

GUITAR DISTORTION: BASIC CONCEPTS*

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Abstract

In this module, we discuss the ideas behind distortion.

In trying to mimic an amplifier, one fact must be forefront in our brains: distortion is almost **always** nonlinear! Therefore, instead of looking directly to convolution and linear transforms, we have to think a little bit first. The first place we can look at is the Taylor series.

1 Taylor Series

In calculus, we learned about the **Taylor Expansion** and the **Taylor Series**, also known as the **McLaurin Series**. In essence, the expansion follows (1).

$$f(x) = \sum_{n=0}^{\infty} \frac{f(x_0)^n}{n!} (x - x_0)^n \quad (1)$$

The Taylor Series is used to approximate a function. As we know from the concepts behind signals, all signals are functions, and therefore we can use the Taylor Series to approximate a signal. As we add more and more into the series, the approximation becomes closer and closer to the original signal. However, for distortion, we **do not** want the original signal; instead, we want something grindy, something swanky to excite all of the rock-and-rollers out there.

2 The DFT and the FFT

Another idea used in analyzing distortion is the DFT. Before and after using the Taylor Series to "play around" with the signal, the DFT can be used to analyze the new (or old) sound, seeing which harmonics are the most important. MATLAB has a wonderful FFT function that allows for simple and fast DFT calculation.

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