
# EQ2401 Adaptive Signal Processing
# Project Assignment I, Spring 2024

**Deadline: Wednesday, 7 February, 2024.**

## Background

In this assignment you will design "vacuum cleaner" noise attenuation filters by using the Wiener filter theory. You are given a noisy speech signal and you should investigate the potential of using Wiener filters for reducing the background noise caused by a vacuum cleaner.

## Task

The data can be found on the course homepage under "Assignments" and "Project 1." There you will find a wav-file `EQ2401project1data2024.wav` containing a noisy recording. The file can be read into MATLAB by
`[z,fs] = audioread('EQ2401project1data2024.wav');`
where the variable `z` contains the sound data and `fs` is the sampling frequency. You can listen to the recording by using, e.g., `soundsc(z,fs)` in MATLAB[1]. Your task is to try to reduce the background noise as much as possible and in that way enhance the speech. You should try filters of three different types: FIR Wiener, Causal Wiener and Non-Causal Wiener. (You may of course experiment with other solutions as well.) Include one filter of each category in the solution. For these filters you should provide a frequency response plot and comment on the particular characteristics of the filters.

HINT: To get some information about the background noise you may use time periods when the speaker is silent. It is a good idea to first do the computer exercises about Wiener filtering and possibly AR-estimation if you are not familiar with that from before.

## About the Project

This is a project assignment that is part of the examination in the course and, hence, examination rules apply.

You should work on the project in groups of **two** students, but **not** in larger groups.

[1] It is recommended to use `soundsc` and not `sound` when you listen to signals. That way you do not have to worry about scaling the signal before listening to it. See also `audioplayer` for an alternative.

Your solution should be presented orally in a short seminar. You will be given 5 minutes for a slide style presentation and then we will have about 10 minutes for running your matlab script and discussions.

That is, your solution strategy and results should be documented in the form of a few presentation slides and a well designed matlab demo script.

The project is graded by **Pass** or **Fail**. A passing grade is required to complete the course. To give credit to good solutions and presentations, we will further award up to **2 bonus points**. The students can then add these bonus points to their exam score. The bonus points will be valid on the exams in March or June this year.

**The following is required for a passing grade:**

- A solution to the project tasks, documented in a clear and concise manner.
- The solutions should of course be unique and accomplished only by members of the individual groups.
- The solutions should be presented according to deadlines.

When you have finished the task please upload the following (at the course homepage under assignment Project 1):

- A zip-file containing:
  - Presentation slides in ppt or pdf format. The front page should state your names, and email-addresses.
  - Your solution in the form of a matlab script named as `main.m`.
  - All related files needed to run the script (except for standard matlab functions)

Make sure that we can run your script as is. That is, make sure that all files are included and all paths are set in the script if needed.

In the presentation, make sure you are describing what the problem really is about, what the solution is, what assumptions you have made, and that you have motivated choices or approximations made.

If the solution does not pass, there will be a chance to turn in a revised version before a new deadline. The revised version will be graded with pass or fail; that is, it will not be possible to get bonus points with a revised project. If the solution fails the second time, a new project must be completed next year.