stored in a HDF5 data format under the time_data key. The sampling frequency is stored under the time_data key as well. The air temperature during the measurements is between 16.5°C and 17.0°C . Table 1 shows the configuration for each measurement file. Delaying the signal to each speaker in the line results in a

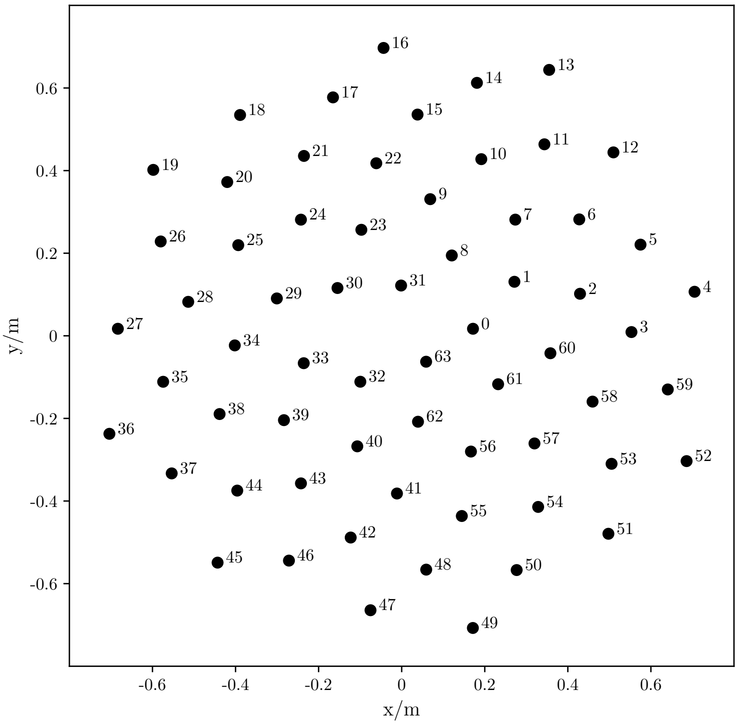
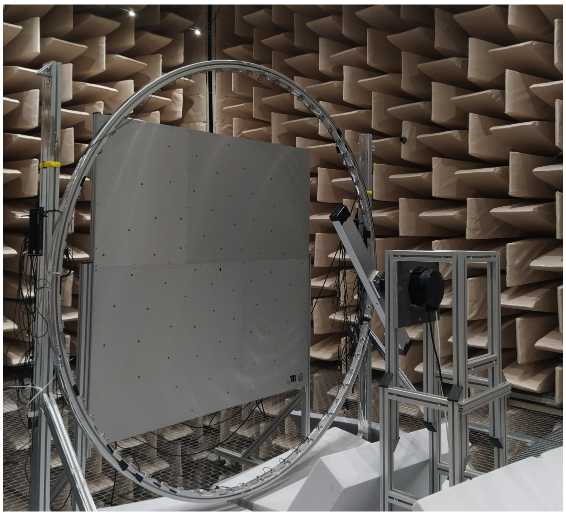


Figure 2: Distribution of microphone sensors in the array.

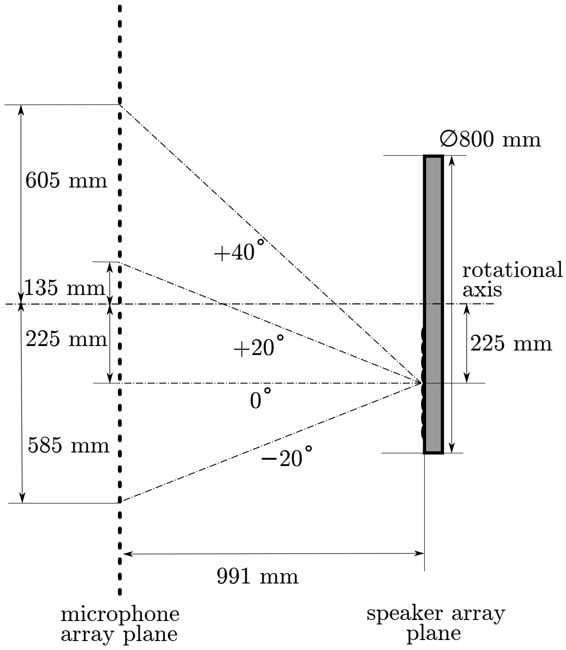
directivity of the source towards the microphone array. Inverting the speakers next to each other results in a dipole like source characteristic. The measurement files 1 to 5 use all 8 speakers with white noise signals. The files 6,7 and 8 only use the outer two speakers in phase or with inverted phase between them.

