

Demo 12 Exercises: Block Processing

DSP Lab (ECE 4163 / ECE 6183)

Fall 2023

Demo files

`AM_demo.py`
`AM_blocks.py`
`AM_blocks_corrected.py`
`AM_blocks_from_microphone.py`

The demo program `AM_demo.py` applies amplitude modulation (AM) to a signal obtained from a wave file. This moves the signal to a higher frequency and changes the way the signal sounds.

The usual practice is to read and write signal values to and from audio devices in *blocks* rather than one signal value at a time.

The demo includes a program that reads the input signal from the microphone. In this case, it is recommended that headphones be used to audio feedback (sound passing from the speaker back into the microphone).

Exercises

1. Modify the program `wave_filter_python.py` in Demo 06 so that it reads and writes the signal in blocks instead of one signal value at a time. Do not use Numpy for this exercise. SUBMIT
Namely: write a Python program that reads a signal from a wave file in blocks, implements a bandpass filter as a recursive difference equation, and plays the output signal using `pyaudio`. The output signal should be written to the audio output stream in blocks. Using a block duration between 10 and 60 milliseconds. The output of your program should be the same as `wave_filter_python.py`.
2. Write a Python program to implement the vibrato effect, where the input signal is read block-by-block and the output signal is written block-by-block instead of one signal value at a time. Your program should produce the same output as `play_vibrato_interpolation.py` in the previous demo. Verify that the output signal of the new version (using block processing) is the same.
3. Same as the previous exercise, but the input should come from the microphone instead of a wave file.
4. Write a Python program to implement audio AM with a stereo output, where different modulation frequencies are used for the left and right channels. The output stereo signal should be saved to a wave file. Listen to the output using headphones.
5. Modify the demo program `AM_blocks_corrected.py` so that it works for stereo wave files. Listen to the output using headphones.