Stereo Graphic Equalizer

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Abstract

This senior design project will consist of the design, prototyping, testing, and production of an analog electronic-based 3 band graphic equalizer plus 2 watt audio power amplifier suitable for use with handheld audio devices with a standard mini-stereo jack. The equalizer would plug in between the portable audio unit and stereo speakers and would allow the user to adjust the frequency response to their personal preference. The students will test their circuit both in the lab as well as in a 'real world' sense by listening to the system in action. The device built may have a separate low-pass output for use with a subwoofer. Since it is stereo, there will be two identical halves, one for the left channel and one for the right, with the equalization of each being synchronized. The primary mechanism for filtering will be 741 Op-Amps. The unit will be powered by 12 V DC.

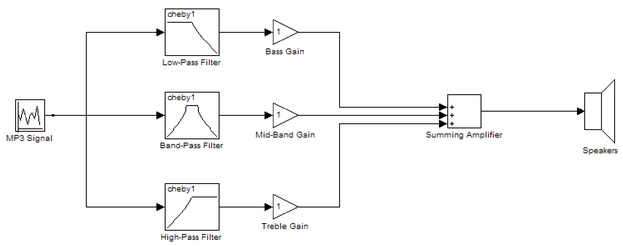

Figure 1: Block Diagram of Single Channel

Theory

In order to equalize the different bands of frequency to obtain an ideal sound, three filters must be implemented: an active low -pass RC filter, an active band-pass RC filter, and an active high-pass RC filter. The three bands must overlap in precisely the right way in order to ensure continuous operation over all frequencies within audible range. The low pass filter will have a 3 dB power cutoff at approximately 200 Hz, while the high-pass filter will have a 3 dB power cutoff at approximately 2,000 Hz. The Band-pass filter will have a lower cutoff of 200 Hz and an upper cutoff of 2,000 Hz. This will ensure that all the bands seamlessly interact with each other and that none of the frequencies are unnecessarily attenuated. To get a sharp roll-off, a fourth order circuit has been implemented, which will effectively attenuate the signals in the stop-band by 80 dB per decade. Shown to the right are the schematics and responses of each of the filters.

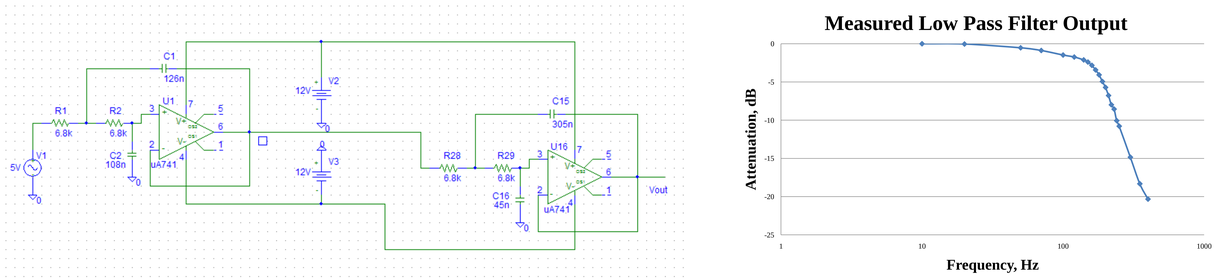

Figure 2: Low -Pass Filter and Output

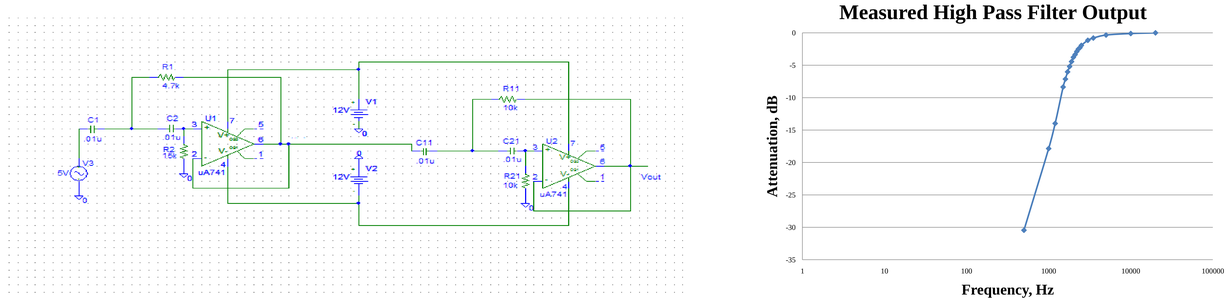

Figure 3: High-Pass Filter and Output

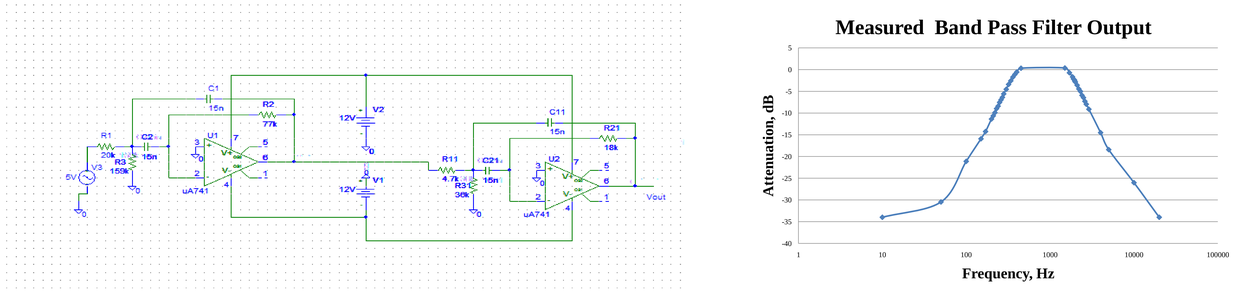

Figure 4: Band-Pass Filter and Output

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