discoDSP Vertigo

Users Manual

Additive Synthesizer

http://www.discodsp.com/

Description

Vertigo is an additive synthesizer for VST / VST3 / Audio Units hosts featuring 256 partials, re-synthesis and morphing with very high sound quality and built-in effects.

Installation

- **Apple OS X**

  Run the installer and follow the instructions.

- **Microsoft Windows**

  Run the installer and follow the instructions.

- **Linux**

  Place **discoDSP** folder at **/home/username/Documents/**
  Place Vertigo.so at your VST folder, usually **/home/username/.vst/**

Features

Vertigo boasts the following powerful feature set:

General

- Up to 16 voices polyphony.

Envelope

- 256 breakpoints parabolic envelopes with stage slope control.

Partials (Oscillators)

- Euler generated (Max: -120dB s/noise ratio) (no wavetables used). Up to 256 per voice.
- 2 Modulation sources with morphing.
- Phase.
- Amplitude.
- Note pitch shift amount.
- Frequency ratio.
- Frequency/amplitude envelope (see Envelope above).

Synthesis options

- Harmonize (Harmonic/Odd Harmonic vocoder).
- Phase smearing.
- Frequency smearing (ensemble).
- Classic waveform generator assistant (Saw/Square/Triangle/2X Saw/Square/Triangle).

Filter

- Low Pass/High Pass/Band Pass 12/Band Pass 24/Notch/Peak.
- Cutoff envelope.
- Wheel/Key/Velocity modulation amounts for cutoff.
- Wheel/Velocity modulation amounts for resonance.

Voices

- Two resonant filters (serial/parallel mode).
- Pitch envelope.
- Amplitude envelope.
- Pitch bend control.

Mono Effects

- Distortion (8 times oversampled overdrive with soft clip).
- Phaser (up to 128 taps).
- Flanger.
- Compressor.
- Equalizer (8 bands).

Stereo Effects

- Chorus,
- Delay.
- Reverb.

Resynthesis and Sampling

- WAV PCM analysis and PNG/JPG import.
- 1024, 2048, 4096, 8192 FFT frame sizes
- 4 Windows: Bartlett, Hamming, Hanning, and Blackman.

Additive Synthesis

Additive Synthesis (also called **Fourier Synthesis**) is a type of synthesis, which produces a new sound by adding together two or more audio signals.

The "classical" form of additive synthesis, still used on some synthesizers, may be called "harmonic synthesis."

A method of sound synthesis based on adding sine waves in a harmonic series (e.g., 100 Hz, 200 Hz, 300 Hz, etc.) The Hammond B3 organ implemented additive synthesis by allowing the user to adjust "draw bars."

In practice, however, the approach can be extremely time-consuming since often hundreds of harmonics may be used to create a complex sound. Additive synthesis refers to a number of related synthesis techniques, all based on the idea that complex tones can be created by the summation, or addition, of simpler ones.

Understanding Vertigo

Synth parts are explained detailed below.

General

1. **Program name**: Displays current program.

   Vertigo reads the program in **Banks** folder. If you want your programs to be read by the plugin copy the files to the same location.

2. **Zoom**: Change the program envelopes or operators sizes.

3. **Voice Gain**: Positive or negative amount in decibels for the current program.

4. **Polyphony**: Simultaneous voices able to be played at one for the current program.

5. **Pitch Envelope Range**: Amount of semitones to be applied in the Pitch Envelope.

6. **Pitch Bend Range**: Amount of Semitones to be applied when using Pitch Bend.

7. **Open**: opens a dialog window pointed to Vertigo patches folder.

8. **Save**: Allows overwriting current program with the changes made or by saving it under other filename.

9. **Reset**: **Resets** current program to initial state.

10. **HQ button**: Quickly limits oscillator numbers (partials) once it's turned off.

Partials

Programs can use up to 256 operators. Each operator is a sine wave and there are two groups of operator states: A and B. You can copy and Paste A to B states by using the **Copy/Paste** button located under Partial menus.

Link button will make a linking of both of A and B for **any Operator related function** (in Partials and Spectral views).

You can morph between 2 states by using modulation wheel, velocity modulation or VST automation.

Each partial here is composed by:

1. **Phase** (A/B): Initial phase of the operator

2. **Amplitude** (A/B): Amplitude of the operator.

3. **Frequency multiply of fundamental** (A/B): Ratio relative to note frequency.

