MEK4600: LabView; The sound of turbulence

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The sound produced by turbulence may be called aerodynamic/hydrodynamic noise and has a broad frequency spectrum. The fundamental question you should investigate in this lab is to understand the mechanism of conversion of energy between two of its forms: kinetic energy of fluctuating shearing motion and acoustic energy of fluctuating longitudinal motion.

For this assignment you will design and setup the experiment based on initial calculations. This can be modified when the initial calibration tests have started. The main hypothesis for this lab is to see if the acoustic footprint of the flow can be measured by the use of a contact microphone. The energy spectra should be analyzed and the difference between laminar and turbulent flow should be scrutinized.

1 Pre-Lab activities

- A small test has been performed and data has been collected for pipe flow with unknown Re. Please find the data on the course Teams' site NOISE-LAB. Two cases have been conducted and the sound has been recorded; one without any flow in the pipe and the other with a high Re flow.
- Make a small program that reads the files and plot the spectra and compare with the results shown in Figures 1 and 2.
- This program should be used during the experiments to have a quick look at the data to be sure that any energy decay is detected.

2 Steps to perform

1. Write a short paragraph; What is turbulent flow? When do you have transition from laminar to turbulent flow?
2. What kind of fluctuating signals can be detected with the microphone with this setup?
3. Make a small literature review; Sound of turbulence in pipe flow; what has been done.
4. Procedure to find turbulence in pipe flow

- Find the flow rate (using a pipe with ID of 8 mm and length 2 m) to generate flow with e.g. Re for $50, 500, 2000, 4000, 10000$ by adjusting the flow rate and measure the amount of water with a scale or flow meter.
- Make a 1 min recording for each Re and save data to a file

5. Analyze the data and plot the frequency spectra.
6. Which frequencies are detected? Show the turbulence spectra.
7. Filter out noise and show the time series.
8. Make a report and upload it on Canvas, due 30th of April 2021.

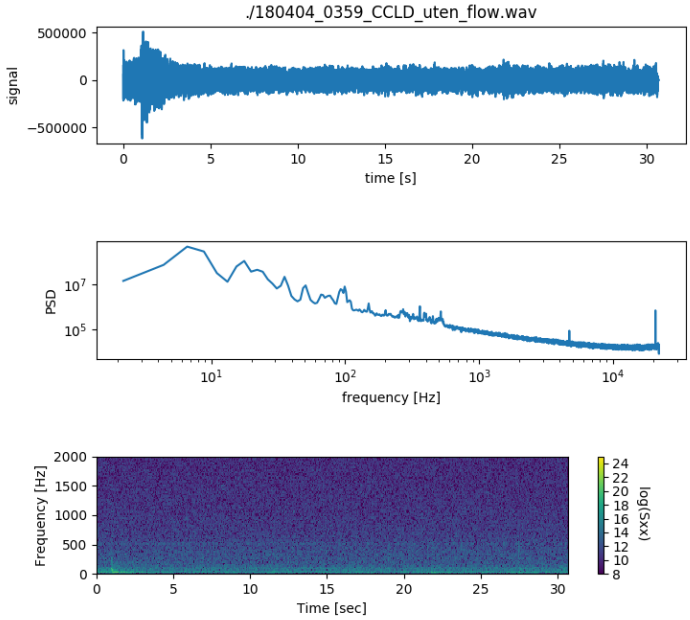

Figure 1: Spectra of the case without flow in the pipe. A measure of the noise level.

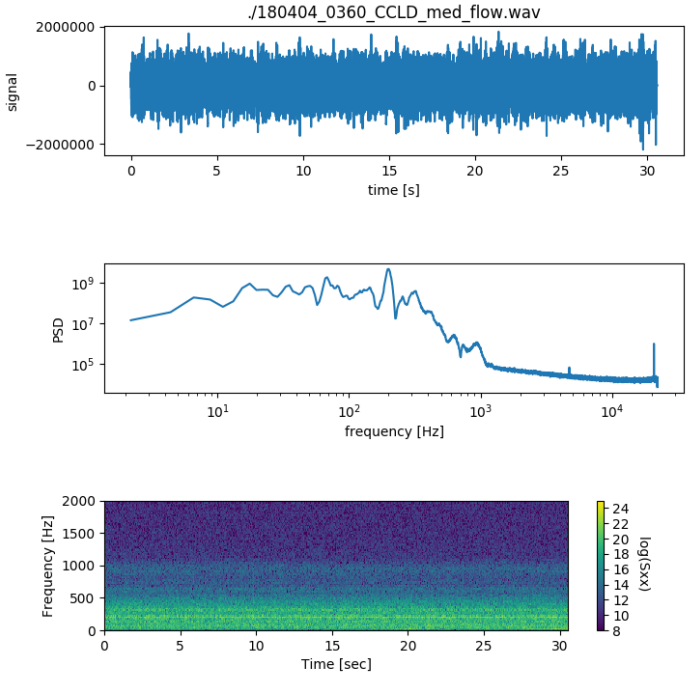

Figure 2: Spectra of the case with flow in the pipe.