

MEK4600: LabView; Can turbulence be detected in the human body?

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For this assignment you will setup hardware, make logging software and find turbulent spectra for different flow rates in a human blood vessel.

1 Hardware and Software

- Sony Vaio laptop - LabView installed
- NI myDAQ
- Amplifier
- Microphone
- Stethoscope
- Arm cuff

2 Steps to perform

1. Make a LabView program that record the sound from the microphone. Use filters to remove noise and unwanted signals. Remember to save the raw signal to the disk and also the post-processed data.
2. Please define systolic/diastolic pressure. What does it mean? What is the expected level of the systolic/diastolic pressure in a healthy human body?
3. What kind of fluctuating signals can be detected with the microphone with this setup?
4. Make a small literature review; Is turbulent flow in the human blood vessels reported in the literature?
5. Procedure to find turbulence in a vessel
 - Mount the cuff on one of the arms
 - Rest for 5 minutes before the measurement start
 - Inflate the cuff until you can read 30 points above your expected systolic pressure

- Easily release the valve approx. 2-3 point per hear beat until you can detect the pulse with the stethoscope
 - Take a reading of the blood pressure
 - Record the sound with the microphone
 - Listen for a change in the pulse sound when the air is slowly released from the cuff
 - Record data for the different pressures
 - Repeat this procedure 3 times
 - Wait 1 minute before you repeat the procedure
6. Analyze the data and plot the frequency spectra at different blood pressures.
 7. Which frequencies are detected? Show the turbulence spectra.
 8. Filter out noise and show the time series.
 9. Make a report and send it to atlej@math.uio.no and olav.gundersen@mn.uio.no before 11/4-2014 at 16:00.

3 Checklist

Adress these issues/topics in the report

3.1 Sampling data:

1. What is the lowest sampling frequencies to use when sampling the data from the microphone?
2. Why should you go a bit higher than the lowest possible rate?
3. In which range/level should the analogue signal be before sampled by the DAQ?
4. Why do you not want to let the signal fill the entire input range of the DAQ?
5. How many samples (vector length) should you read each time, and why? Pros and cons for few vs many samples?

3.2 Recording:

1. Would it be an advantage to be able to start/stop saving data and to change/make new file names without stopping the measurements?
2. Why should you try to avoid noise in your measurements and how can you improve your recordings to mostly get turbulence sound?
3. Would you benefit from being able to listen to your microphone data? If so, how would you implement that?

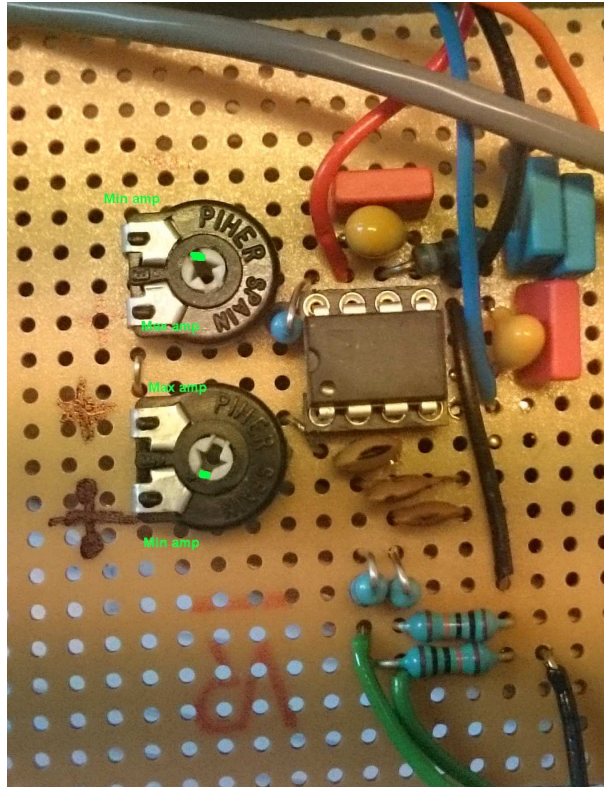


Figure 1: Amplifier used in this lab.

4 How to adjust the gain of the amplifier:

There are two potentiometers on the amplifiers circuit board -both have different usage:

- When the upper potentiometer is adjusted to 11 o'clock and the lower potentiometer is adjusted to 7 o'clock the gain is approximately 10x.
- Adjusting the lower potentiometer counter clockwise increases the gain. When it is set to 11 o'clock the gain is increased to approximately 92x.
- To increase the gain further turn the upper potentiometer clockwise. Max gain is when the upper is positioned at 7 o'clock.

Please note that you can also adjust the gain from 11x to 955x by keeping the lower potentiometer fixed at 7 o'clock and adjusting the upper from 11 to 7 o'clock. However, the lower gain range will then be very coarse."