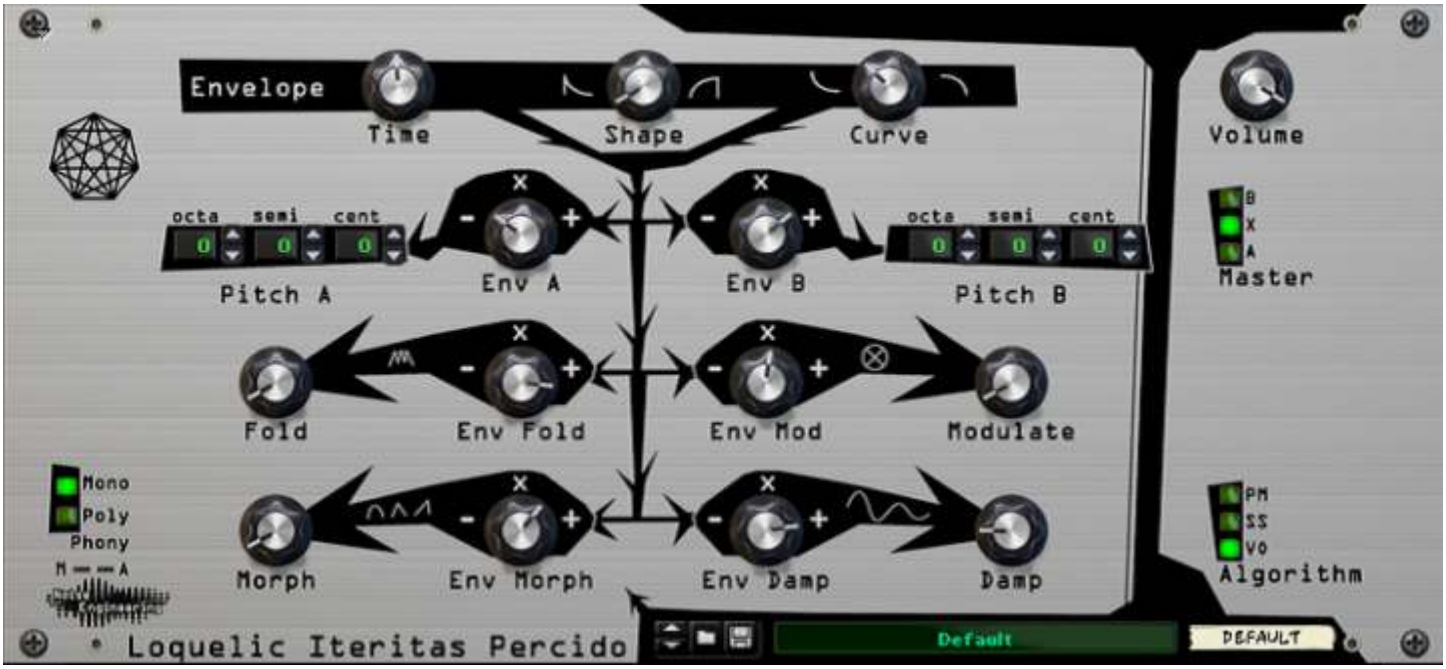
Noise Engineering Loquelic Iteritas Percido

Complex Digital Voice
Rack Extension

"Twice as mental" - Aleks Jurczyk

Loquelic Iteritas Percido is a digital VCO with interpretations of three classic synthesis algorithms. It creates a huge variety of sounds parameterized by four tone and two pitch controls. An internal envelope can be shaped and routed to pitches and tone controls. LIP is gnarly and gross, and makes excellent percussion, glitch, lasers, farts (yes, farts) and noise sounds.



Pitch A/B - The pitch selector adjusts the pitch of each oscillator. Define octave, semitone, and cent.

Master - Toggle and back panel control of the sync of the oscillators. When in the middle position both oscillators are free running. When A is selected, oscillator B will sync to oscillator A; when B is selected, A syncs to B.

