Mock Design Review

Pocket Pedal: A Bluetooth Controlled Guitar Effects Box
Power Converter

The analog filter circuits and the microcontroller will be tied to the same power source that will take in 120V AC from a standard wall outlet and convert it to 9V DC. We will be constructing an AC-DC conversion circuit that isolates the input from the circuit with a 12:1 transformer. The secondary side of the transformer will feed into a 4-diode bridge circuit that will rectify the AC signal. Adding a filtering capacitor at the output to clean up any noise in the signal as well as a 10V reverse biased zener diode will bring
our output to a stable 10V DC. We will then feed this voltage to our analog filter circuits and the microcontroller in order to power our design.

Calculation

Below is an example of some nonlinear soft-clipping of an input signal [1]. This instance of soft-clipping is called ‘overdrive’ in the guitar world. Essentially it distorts the input signal based on three different thresholds (see below).

\[
f(x) = \begin{cases} 
    2x & \text{for } 0 \leq x < 1/3 \\
    \frac{3 - (2 - 3x)^2}{3} & \text{for } 1/3 \leq x < 2/3 \\
    1 & \text{for } 2/3 \leq x \leq 1 
\end{cases}
\]

Plot(simulation/experiment) [3]

There are several different types of gain circuits that use the above methods of altering the signal. Soft clipping is used for a more smooth overdrive sound, while hard clipping is intended for heavier distortion effects. This can be implemented using simple band-pass filter with varying degrees distortion.
## Requirements/Verifications

### Requirements

<table>
<thead>
<tr>
<th>1) Microcontroller/Bluetooth</th>
<th>1) Microcontroller/Bluetooth</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Each output pin on the Arduino Uno is capable of producing 3.3V (5% error) [2]</td>
<td>a. Use a voltmeter connected to GND and each pin and verify that the readings are in the correct range</td>
</tr>
<tr>
<td>b. DC Power is supplied to the Arduino Uno at 8-11V (5% error). [2]</td>
<td>b. Use a voltmeter connected to GND and the VIN pin, then verify that the readings are in the correct range</td>
</tr>
<tr>
<td>c. Bluetooth capable of sending “Hello World” message to device 10m away.</td>
<td>c. Using the Arduino, transmit the “Hello World” message to the mobile device and verify that the message is intact.</td>
</tr>
</tbody>
</table>

### Safety Statement

Our primary safety concern lies with the connection of the wall outlet (120 V AC), through the power supply and stepped down accordingly to the rest of our design. We will ensure that we have taken measures to properly protect the main 120 Volt line into the power converter. These will be insulated and protected to insure that there will be no external contact with harmful objects (other wires, food, liquids) and they will also be a larger gauge to resist normal wear and tear.

Following these protective measures, we will also ensure that the rest of the electronics will be properly enclosed to ensure that nothing can be unintentionally affected or tinkered with.
As a precaution, we plan to use a few limiting fuses to ensure we are not feeding too much power into any of our specified components. Additionally, we are implementing a hardware ‘killswitch’ feature which will essentially ground the incoming signal and filter it out so that the design will not feed the unwanted signals into the user’s amplifier.

Citations