Heterodyning and Powers of Phi

11/9/97 by Rick Andersen

One of Dan Winter's weird and wonderful files caught my attention one day, when I was browsing his web site. He was making remarks about how waves can, when organized in a certain way, spiral inward toward a central zero-point in the same way that Lorenz attractors occur in Chaos theory. Tying together several concepts such as implosion, fractal embedding, compression, and wave (non)-interference based on the fact that Phi-ratioed waves can both add and multiply non-destructively, he wove his tale... My ham radio hobbyist antennas went up... What did he say about "both add and multiply?....

Well, I checked, and it turns out to be very strange but true: Another one of Phi's many unusual traits is that it's the one ratio whose *powers, when added together, generate the next higher in the series, automatically*. Whoa.

Now, you have to be a radio-head to appreciate some of this. But I'll clue you in. This has tie-ins to modulation-- specifically, Amplitude Modulation, in its balanced mode, which produces what is known as **double-sideband, suppressed carrier** modulation.

Basically, when you mix two waves "linearly", you just sum their amplitudes together, point by point, so that the resulting wave is an algebraic sum of the original two waves components. If you have an **oscilloscope** you'll see a new wave which is the sum of the two originals. Oscilloscopes display a wave's "height" or "strength" or **amplitude** along the vertical axis of the screen, **time** along the horizontal; this is known as the **time domain** way of looking at waveforms.

An alternative way is to look at a wave or sum of waves in the **frequency domain**, which is amplitude vs. *frequency*, rather than time. To do that you need a **spectrum analyzer**. The spectrum analyzer won't show you the sum of the waves, as did the 'scope. Instead, it shows you two "spikes", each one corresponding to the frequency of its original wave along a horizontal spectral axis. So the 'scope shows you a new wave formed by adding the two originals, and the spectrum analyzer shows you what's *inside* that summed wave, namely, the two original frequencies (that's why it's called an *analyzer*).

Well, linear mixing is what a DJ does when he mixes his microphone with the music; each sound wave co-exists and mixes smoothly into a summation of the originals; this is known as **superposition of waves**, and in essence it says, "though these waves co-exist, yet they don't influence or control or change one another, though they do sum together."

It turns out that this method won't work when you want to broadcast your voice over a **radio signal** "carrier" wave. To do that, you need to vary the overall intensity or amplitude of the carrier with the lower-frequency voice... you need to **modulate** the carrier's amplitude with the voice waveform. And the way to do that, mathematically, is to *multiply* the two waves together, instead of simply adding them. Just like we learned in school that you can multiply numbers by adding their powers or exponents, so when we add wave voltages against a nonlinear (logarithmic) background (in the PN-junction of a diode or transistor), we are actually doing the same thing as if we had multiplied them. *Multiplication is nonlinear addition.* In radio work this is called **heterodyning**.

Now they are interacting with each other, big time. The output on the 'scope is a high-frequency carrier wave, intensity-modulated by a low-frequency voice pattern.

What does this look like on a spectrum analyzer?

Here is where we find something unexpected. The analyzer now shows *four* separate frequency spikes! When we measure their frequency, it turns out that the original two frequencies are there, plus a new one which is equal to the *sum* of the original *frequencies* (not amplitudes), and one more, like a mirror image, which is the *difference* of the two frequencies.

We find that *multiplying two waves together in the time domain is exactly the same as shifting frequencies up and down, simultaneously, in the frequency domain.* These two new frequencies are called the **upper-** and **lower-sideband**, respectively. They appear whenever two or more waves intermodulate one another, and they are how low frequency audio waves get shifted up the spectrum to cluster around the carrier wave, which is way above the limit of audibility. This cluster of high (electromagnetic, not sonic) frequencies (the carrier, plus the upper and lower sidebands) is what gets transmitted out of the antenna of your favorite radio station. But on the 'scope, all you see is the *sum* of all three, which ends up looking like a point-by-point *multiplication* of the carrier and voice.

