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Abs: 8 / 10
Intro: 11/12
Method: 20 /20
Results: 10 /25 Missing Text?
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Total: - 33 : 67 / 100 : 33.5 / 50

PHY 2010 Project

23 April 2012

Morpheus DropTune FX Pedal

Abstract

This project investigated the Morpheus DropTune and its ability to reproduce sound with tonal fidelity. The methods for this investigation required the recording of signals from a signal generator and physically de-tuned guitars. Those recordings served as baselines for comparison. Subsequently, those baseline signals were processed through the DropTune and recorded again. The two sets data were compared by applying the principles of Fourier analysis, from which conclusions were made that the DropTune reproduces fundamental pitch and upper-range harmonics with poor accuracy.

Introduction

The purpose of this project was to test the tonal accuracy and quality of the Morpheus DropTune—a signal processor that allows guitarists to de-tune in half-step decrements. Morpheus claims that their product maintains “perfect harmonic accuracy and tonally-correct overtones” during polyphonic pitch drop. It was hypothesized that the DropTune would not fulfill those claims. As such, the goals of the project were to clearly show the accuracy (or lack thereof) at which the DropTune reproduces sound while also discovering specific trends or patterns in its processing. It appears as though no research of this kind has been conducted on this product previously.

Equipment and Procedure

The equipment used in this project included the Morpheus DropTune and the PreSonus FP10 Digital Interface. Electric guitars used during recording included the Aria PE-SPT and a Fender Squier. Software used included Pro Tools 10, Audacity, and Apple Numbers.

The first step of the project began with the recording of basic tones. By using the tone generator in Pro Tools, sine, triangle, and square waves at 440 Hz were recorded, 10 seconds for each type. Subsequently, this process was repeated in half-step decrements at 415.3 Hz, 392 Hz, 369.9 Hz, and 349.2 Hz. All tones were re-recorded to verify that any harmonic differences were not the result of D/A and A/D conversion due to the audio interface. Next, using the 440 Hz tone as the source, the DropTune was used to record tones in the same half-step decrements. Finally, the 415.3 Hz, 392 Hz, 369.9 Hz, and 349.2 Hz tones were compared—the results of which will be mentioned in the section below.

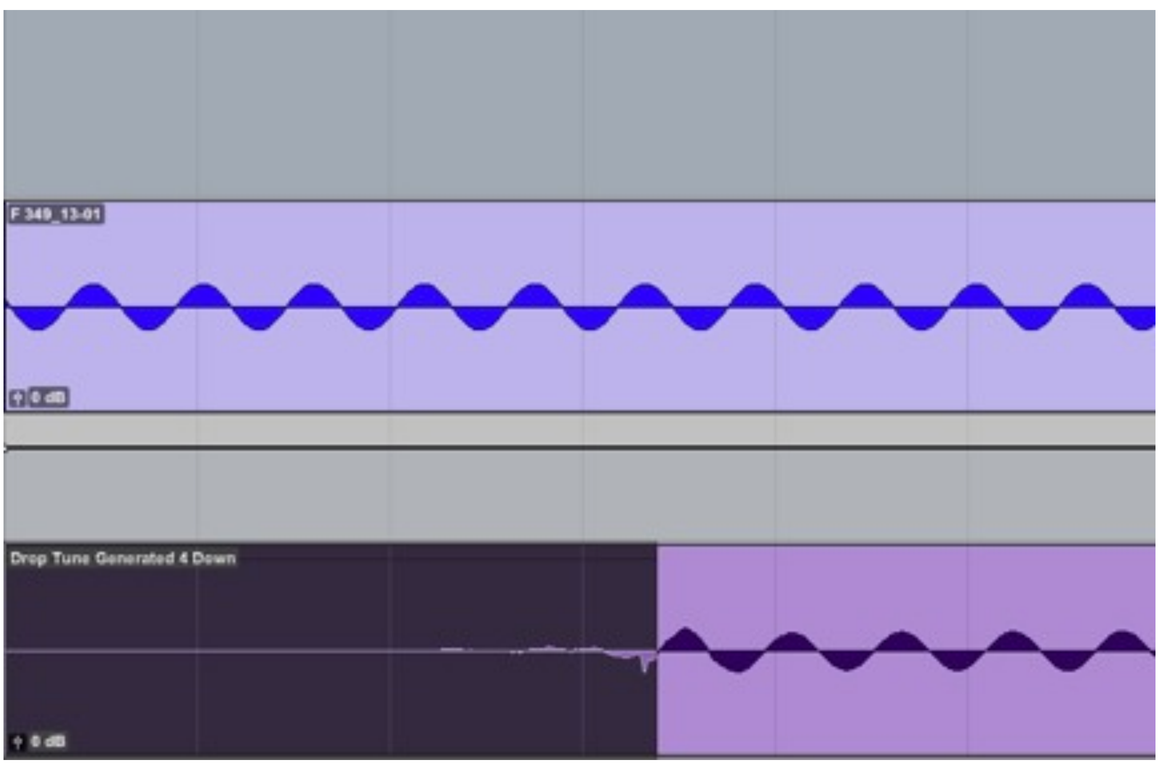
The next phase of the project included the recording of guitar tones. The decision was made to use DADGAD tuning on the Aria for the purpose of observing how the DropTune would handle repeated notes. If beats became more emphasized and warbling, it would provide evidence of the DropTune's inaccurate tuning. Next, a standard D chord was recorded in capo 3 and played in three different styles: a full whole-note strum, a rhythmic pattern, and the chord's single notes. This process was repeated in capo 2, capo 1, and open tuning.