4. **Panning** (A/B): Panning relative to each partial.

Each envelope can hold up to 256 breakpoints, each one with delta value (position relative to the previous point), level (from 0.0 to 1.0) and slope (parabolic slope).

In the operator section you can see a display with a N vertical bars, each one represent the value of the property selected/highlight in the 'oprts graph' selectors for each operator.

Solo button mutes the rest of the operators.

Example: When 'phase' is selected, the bar graph shows the phases of the operators.

You will see many bars as operators used by current program, and you can paint/drag each one to change the property value

Synthesis options

Several global synthesis and program options are covered:

1. **Operators**: Number of operators (sine wave waveforms) to use. Use a low number of operators if you're low on CPU. But of course, complex resynthesized waves will need more operators to get a more faithful sound.

2. **Dephase**: Amount of "randomicity" applied to initial phase state of operators, you can use it to add blurriness to the sound.

3. **Ensemble**: Amount of random frequency detuning for each operator.

4. **Tune**: Default value is 440 Hz. Used to fine-tune.

Envelopes

The **Zoom buttons** allows changing the size of the envelopes as well.

You can switch between:

1. **Amplitude envelope**: Operator amplitude.

2. **Morph envelope**: A/B morphing envelope.

3. **Stretch envelope**: Increase or decrease operators playing speed. (bipolar)

4. **Filter 1 cutoff** frequency envelope. (bipolar)

5. **Filter 2 cutoff** frequency envelope. (bipolar)

6. **Voice pitch envelope**. (bipolar)

Notice the envelope editing differs from v1.x. There are not A/B envelopes. This is a **global envelope setting**.

Envelope points
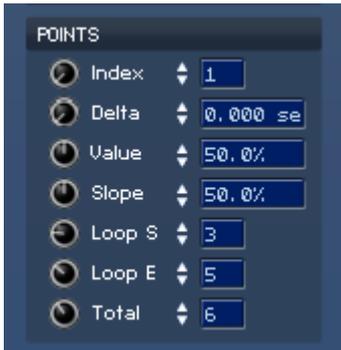
Envelope points covers precise editing for every envelope point.

1. **Index**: current active/editing envelope breakpoint index.

2. **Delta**: Distance in seconds from previous point.

   Notice you can't edit delta of first envelope breakpoint, because it must be zero.
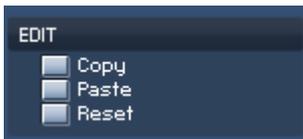
3. **Value**: level of the current breakpoint.

4. **Slope**: curvature of the current envelope breakpoint stage parabola.

5. **Loop start**: breakpoint index for the sustain start of the envelope.

6. **Loop end**: breakpoint index for the sustain end of the envelope.

7. **Total point**: total number of breakpoints for the selected envelope.

Envelope editing

8. **Copy:** Copies active envelope**.**

9. **Paste:** Paste envelope in memory**.**

10. **Reset**: Resets active envelope to the default state.

Formant Filter

Vertigo includes a 128 band filter, able to apply formant filtering.

You can copy and paste the values between Operators, or do a reset of the curve.

In order to edit the curve, simply focus the mouse to the big LCD and left click the mouse.

Points can be edited individually by single clicking or like a curve, by holding click and dragging the mouse.

FFT Edition

Vertigo allows an alternative synthesis edition, based in the spectral view of the imported or generated samples.
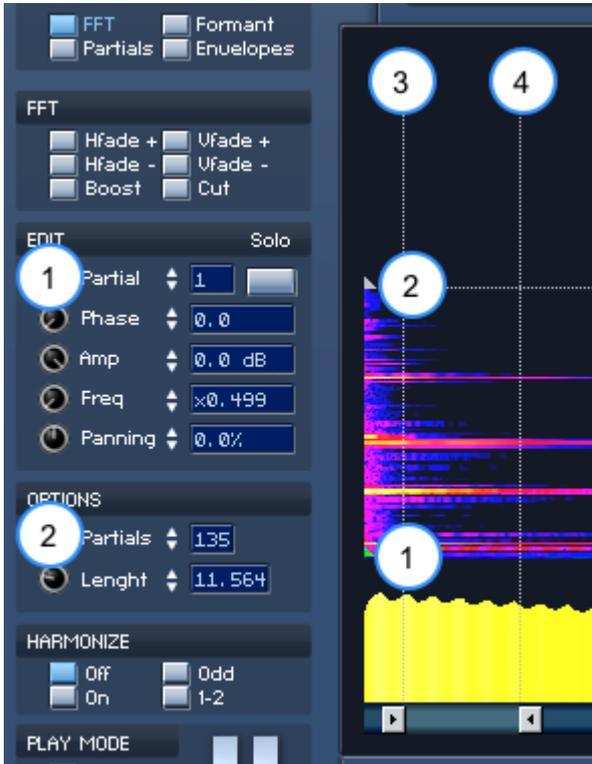
Notice EDIT part is exactly the same as the one under Operators menu, explained before.