Here's an example of AM frequency products:
You play a 1KHz tone into your microphone; that audio tone modulates a 1 MHz carrier frequency. The 4 outputs from the modulator are
1 KHz
1 MHz
1.001 MHz (the sum, or upper sideband)
0.999 MHz (the difference, or lower sideband).

The 1 KHz audio is too low in frequency to radiate from the antenna, so it is filtered out and the other 3 radio frequencies are transmitted.

Notice, too, that if you were to increase your audio signal to 10 KHz, the upper sideband would move up to 1.01 MHz, and the lower would move down to . 990 MHz. Thus, the closer the audio is to zero Hertz, the tighter the two sidebands cluster in against the carrier, and vice-versa.

So as you can see, these new sideband frequencies are dependent solely on the addition and subtraction of the carrier and audio; there is no *harmonic* relationship at all between them.

So what's Phi got to do with this?

Phi possesses the strange property of being able to *automatically generate its power series when heterodyned successively with its own next-higher or lower powers!* I believe this fact is a key to many fascinating areas yet to be discovered. As far as I can tell, this trait is not shared by any other number. Dan Winter seems to be on the right track on this one, for sure.

<u>Powers of Phi</u>
Phi^0 = 1
Phi^1 = 1.6180339
Phi^2 = 2.6180339
Phi^3 = 4.2360672

Phi^4 = 6.8541004
Phi^5 = 11.0901669
... etc...

Now, what do you suppose happens when we take two frequencies, f1 = 1 unit, and f2 = a frequency that is Phi times larger, or f2 = 1.6180339, and modulate them-- *nonlinearly mix* them-- in an AM modulator? The two new frequencies are the sum, which is 2.6180339-- hey, that's the same as Phi^2, and the difference, which is .6180339-- hey, isn't that Phi to the -1th power? Yup, it is. So we stumble upon the very interesting fact that powers of Phi are automatically generated whenever we "heterodyne" or modulate two frequencies that are related by a ratio equal to Phi.

If we use a slightly more developed form of AM modulator, we can suppress the carrier entirely (and the audio, too) and just get the sum and difference frequencies out. This is what is done in a **balanced modulator**, and this is called **suppressed-carrier double-sideband transmission**, just one step away from the **single-sideband** that Hams and CBers are familiar with.

