DSP Wah Pedal

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Overview

The objective of this project is to design and build a digital "wah" pedal effect that can be implemented into a guitar audio processing chain. A "wah" pedal consists of a filter that sweeps its cutoff frequency in response to the movement of the expression pedal by the user. A potentiometer will be used to sense the position of the expression pedal. Different filter models can be used that provide different sound characteristics. Students will initially design one filter model and expand to other filter models if time permits.

Raw analog audio signals will be sampled with an ADC, then an FFT will be performed on the sample. The result of the FFT will be multiplied by the frequency response of the "wah" filter. Taking an inverse FFT of this multiplication will result in the digital version of the output audio. Finally, the digital signal will be converted to analog with a DAC and output of the pedal. Actuating the pedal will alter the frequency response of the filter, altering the sound of the audio signal.

A microcontroller will be used to perform the digital signal processing required for the project. The microcontroller will need at least three ADC channels and two DAC channels. Two of the ADC and DAC channels will be used to convert stereo audio from analog to digital and back to analog. These ADC's and DAC's must be configured to 16 bit precision and 44.1 kHz sampling rate for good audio quality. The third ADC will be used to read the voltage of the potentiometer connected to the pedal so that the microcontroller can adjust the filter cutoff according to the expression pedal's position.

Materials:

Wah Pedal Enclosure - https://www.pedalpartsplus.com/product-p/7902.htm

Microcontroller with 3 ADC's, 2 DAC's with 16 bit precision and 44.1 KHz sample frequency.

Potentiometer

2x1/4 inch audio jacks

Power supply and connector