In order to move the bars and loop points, you need to left click the small triangle and drag the mouse up or down. You can see the changes in the LCDs.

1. **Total partials** bar is linked to **Options**, Partials.

2. **Single Partial** edition is linked to **EDIT**, Partial number.

3. **Wave loop end point**, it is **independent** for Operators A and B, and can be linked by using LINK button.

4. **Wave loop end point**, it is **independent** for Operators A and B, and can be linked by using LINK button.

FFT Operations

The following operations are applied to Amplitude or Frequency, which you can select at the top of the big LCD once you switch to this spectral editing mode:


In order to apply the following editing option you must select some are in the big LCD by left clicking and dragging the mouse.
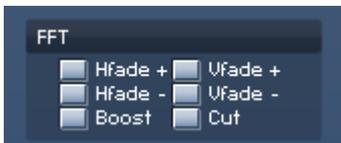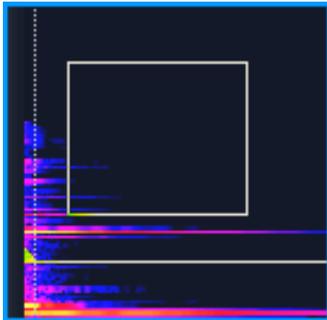
1. **HFade In**: Horizontally fades in the active spectra (amplitude or frequency) of the selected Spectral range.

2. **HFade Out**: Horizontally fades in the active spectra (amplitude or frequency) of the selected Spectral range.

3. **VFade In**: Vertically fades out the active spectra (amplitude or frequency) of the selected Spectral range.

4. **VFade Out**: Vertically fades out the active spectra (amplitude or frequency) of the selected Spectral range.

5. **Boost**: Applies +6dB boost to the active spectra (amplitude or frequency) of the selected Spectral range.

6. **Cut**: Applies +6dB cut the active spectra (amplitude or frequency) of the selected Spectral range..

Harmonize

Harmonizing is an alternative way to interpolate between A/B operators.
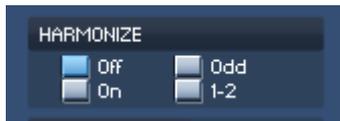
1. **Off**: Disables harmonizing.

2. **On**: Ignores operator frequencies and makes a sound based in harmonics, that is, root frequency plus frequency integers multipliers (1, 2, 3, 4 and so on).

3. **Odd**: Operates in the same way as On but only on pair harmonics.

4. **1-2**: Generates serial partials, whose difference is proportional to the frequency difference between the first and the second operator.

    In case of **Operator 1** results in **x1.0** and **Operator 2** in **x1.5**, once this option is enabled, operator 3 will result in x2.0, Operator 4 in x2.5 and so on.

Filters

Vertigo uses 2 filters, which can be used in serial or parallel to shape the operator bank sound.

Each filter have 6 filter types:

- **LPF** 4 Pole Low pass filter.
- **HPF** 4 Pole High pass filter.
- **BP1** 2 Pole Band pass filter.
- **BP2** 4 Pole Band pass filter.
- **NTF** 4 Pole Notch filter.
- **PKF** 4 Pole Peak filter.

1. **Cutoff**: Cutoff frequency of the filter.

2. **Q**: Feedback or gain around cutoff frequency. Also know as **Resonance.**

   Below Cutoff and Q you can setup the amount of every labeled value.

   Note: These knobs are **bipolar** so they work in positive and negative having the middle position as Zero.

3. **Velocity**: Amount of key velocity tracking to Cutoff frequency or Q.

4. **Mod Wheel** Amount of modulation wheel tracking to Cutoff or Q.

5. **Keyboard**: Amount of keyboard tracking to Cutoff frequency.