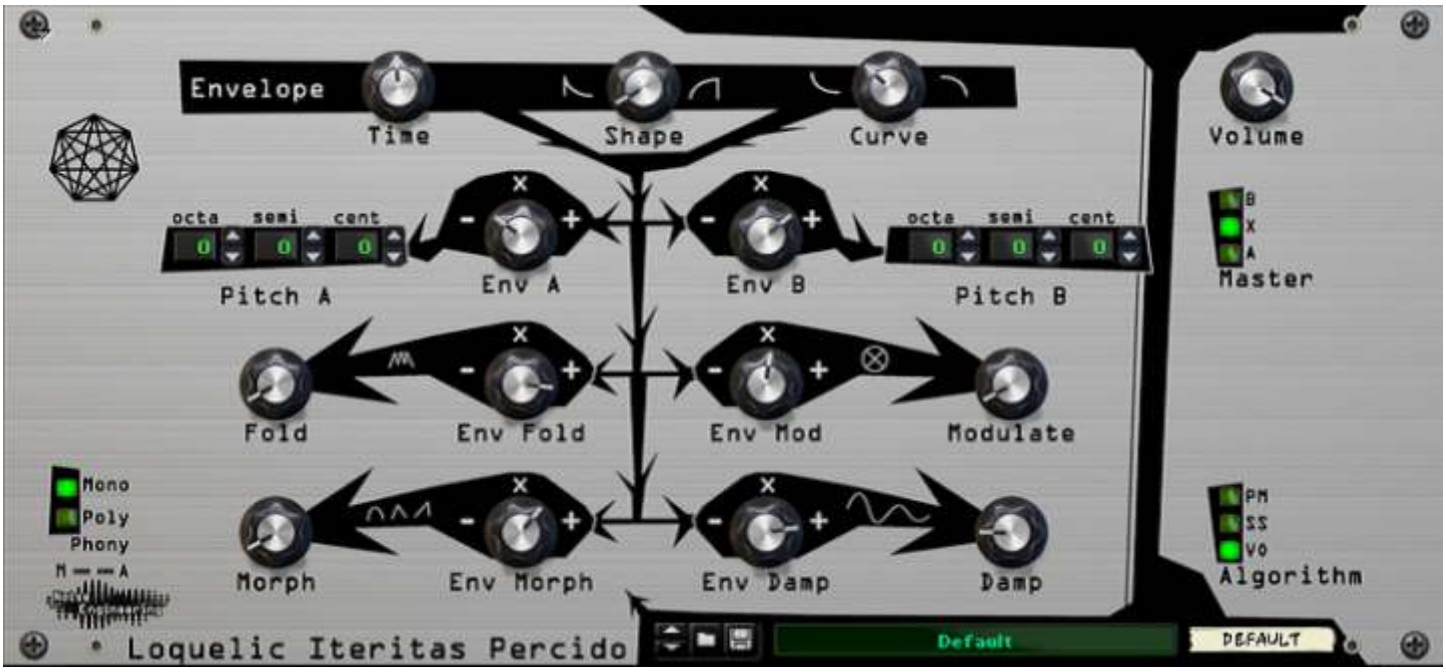
Algorithm - Toggle and back panel control of tone-generation algorithm (more information on algorithms below).

Envelope Controls: knob and back-panel control

Shape - controls the attack and decay of the envelope. All the way CCW, the envelope is all decay; all the way CW, attack dominates. Turning the knob transitions between these two extremes gradually.

Curve - controls the shape of the curve: CCW gives an exponential curve, while CW gives a logarithmic curve. In the center, the shape is linear.

Time - controls the length of the envelope.



Envelope Sends - six attenuverters that route envelope to pitches and parameters. Positioned at 12:00, the envelope is off and does not route to a parameter. Fully CCW results in an inverted envelope send. Fully CW yields full positive send.

Volume - knob and back panel input adjust the level of the Rack Extension.

Preset Load/Save - click the folder button to open a preset. Use the arrows to toggle through presets. Use the disk button to save a preset.

Phony - select monophonic or polyphonic sound.

Tone Controls (knob and back-panel control) - Function of controls varies slightly in the three algorithms. Here is a brief description of each and an explanation of how the controls work in each mode.

