Adjustable Parametric Equalizer Proposal

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Introduction

The Adjustable Parametric Equalizer (APE) allows the professional audio engineer to select and adjust a frequency using a single knob. With a 31 band graphic equalizer (EQ) which is the most common method of equalization in sound reinforcement, the entire audio signal will be passed thru 31 filters and then be summed together. With the APE, the audio signal will only pass thru five filters. One of the filters is a band pass filter for anti-aliasing purposes. The remaining four can be used as a high pass filter (HPF), low pass filter (LPF), notch filter (NF) or a narrow band pass filter (NBP). The current settings will always be saved so that they won’t be lost when the unit is powered down. The APE will be used for live and studio sound applications: equalization of the main stereo mix out of a sound console, two separate monitor mixes, equalization of two different instruments, or as a crossover.

Description

The APE will have both a dual XLR and ¼” Phono jack for inputs (Figure 1.). This allows the APE to be used with a variety of high end systems quickly and without any adaptors that could introduce problems. The signal will then go through an audio band pass filter. The low frequency roll off will start between 20 Hz and 25 Hz and the upper frequency roll off will be around 20 kHz. The audio will then go through a series of audio filters. The APE will have one knob (Figure 2.) that will allow the user to adjust the frequency of the filter. After pushing on the knob the gain of each filter will be controlled by a digital potentiometer (Figure 3.). Once the adjustment has been made, the knob is pressed again and the frequency of the next filter can be adjusted. To re adjust a filter, the user would press the knob a number of times until the desired filter is selected. A representation of the equalization will be displayed on a text LCD. When
the user is adjusting the filters, the LCD will show what the frequency is and the cut or boost in
decibels. Once the user is finished adjusting the filters, the display will go back to a graphical
representation using the text LCD.

Benefits and Comparison

This EQ is aimed for the professional and high end audio market. While other pro-audio
EQ’s use a series of small faders that can be easily bumped out of position to adjust the gain of
each frequency, the gain on the APE would be stored safely. So while in transport there is no risk
of the EQ being altered from when the unit was powered down. The frequency selection is based
on speaker management systems similar to the BSS Omni-Drive which also has delay, humidity
adjust, Q adjust and crossover abilities.

Expansion Options

Sweepable Frequency Search

An arbitrary frequency would be selected. The gain and type of filtering would be selected (e.g.
notch filter or a low pass filter). While the knob is held in, the knob would be rotated to move the
type of filter and gain through the different frequencies. This would be extremely useful for
finding a problem frequency quickly.

Delay

Loudspeaker management systems often come with some kind of delay. If the APE was being
used with a system involving speakers at different distances from the audience the signal would
require delay. This is more for large room applications like a church or gymnasium.
Project Development and Demonstration

To design and test the hardware I will be using the equipment in ETEC 340. I’ll use Eagle to design a circuit board for the final design. I will run a frequency sweep into the input and then display the output on a spectrum analyzer to demonstrate the APE. As the user adjusted the gain of each frequency, the changes will be seen on the spectrum analyzer and the APE’s display.

Figure 1. Rear Conceptual Sketch

Figure 2. Front Conceptual Sketch
Figure 3. Block diagram of EQ