Viewing Magic Sinewaves with Sigview

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A new class of **math functions** called **Magic Sinewaves** lets you efficiently produce power sinewaves that can have **any** chosen number of low harmonics forced very near **zero**. And do so using the fewest possible switching events for the highest possible energy efficiency. Two new intros appear **here** and **here**, along with a development proposal **here**, a tutorial **here**, visualizations **here** , jitter and distortion analysis **here**, lots of calculators **here**, seminars & workshops **here**, and evaluation chips **here**.

The **SigView** shareware available through **http://www.sigview.com** appears to be extremely useful for spectral analysis of **Magic Sinewaves**, both theoretical and real world. But there are some minor gotchas that I'd thought we'd go over in this brief **GuruGram**.

Spectral analysis was originally done with a **CFS** classic Fourier Series. Any digital calculations will of necessity involve **sampling** and use of a **DFT** Direct Fourier Transform instead. I originally elected to use **eight place** decimal accuracy for our **Magic Sinewave** analysis. This is way beyond what an engineer would need and is "close enough" for all but the fussiest of mathematicians.

While eight decimal places are slightly beyond the 32 bit math of **PostScript**, they are easily dealt with by JavaScript's 64 bit math and 15 decimal place or better noise floor. Per these **Calculators**.

It sure would be tempting to simply shove a **Magic Sinewave** into a PC sound card for digitizing and later analysis. But a typical Magic Sinewave might involve **41,664** samples per **60** Hertz cycle, or **2,499,840** samples per second. A mono 8-bit sound card will only sample at **22,050** samples per second and thus misses by a country mile…

The sampling rate of PC sound cards is way too low for Magic Sinewave analysis.

The **SigView** shareware normally works with **.WAV** files that are often sound card input. But Sigview also allows an alternate input of 8-bit binary files of format…

<sample#1> <sample#2> . . . <sample#n>

Apparently any sane number of samples is permitted. Typically, a bipolar magic sinewave might have positive values of hex **$C0**, zero values of hex **$80** and negative values of hex **$40**. A test demo of an amplitude **0.53** Delta28 Magic Sinewave is available as my file **http://www.tinaja.com/glib/FULL60-1.ASC**. This demo provides **60** cycles of a **60** Hertz waveform. There are **41,664** samples per cycle and **2,499,840** samples total

Which brings us to this minor detail…

Select raw files ----> import ----> 8-bit unsigned when loading an 8-bit binary data file into Sigview.

The **total** number of samples of **2499840** is then entered as the sample rate.

SigView uses a **FFT** or **Fast Fourier Transform** for its spectral analysis. Any FFT has a nasty habit of getting its envelope mixed up with the signal it is analyzing. This is called the **windowing problem** and is it ever. If you try to analyze only a single cycle of a waveform, you are likely to get misleading humps between all of your harmonics rather than sharp dips.

We get around windowing by first **providing a full sixty cycles for analysis**, rather than just one. This also conveniently makes the frequency display accurate. We secondly use the SigView **Hanning** Window to further ease artifacts.

Either the **Magnitude** or **db-Max Reference** Spectral Analysis Defaults can be used for your FFT. The former is more impressive; the latter much more useful.

Regardless of display options, the entire spectrum will first be presented by **SigView** when you click on the **FFT** button. To expand the low harmonics…

Sigview initially displays a full spectrum. To expand the low harmonics, use Zoom First Pow2 in Edit to pick 4096 [2^12].

Viewing **FULL60-1.ASC** with **SigView** should give you the expected classic frequency spectrum of a unity height 0 decibel fundamental, all even and all triad harmonics invisibly below -120 decibels, and harmonics 5, 7, 11, 13, 17, and 19 all down by -65 decibels or more. Harmonics 23 and 25 as expected should be a significant fraction of the fundamental. And are normally filtered out by the motor's inductance and load inertia.

Fun With Filters

Sigview also offers some very useful "brickwall" filters. Setting your lowpass filter to **22** harmonics should show a sinewave just as clean looking as setting it to the second harmonic. Bandpass filtering harmonics **22** to **26** should show you a textbook perfect carrier, and so on. And highpass filtering clearly shows you the noise energy that you'll have to reject.

For More Help

The MS28D-04X chips are available at $19.63 each plus shipping. Sourcecode and one hour of consulting is separately available for $89 additional.

You can order your samples and sourcecode **here**. They should also be shortly available on **eBay**.

Licensing arrangements for your own chip production using our sourcecode or any of its derivatives or variants are available and are quite reasonably priced. You can **email me** for further details.

Additional **Magic Sinewave** services, programming, seminars, training and project development is available **here** and **here**.

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