You can also configure the filter routing to serial or parallel by **left clicking** the LCD display located between the two filter, so you can manage to get interesting vocal and phasing filter with some combinations.

Morphing

Below Filter Routing you will find the Morphing configuration, which are automatable as well.

1. **Velocity**: Amount of key velocity tracking to operators group (A/B) morphing.

2. **Mod Wheel**: Amount of mod wheel velocity tracking to operators group (A/B) morphing.

3. **Voice gain**: Overall voice amplitude gain

Effects

Vertigo features a multi effects unit for each program, divided by:

5 mono effects:

- Distortion
- Phaser
- Flanger
- 3 band EQ
- Compressor

3 stereo effects:

- Chorus
- Delay
- Reverb

You can bypass the effect chain by clicking the FX button.

To enable and disable each effect you must click the radio area where the green leds appear.

If you want to edit the parameters of a particular effect you can do it by clicking the blue buttons next to each label.

Resynthesis

Vertigo has been the first instrument able to analyze WAV PCM file and extract all the partials (Resynthesis).

1. **Import**: Analyzes a bitmap (.BMP) or audio file (.WAV). Using FFT analysis and a few psychoacoustics model algorithms, it decomposes the audio in partials, and tracks their frequency and amplitude envelopes, applying a model approximation for the current vertigo program. This operation can be done in **both** A and B **operators** when they are selected.

   The PCM data is discarded after analysis.

2. **Freq Pairing**: See next section.

3. **FFT**: Window and FFT size to shape the overlapped audio chunks used to analyze the PCM/wave audio.

A bigger chunk (8192) will achieve accuracy for determining trace low frequency audio (bass, etc), but will lack of time resolution (dynamics/envelope).

A shortened audio chunk for analysis (1024), will achieve better time resolution and dynamics (rhythm loops, some vocals, etc), but will lack of low frequency resolution.

Nearest Frequency Pairing in depth

Frequency Pairing reorder frequencies in operators' status to make a smoother transition between frequencies when morphing is used.

Graphical example:

Not Using A/B Frequency pairing

Using A/B Frequency pairing
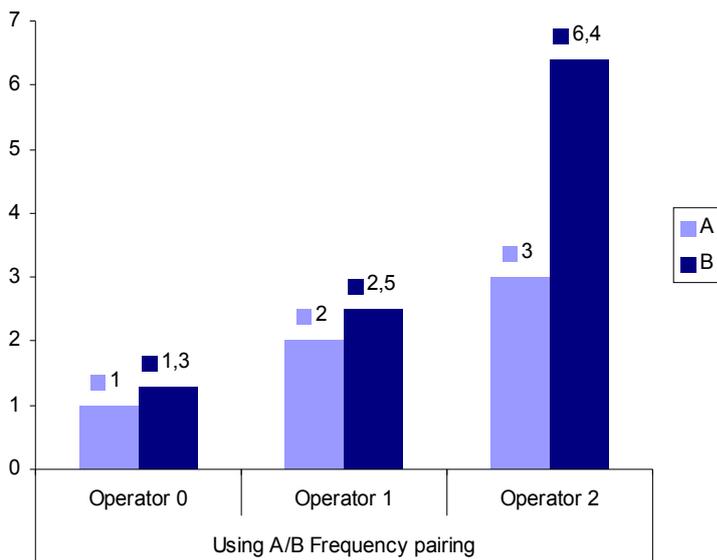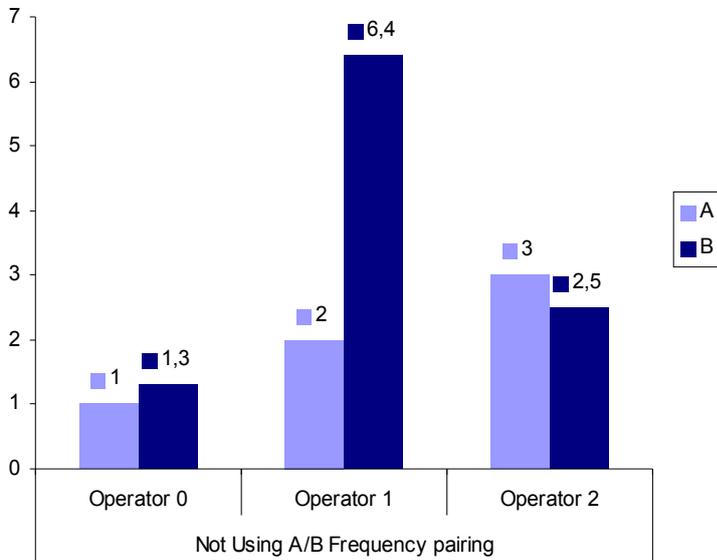
Note: Frequency pairing will always be applied to Operator B.

