

Assignment 5
Date handout: 16/02/2024
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Assignment 5: 2D Beamforming of Aircraft Fly-Over Noise

Study sections 8.3 and 8.4 of the lecture notes on Aircraft Noise and Emissions, Introduction to Aircraft Noise.

The acoustic data provided for this assignment consists of 0.05 sec data of an A321 fly-over. During the 0.05 sec, the aircraft is directly overhead the microphone array at a height of 64.87 m. For the beamforming you can assume the aircraft to be stationary and $\vec{M} = \vec{0}$. The sampling frequency amounts to 40 kHz.

The microphone configuration is provided in the file 'array.txt'. The first column indicates the microphone number (32 in total), the second and third columns indicate the x- and y-positions of the microphones. The y-axis is parallel to the aircraft flight path and the x-axis is perpendicular to it.

Make a (MATLAB) program to calculate the so-called source map and identify the A321 noise sources by taking the following steps:

1. Define the scan grid (typical size is 50 m x 50 m with the aircraft center at around (0,0)).
2. From the spectrum of the received signals, determine the frequency band(s) that you consider of interest for beamforming (minimum frequency 1.5 kHz, maximum frequency 9.5 kHz).
3. Beamform the data at various frequencies. A necessary step is to incoherently add the beamform plots over a *large* number of frequencies.
4. Interpret your results. Possible sources are the main landing gear, the nose landing gear and the engines. Make use of the A321 geometry for this interpretation.

Hand in your answers as a report with figures illustrating the above steps. Make sure you include a description with the motivation for choices made. Include in the document the listing of your program. Limit your report to around 6 pages, excluding the listing of the program.