

FUZZ FACE OVERDRIVEN BY TUBE-SCREAMER (OVERDRIVE DISTORTION AND FUZZ)

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ABSTRACT

Distortion effects implemented using digital signal processing software MATLAB, problem description about past and current issues we deliver final product specification, implementation, evaluation of final product development.

1. INTRODUCTION

In the early age of rock music, audio circuits were widely used as musical instruments. As rock music became popular many of effects dedicated for electric guitars were produced. Distortion is one of the essential guitar effects for electric guitarist it provides sharp and edge to the guitar timbre. Each effect modules were created using analog circuits and now by using few code lines of texts and numbers it can be simply simulated by digital signal processing. This distortion effect project "Fuzz face overdriven by tube-screamer" was named after famous distortion effect pedal names like 'fuzz face' and 'tube-screamer'. By implementing code line through Mathworks MATLAB software we can make our own digital audio system.

As previous reports on initial report and lab report we discussed about how distortion works and it can be created now it's time to show our final product in details.

2. PROBLEM DESCRIPTION

Distortion is a one of the most popular effect for guitarist around the world and is a must have effect for among rock musicians. However, nowadays these effect does not only used for guitarist it can be connected to instruments such as keyboards (synthesizer), electric violin or any other instrument with audio outputs. By means of connecting audio signals to the effect module, audio can be modified, modulated and distorted. Original audio signal may sound pleasant although, by implementing additional signals like overdrive effect it creates harmonic distortion of each third octave band it adds symphonious to original sound.

One other problem maybe costs of buying effect pedals the price range estimated between few hundred dollars to most expensive vintage pedals above two thousand dollars ahead. The word vintage has nostalgic meaning to it, most people likes to buy new product off the shelf however, for some users prefer old vintage used products. Vintage also maybe discontinued rare product that cannot be bought no longer. Due to advance in technologies recently may audio companies have developed so called simulations of vintage gears it is not hundred percent identical to

the original product thus complexity of algorithm improves to duplicate original products.

Using MATLAB software any of signals can be manipulated in digital systems, this project is simple and working model it gives user an ease-of-use product with infinite amount of flexibility of gain control.

3. SPECIFICATION

This distortion project works by simple structures as shown in Figure 1. When the audio input is fed user can choose one of the following effect.

Overdrive
Distortion
Fuzz

User can tweak gain and mix valuable to their tastes and audio output is played and produced. (see script.m)

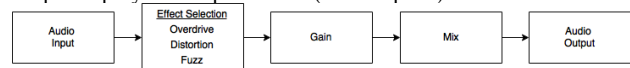


Figure 1. Simple audio I/O diagram.

The equations to produce distortion sound is as the following. (see Figure 2.)

The first step involves threshold of 1/3 of input is multiplied by 2, between 1/3 to 2/3 are calculated as shown in Figure 1. $((3-(2-3x)^2)/3)$, and lastly any input above 2/3 are as 1 value [1]. This affects some of signals to appear as distorted and clipped but some of them remains just at 1 value which is the maximum value of the amplitude.

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

Figure 2. Formulae for creating overdrive effect. [1]

Audio input is multiplied by the gain (value) and it can be either mixed with original sound or can be output as processed sound. This can be achieved by changing 'mix' value in the function.

4. IMPLEMENTATION

The working MATLAB function is located in effect.m file and in conjunction of script.m file user can experience the prototype model.

The main function of distortion effect can be selected by choosing one of the effect module (o=overdrive, d=distortion and f=fuzz). When the effect is selected blue light comes up on the light indicator also on the upper right side display shows which effect is selected and when controlling gain or mix value it shows value of the selected controls.

There are two knob controls gain and mix, each dial has level indicators around the knob. White dot on the knob shows which position the knob is located and glowing dot indicator also shows the position of the knob.

Gain has value of 0 to 100 where dial knob is located on the far left it has value of 0 which means there is no additional gain it results in original sound. On other hand, when gain is fully turned to right gain has value of 100 the input sound will sound very distorted.

Same goes for mix dial, when mix knob is located far left it means original sound and processed sound does not mix together whatever the gain value is when mix value is 0 sound does not change. If mix knob position is located far right side only 100% processed sound will be generated as a result.



Figure 2. *Graphic User Interface of distortion effects*

5. EVALUATION

Evaluation is subjective process however, to be objective as we previously discussed plotted graphs we found that functions amplified the gain structure and resulted audio distorted. For the listening evaluation purpose the following sound excerpt was produced using MATLAB function.

- Elec_original.wav
- Elec_dist.wav
- Elec_over.wav
- Elec_fuzz.wav

- AG_original.wav
- AG_dist.wav
- AG_over.wav
- AG_fuzz.wav

As the name implies dist = distortion and over = overdrive these sounds were processed with the named original sounds.

Each electric guitar and acoustic guitar was recorded in uncompressed wav file format and electric guitar sound was processed using brickwall limiter for the little bit of gain before MATLAB processing.

By comparing processed samples to original sound samples, processed sound possess more sound in level and overdrive seemed not very effective as distortion and fuzz effects. Also

distortion and fuzz effect give the impression of being similar sound in context there seems not much difference.

6. DISCUSSION & CONCLUSION

This digital audio system project was challenging experience because it was my first experience with MATLAB and without no computer programming language background it was very difficult to understand the concept.

When the gain level went up to over three digits the sound became unpleasant due to the fact too much distortions tonal sound quality completely demolished, it may have been better to include compressor with the effects to keep some of the details left out. The limitation of only able to select one effect processor at a time lacks creativity of mixing each sounds

Despite of many errors and difficulties to this project in overall distortion effect model worked as described implementing three separate functions into one function was also challenging, if there was more time implementing compressors and equaliser into functions may resulted better sounding effect processor.

In conclusion, distortion effect proves that it creates guitar sounds alive and to extreme level there is no doubt that distortion is a divine indispensable guitar effect processor.

7. REFERENCES

- [1] Zölzer, U., Ed., (2002). DAFX - Digital Audio Effects, J. Wiley & Sons