Algorithm VO

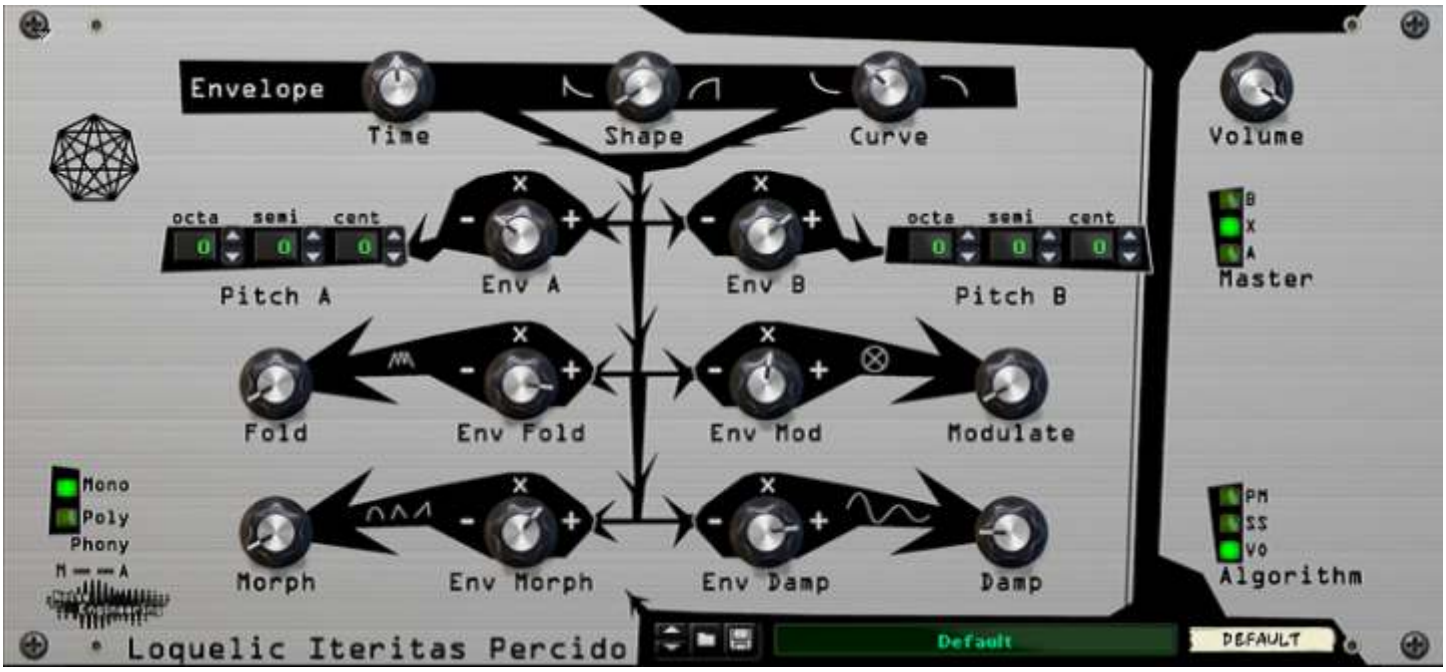
The VO algorithm is roughly based off of the VOSIM algorithm discussed in Curtis Roads's *Microsounds*. VO amplitude modulates a carrier by an exponential to create a complex harmonic structure. The simplest carrier is a sinusoid which produces a spectrum with a Gaussian distribution centered on the carrier. More complicated waveforms produce Gaussians around each harmonic, producing spectra similar to comb-filtered noise. Pitch A is the fundamental frequency of the carrier. Pitch B is the retrigger frequency of the exponential decay.

Morph - changes the waveform of oscillator A

Damp - sets the decay constant on oscillator B relative to its period

Mod - phase modulates oscillator A by oscillator B

Fold - sets the wave fold threshold on the final wave folder



Algorithm SS

Algorithm SS is a highly modified version of summation synthesis originally developed by James Moorer. The premise comes from a simple mathematical equality between an infinite harmonic series and a relatively easy-to-compute expression:

$$\frac{sin(\Theta) - a\,sin(\Theta-\beta)}{1+a^2-2a\,cos(\beta)} = \sum_{x=0}^{\infty} a^{x} sin(\theta + x\beta)$$

This equation allows a wide variety of musical spectra to be produced by only two parameters. LIP generalizes the sinusoidal terms into multi-waveform oscillators: two of these track the two input pitches while the third tracks the difference of the two pitches and adds a wave folder for more harmonics. In the equation oscillator A is the left sinusoidal term in the numerator. Oscillator B is the sinusoidal term in the denominator. The equation becomes

$$\frac{sin(w_A t) - a\,sin(w_A t - w_B t)}{1+a^2-2a\,cos(w_B t)} = \sum_{x=0}^{\infty} a^{x} sin(w_A t + x w_B t)$$

Morph - changes the waveform of all oscillators

Damp - sets the a parameter in the equality. This controls the generated spectra with higher values producing higher power harmonics.

Mod - phase modulates oscillator A by oscillator B

Fold - sets the wave-fold threshold on the final wave folder

Algorithm PM

The PM algorithm is a naive time-domain two-oscillator phase-modulation implementation that combines both oscillators with amplitude modulation.

Morph - changes the waveform of both oscillators

Damp - blends between oscillator A and B through their product (AM)

Mod - phase modulates the oscillators by each other

Fold - sets the wave-fold threshold on the final wave folder

Back-Panel Controls

The back-panel inputs allow control of all front-panel controls. Back-panel only controls include

Trigger: Gate - Input to trigger the module

Trigger: Note - CV input to specify note

Output: Envelope - a CV output that tracks the current envelope level

Output: Audio - Monophonic output

Back-panel knobs act as attenuators for all inputs.

References

Jolley, Leonard Benjamin William, ed. Summation of series. Courier Corporation, 2012.

Kaegi, Werner, and Stan Tempelaars. "Vosim-a new sound synthesis system." Journal of the Audio Engineering Society 26.6 (1978): 418-425.

Moorer, James A. "The synthesis of complex audio spectra by means of discrete summation formulas." Journal of the Audio Engineering Society 24.9 (1976): 717-727.

Roads, Curtis. Microsound. MIT press, 2004.