angle vst and black vst

These vst both combine what I am terming **normalisation synthesis** with feedback to produce two new forms of chaotic attractor specified for audio. Each vst uses a slightly different method of compounding and transforming rotations. The result is then normalised to unit length to produce harmonics.

The spectra of multidimensional rotations differs from traditional audio synthesis methods. After making black I immediately continued to experiment with rotations to see if circular membrane harmonics could be easily approximated. Angle was a simple hypothesis that does not produce the fundamental and proved useful for synthesizing a variety of atonal timbres with complex harmonics. After giving the synths a test run and finding them useful, here they are. The methods used have not been studied much to date that I'm aware of.

Due to the combination of irregular spectra and chaotic timbral behaviour, these synthesizers can create a wide variety of sounds that respond richly to modulation. The methods may have an extensive utility to general timbral synthesis but so far I have found their use more intriguing for modulated textural applications more than leads and basses. I recommend them for when you want something that sounds weird.

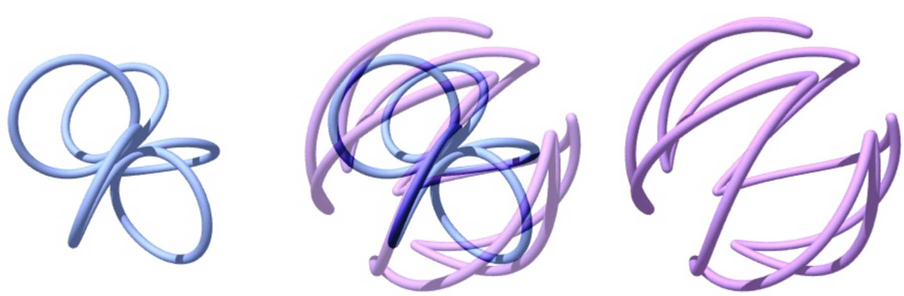
what it is (part 1: normalisation)

Black is a 3d extension of a preceding 2d normalisation synthesis concept :) The fundamental pitch of black is a rotation on the x axis. The output is y and z in both vst, so a circular path produces a sine and cosine, or two sines with a quarter phase offset.

In black vst, Freq 2 is a second circular path that transforms the 2d circle fundamental into a 3d torus. The amplitude of Freq 2 expands the circle into a sphere, so amplitude of the helical path is applied within the unit circle.

examples of blue sausages

Next the oscillator is tilted on the z axis (Angle 1, 0-90°) then tilted on the y axis (Angle 2, 0-180°), then rotated by a third oscillator Freq 3. Then the oscillator is Scaled, Biased (shifted off center) and then the previous rotation and two angle transformations are applied inversely, resulting in transformation on an arbitrary plane.



unit normalisation of one of the sausages

...and then the result is normalised, extending a line from the center through the point to a set distance. As you can see from the illustration, harmonics are created.

What this means to you is several degrees of continuous timbral variation, being able to fade between numerous combinations of spectral features.

part chaos

The output is tapped and applied to pitch modulation, providing the nonlinear criteria for chaotic motion. Generally, when a threshold of stability is surpassed, the oscillator emits noise. A filter on the feedback path allows modulation to be defined and applied to regions of interest in the spectrum. Increasing resonance on the filter can promote stability, or sharpen the transitions between orbital regimes. Resonant lowpass and bandpass filtering have intuitive results, but other filter modes can also create interesting timbres. And they're all pretty fun to stare at. (A mono signal on the scope displays as a diagonal line.)

filters

The filter includes zero delay state variable forms designed by Robin Schmidt and zero delay ladder forms designed by neotec. The "nonlinear" 24dB lowpass modification tends to squeeze the bass out of timbres. It works for some things.

oscillator modes

Both oscillators offer 8 performance modes enigmatically numbered 0 to 7 on the gui. The philosophy of rapid and creative implementation of the oscillator forms led me to derive eight simple variants of each procedure. Meaningful descriptions of the processes and variations that would fit in the gui display didn't occur to me.

black modes

order of operations	0	1	2	3	4	5	6	7
tilt z								
tilt y		swap	swap	swap				
rotate x		swap	swap	swap	-	-	-	-
scale, bias								
inverse rotate x				-	-	-	-	-
inverse tilt y				-			-	-
inverse tilt z			-	-		-		-

Forms 1 to 3 swap the tilt y and rotate x operations. Modes 4 to 7 omit the third oscillator to comprise a 2 osc form. Otherwise, modes drop some of the inverse operations to avail variance.

angle modes

mode 0	3d normalisation (standard)
mode 1	2d normalisation (y and z)
mode 2	convolve enigma
mode 3	no normalisation or anything (lower partial count)

Modes 4-7 repeat modes 0-3 but use x for feedback instead of y (derivation of feedback for black is not revealed).

The point of the mode selection is that they may or may not sound different. Design choices were made quickly so there may be ways to implement these concepts differently that have yet to be explored.

The gui for angle and black are almost identical except for a second frequency parameter and a radius parameter for black. The angle synthesis method is similar. Because it is comparatively easy to use, the oscillator method is not described exactly, hopefully to promote some interesting thinking.

output modes

Both vst use y and z for output. They are combined in several ways using the Balance parameter.

cross	left fades y to z, right fades z to y. middle position is mono
mono a>b	mono output fades y to z
m>m-s1	mono (y) fades to mid-side (y-z, y+z)
m>m-s2	mono (y) fades to mid-side (y+z, y-z)
st>m-s1	stereo (y, z) fades to mid-side (y-z, y+z)
st>m-s2	stereo (y, z) fades to mid-side (y+z, y-z)
st>diff	stereo (y, z) fades to difference (z-y, y-z)

modulation

Modulators experience a small latency as modulation targets, eg. lfo1 assigned to lfo1 rate is delayed by one buffer.

Update: development was so rapid that after writing this I found a conceptual error in the first build - to correct this without altering compatability with previous patches, Mode selection for both angle and black now list 0-7 and 0-7 "legacy" modes. In both vst, legacy mode applies Scale to y instead of perpendicular to Bias. In the "correct" configuration, increasing scale brightens the spectrum.