

7 Signal/Geometry Processing Library (SPL)

7.1 Preamble

The exercises below are intended to provide a means to test your understanding of the programming-related material covered in the course. It is highly recommended that you work through these exercises as you cover the corresponding topics in the video lectures. By doing this, you will greatly strengthen your understanding of the material in these video lectures, which will greatly reduce the amount of pain and suffering required to complete the programming assignments in the course. In exercises that require the building (i.e., compiling and linking) of code, the CMake tool should be used for this purpose. For additional information about these exercises, refer to Section 1 of this document.

7.2 Topics Covered

These exercises cover SPL.

7.3 Exercises

1. **HINT:** BEFORE ATTEMPTING THIS EXERCISE, READ THE DOCUMENT ON THE COURSE WEB SITE TITLED “USING LIBRARIES” WHICH IS AVAILABLE FROM THE FILE `using_libraries.txt`.

In this problem, we consider the following demo programs from the SPL:

- The `array1cmp` program, which consists of the single source file `array1cmp.cpp` and uses the SPL and `sndfile` libraries.
- The `filterDesignDemo` program, which consists of the single source file `filterDesignDemo.cpp` and uses the SPL library.
- The `makeAudio` program, which consists of the single source file `makeAudio.cpp` and uses the SPL and `sndfile` libraries.
- The `timerDemo` program, which consists of the single source file `timerDemo.cpp` and uses the SPL library.

The source code for the `array1cmp`, `filterDesignDemo`, `makeAudio`, and `timerDemo` programs can be downloaded from the course web site in the file `spl_examples.zip`.

- (a) Create a CMakeLists file (called `CMakeLists.txt`) that can be used to build all of the above programs.
- (b) Run the `makeAudio` program using the following command:

```
makeAudio 0 44100 10 output.wav
```

The preceding command will create an audio file (in the WAV format) called `output.wav`. Use the `play` command to play the output file to the speaker/headphones. This can be accomplished with the command:

```
play output.wav
```

- (c) Use the `filterDesignDemo` program to design a lowpass filter with the cutoff frequency 0.5 and transition width 0.05. This can be accomplished with the command:

```
filterDesignDemo lowpass 0.5 0.05
```

A sequence corresponding to the impulse response of the designed filter is written to standard output. Use MATLAB to plot the frequency response of the filter.

- (d) Review the source code for each of the above programs. In order to fully understand the code, you will need to read some parts of the SPL user manual. Can you understand in detail how each program works? If anything is unclear about how these programs work, please ask the teaching assistant or instructor for assistance.