Table 1: Measurement data files.

Number	Filename	Distance	Temperature	Rpm	Modifies	Signal
1	2021-03-16_10-32-35_171973.h5	0.991 m	16.7 [°C]	0%	-	White Noise
2	2021-03-16_10-42-46_626446.h5	0.991 m	16.7 [°C]	50%	-	White Noise
3	2021-03-16_11-50-25_317673.h5	0.991 m	16.7 [°C]	50%	-40°	White Noise
4	2021-03-16_11-55-58_879611.h5	0.991 m	16.7 [°C]	50%	+40°	White Noise
5	2021-03-16_11-59-23_370858.h5	0.991 m	16.7 [°C]	50%	+20°	White Noise
6	2021-03-18_11-23-24_095766.h5	0.392 m	16.8 [°C]	0%	Dipole	4 kHz Sinus
7	2021-03-18_11-27-07_363729.h5	0.392 m	16.8 [°C]	50%	Monopole	4 kHz Sinus
8	2021-03-18_11-31-31_077455.h5	0.392 m	16.8 [°C]	50%	Dipole	4 kHz Sinus



(a)



(b)

Figure 3: (**a**) Shows a photograph of the setup and (**b**) shows the side view.

6 List of files

- tub_vogel64.xml - Microphone positions in the array
- Measurement_data.zip - Archive of the time data. Contains the .h5 files listed in Table 1
- Linesource_position_at_trigger.jpg - A photograph of the orientation of the line source at the trigger point. The size at grid distance is 0.5 $m \times 0.5$ m
- calib.xml - The calibration file for each microphone channel

References

[1] H Vogel. "A Better Way to Construct the Sunflower". In: *Mathematical Biosciences* 44 (1979), pp. 179–189.

[2] E Sarradj. "A Generic Approach To Synthesize Optimal Array Microphone Arrangements". In: *Proceedings of the 6th Berlin Beamforming Conference* (2016), pp. 1–12.

[3] Simon Jekosch and Ennes Sarradj. "An Inverse Microphone Array Method for the Estimation of a Rotating Source Directivity". In: *Acoustics* 3.3 (2021), pp. 462–472. DOI: 10.3390/acoustics3030030.

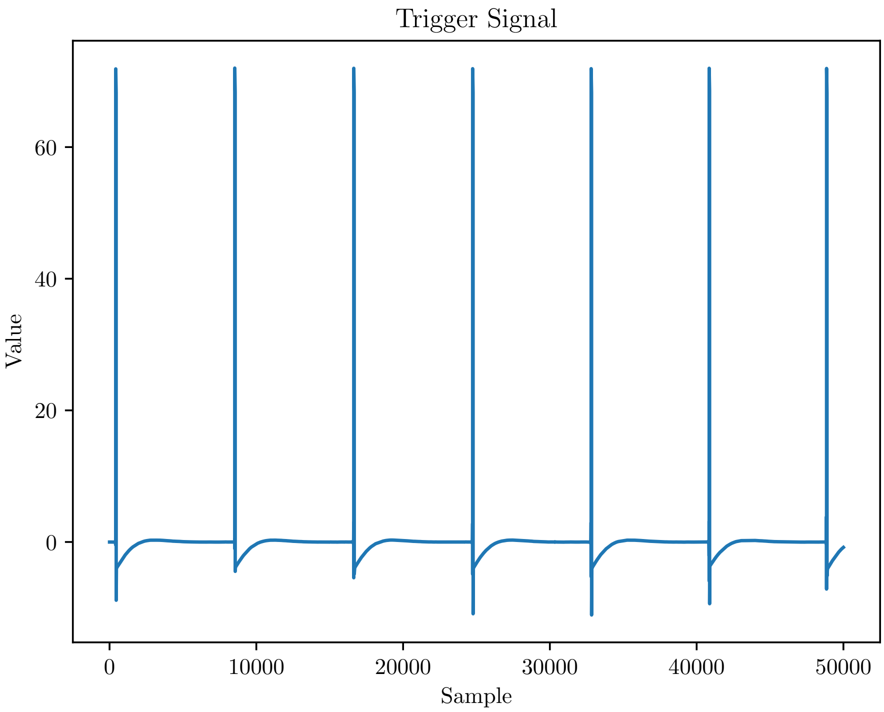


Figure 4: A trigger signal over time.

[4] Simon Jekosch and Ennes Sarradj. "An extension of the virtual rotating array method using arbitrary microphone configurations for the localization of rotating sound sources ." In: *MDPI Acoustics* 2 (2020), pp. 1–13.