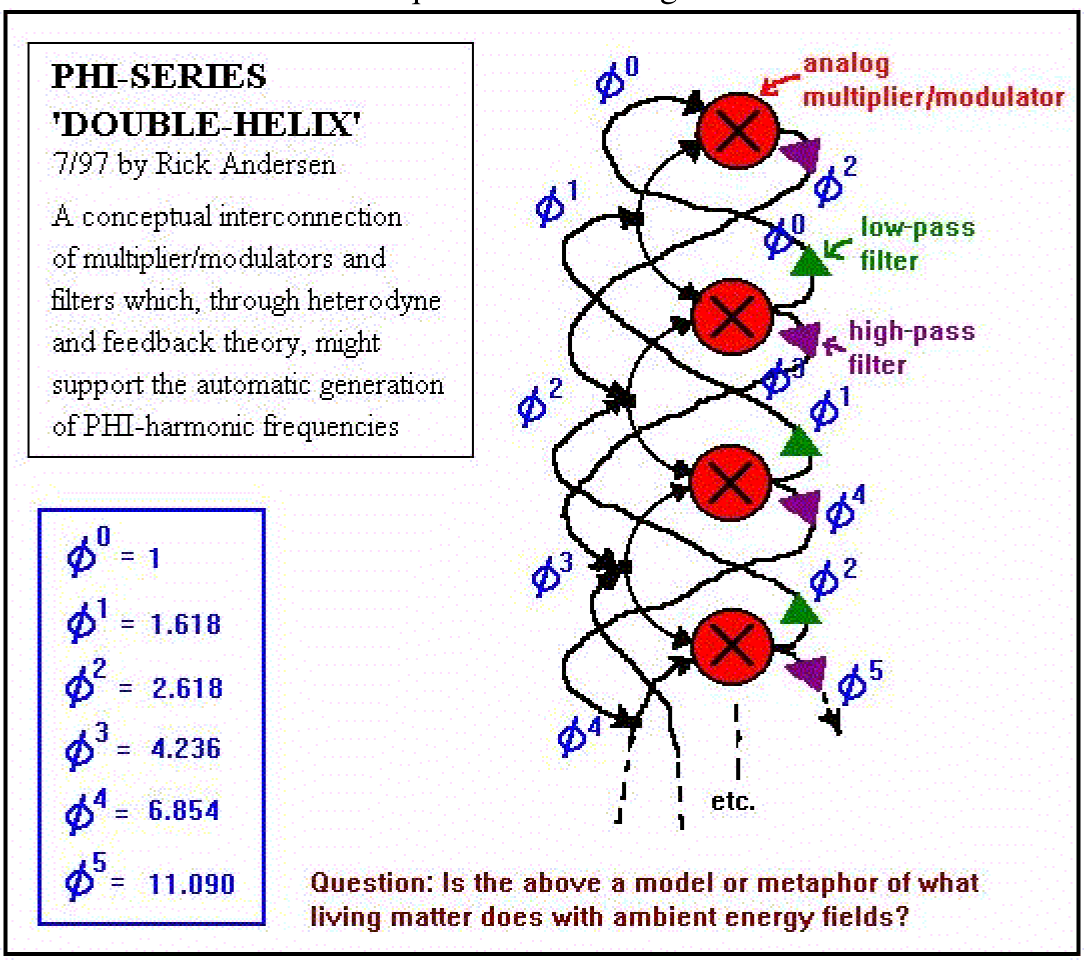
So here's what we can do: Wire up a string or sequence of balanced modulators; the next one will have the frequencies of Phi^1 and Phi^2 as inputs; the two outputs will be Phi^3 (USB) and Phi^0 (LSB). Feed this into the next one: Phi^2 and Phi^3 will give Phi^4 and Phi^1; etc. Eventually you could generate a very large series of frequencies related by the powers of Phi.

Applications?

Would *this* be a good mix to try with some alt-sci experiments involving plant growth, healing waveforms, vortex generation, etc.? Would this have any bearing on Dan Winter's gravity = Phi harmonic implosion ideas? On Tom Bearden's insistence that you need *nonlinear mixing* to accomplish scalar electromagnetics magic?

How about Moray B. King's ideas in his book *Tapping the Zero-Point Energy*, where he describes a cascade of simple resonators with nonlinear breakover thresholds or switching, which is supposed to be able to shift high frequency energy down the spectrum into the lower frequencies, with attendant amplitude increase? *Is this what living things do within their nonlinear cellular and nerve structure?*

What about trees-- do they, by their very fractal shape, act as energy sinks to the surrounding atmosphere, "pricking" the local electrostatic gradient with their branching twig structure, rooted mechanically and electrically at earth ground potential? Is the Phi distribution of frequencies/wavelengths analogous to the growth patterns of trees and other living things... because it is optimal for accumulating and translating energy from across the frequency spectrum? This question led to a brainstorm which resulted in the following illustration of what living things *might* be doing, and what we might need to do to construct a "coherer" of PHI-related frequencies and energies:



And what if we were to rotate an acoustical field made up of Phi-related tones, or even white noise? Does the vortex/funnel shape, like a logarithmic curve, favor the Phi-ratioed frequencies by its very curvature?

1,2,3,5,8,13,21,34.... how can a bunch of Fibonacci integers give rise to one of the strangest and most prevalent of the irrational numbers, Phi?....

My feeling is, that when we really know how to tie Phi, Pi, and Epsilon together with music and geometry, all applied to wave structures, we will have found the keys to the very basis of the structuring of reality.

Note here from Dan Winter, re: Pi , Phi, and e,

see equation approximating Phi=7/5 Pi / e, at PREDICTIONS FOR A NEW PHYSICS OF GRAVITY & AWARENESS BASED ON RECURSION