Next, using the Fender Squier electric guitar, an F/Amaj7 chord was recorded. This particular chord was chosen because it is a thick-sounding, six-string chord with a bit of tonal tension. Hearing how the DropTune would reproduce such a chord was an intriguing idea. This chord was recorded and played in two styles: a full whole-note strum and the chord's single notes. This process was repeated in three half-step decrements.

The baseline recordings from the Aria and the Squier were then processed through the DropTune in three half-step decrements for the purpose of comparing the audio with the other physical de-tunings. Spectral data was obtained from Audacity FFT and compared using Apple Numbers—the results of which will be mentioned in the section below.

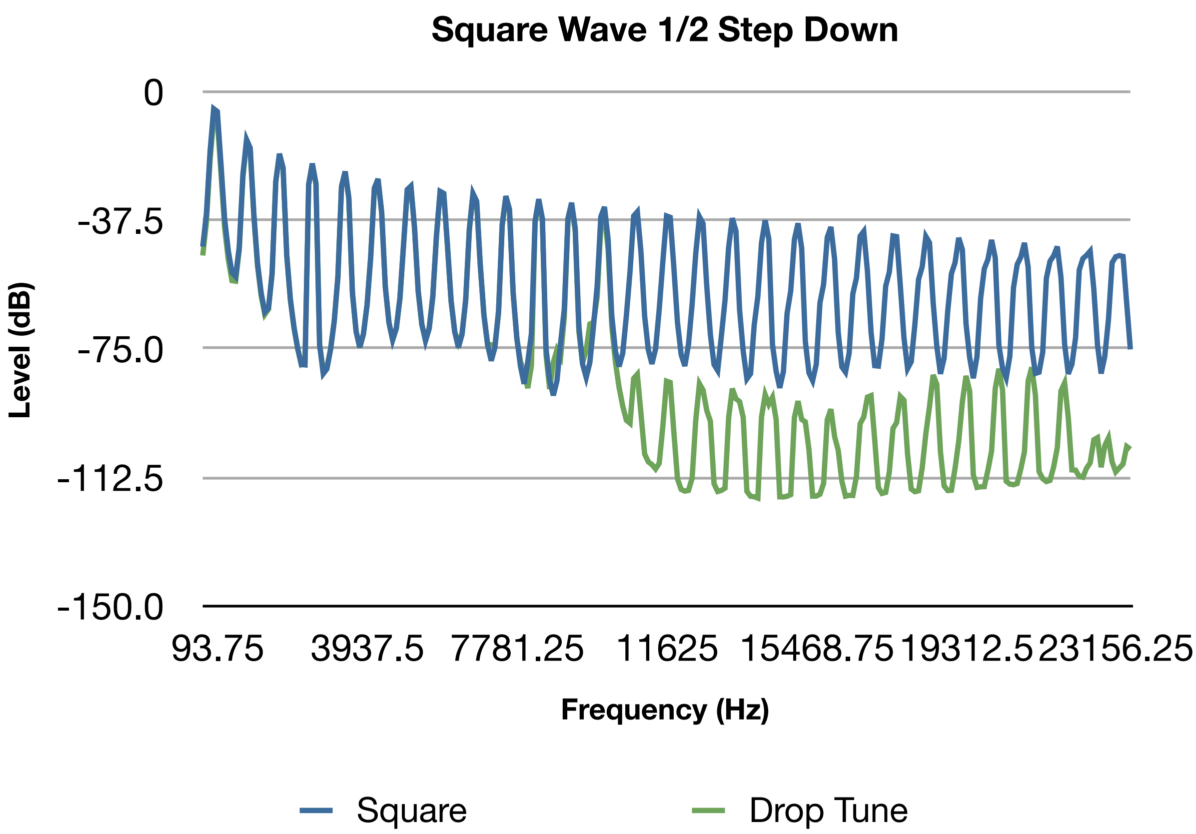
Results

A. Compare signals using visual waveforms in ProTools (verified 10-16ms delay caused by pedal)



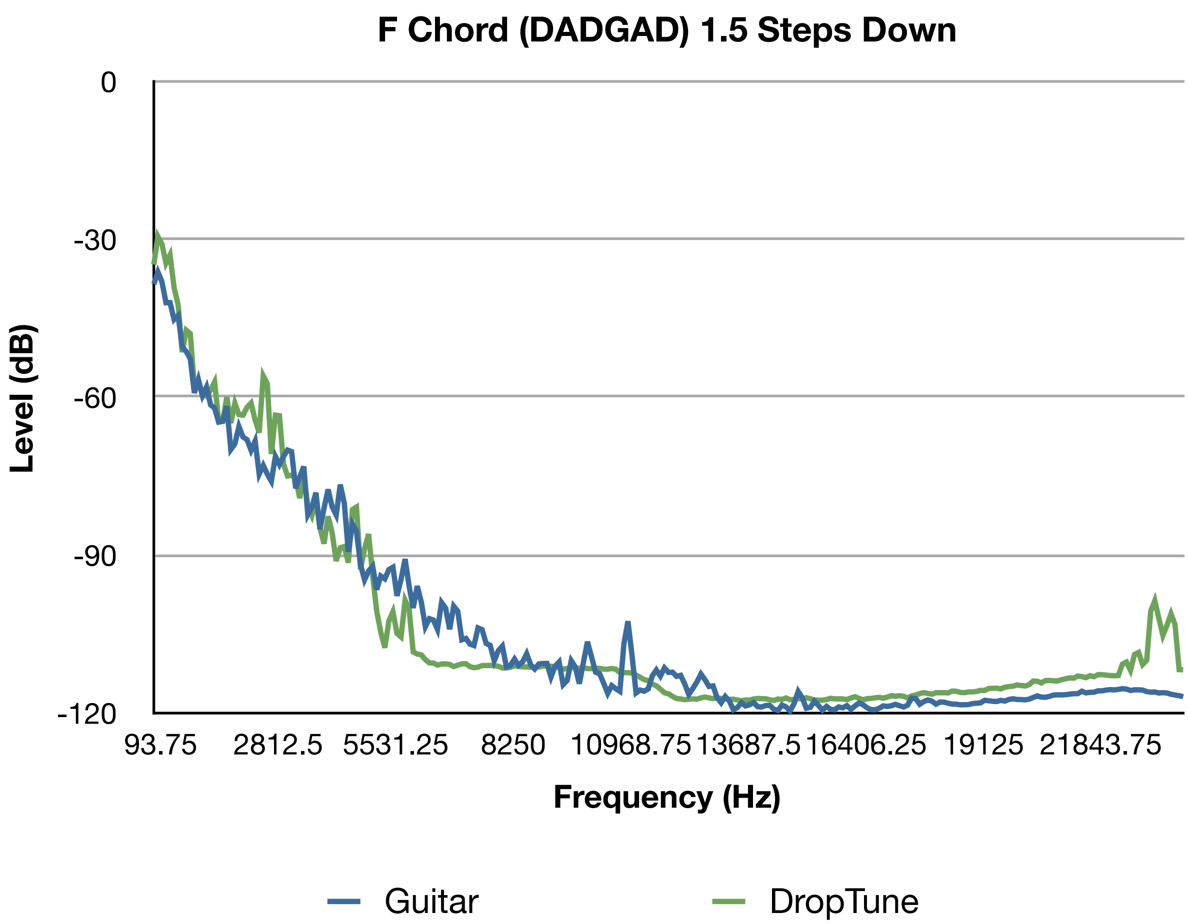
B. Compare audio results (Drop tune was audibly off pitch from calculated frequency)

C. Attenuation of harmonics above 3 kHz, poor reproduction of even fundamental and first harmonics



D. Compare audio of results compared to physical capo/bar chords (off pitch from true guitar recordings, not suitable for accompaniment with other instruments)

E. Spectral analysis of guitar signals showed very inaccurate representation of harmonics, especially in the upper-range



Conclusion

The DropTune begins to inaccurately reproduce frequencies in guitar tone as low as ~5,000 Hz, attenuating such frequencies by as much as ~15 dB. Analyzing its reproduction of a square wave, the DropTune begins to attenuate harmonics at ~11,000 Hz by as much as ~35 dB.

References

"DropTune." Morpheus Extreme Processors. 13 Feb. 2012. <http://www.morpheusefx.com/droptune.php>

Berg, Richard E., David G. Stork. The Physics of Sound. San Francisco: Pearson, 2005