Oscillator

Oscillator can synthesize classic waveforms for the selected operator bank group. This operation can be done in **both** A and B **operators** when they are selected.

1. **Waveform**: You can synthesize:

   - Saw
   - Square
   - Triangle
   - 2X Saw
   - 2X Square
   - 2X Triangle

2. **2x detune**: 2X Versions are 2 mixed waveforms with a detuning parameter, which is defined here.

Version History

Release 3.7

- Added drag and drop to GUI for VPF / WAV / AIFF / OGG / FLAC / JPG / BMP / PNG files.
- Added import to both layers when Link button is enabled.
- Added OGG / FLAC wave import support.
- Added JPG / PNG file import support.
- Added native dialog window support.
- Added filter LCD click to navigate.
- Windows and macOS VST3 support.
- Fixed preset LCD name not updating after using Open.
- Fixed partial mouseover not drawing curves properly while holding click.
- Fixed panning negative values not displayed.
- Fixed preset name not recalled after re-opening the project.
- Removed License.dat copy protection.
- Updated framework.
- Revised manual.

Release 3.6

- Added License.dat copy protection.
- Added more logging to Log.txt.
- Fixed problem with reverse parameter automation from plug to host.
- Fixed certain host override saved program in song with disk based one.
- Fixed envelope drawing when not linear.
- Fixed possible denormals in reverb.
- Updated framework for increased stability.

Release 3.5

- Linux VST 32 and 64-bit support.
- OS X: Compiled using Xcode 5.
- Fixed memory leaks.
- Removed memory allocations from audio thread.
- Improved GUI painting by removing excessive image blitting.
- Speedup oscillator engine with SSE2.
- Zero Delay Feedback filters.
- Improved reverb.
- New chorus.
- Multiple folder support at Documents > discoDSP > Vertigo > Banks location.
- Bank browser clicking Program LED display.
- Factory presets revised and reworked.

Release 3.2

- Fixed Modulation Wheel to Morph settings.

Release 3.1

- Reverb dry/wet amount fixed.
- Minor GUI GFX fix.

Release 3

- 64-bit VST.
- 64-bit Audio Units.
- Mac installer.
- Vertigo Data folder locates at Documents/discoDSP now.
- PDF Manual revision.
- Cross-platform project support.

Version 2.6

- Further optimizations with at least 20% additional CPU speed ups.
- Added Copy and Paste envelope functions.
- Fixed partial panning bug.
- Minor bug fixes and improvements.

Version 2.5

- Full additive engine rewrite and optimization with up to 100% speed ups.
- Importing with A-B Link button enabled will be applied to both layers.
- Open/Save programs will always point to Vertigo Data folder.
- Reset button now asks for confirmation.
- Revised PDF manual.

Version 2.0

Additions:

- Ultra heavy CPU optimization (250% faster than Vertigo 1.x).
- BMP Bitmap Import (any size, any color, linearly interpolated pixel resampling).
- Spectrogram editor.
- Stretch envelope.
- Play mode (Poly, Mono, Legato).
- Partial amplitude and frequency view.
- Improved morphing (with time-stretch).
- Formant filter.
- Morph envelope.
- Redesigned left layout.
- New Harmonize buttons.
- Dedicated formant for each operator.
- Better filter type select behavior.
- Panning position for each partial.
- Zlib implemented for presets (compress/decompress on the fly).
- Other minor additions.

Bug fixes:

- Preset extension added when saving.
- Fixed Filter 2 behavior.
- Better filter list sorting.
- Wave loop points are imported.
- Filter selection buttons work correctly.
- Playing position display-tracks extended to partial amp and frequency curve monitors in spectral editor.
- Active operator selection in spectrogram view.
- Other small additions and bug fixes.

Version 1.5

- New GUI.
- Envelope morph engine for operators' freq/amp envelopes and program envelopes.
- Added A/B/Linked editing for operators and envelopes.
- Additive synthesizer engine enhancements.
- Overall enhancements.
- VST Automation.
- Bug fixes.

Version 1.0

- Initial release.

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