Vulpus Labs

Curvature

Introduction

Curvature is a voltage-to-voltage converter which maps an inbound voltage to an outbound voltage along a user-definable and audio rate-modulatable curve, displayed in a helpful oscilloscope.

It can be used as an oscillator (when driven by a pure sawtooth wave input signal), a wave folder or a general-purpose control signal mangling tool.

Theory of Operation

Curvature's controls define *points* on a curve, and *segment curves* for the values between those points. Each point has an "x" and a "y" value.

There is a start point, whose "x" value is fixed at -5v, and an end point, whose "x" value is fixed at +5v. The "y" values for these points define the start and end of the curve. For a smooth oscillator waveform without noisy discontinuity, you will usually want them to be the same, assuming you are using as input a sawtooth waveform that jumps immediately from x = +5v to x = -5v at the end of its cycle.

Up to six intermediate points can be added. Each intermediate point must have an "x" value greater than that of the point before it (otherwise it is simply ignored). The "y" value ranges between -5v and +5v.

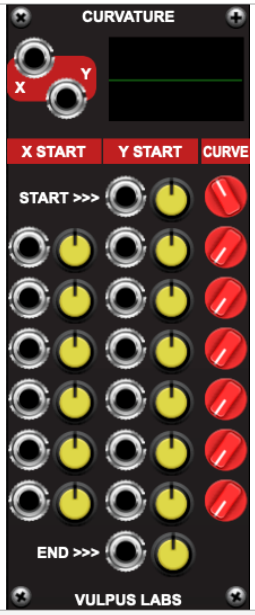
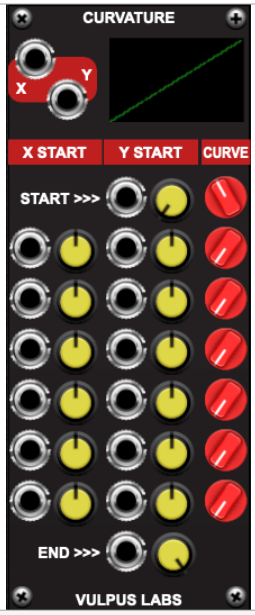
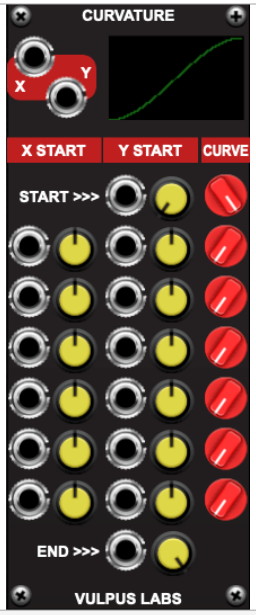
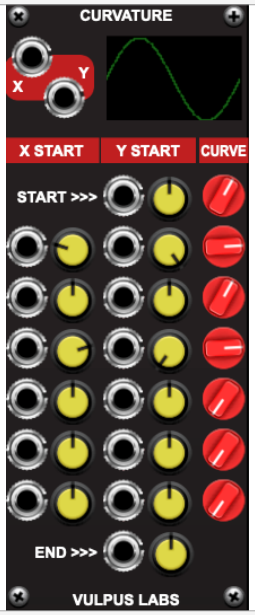
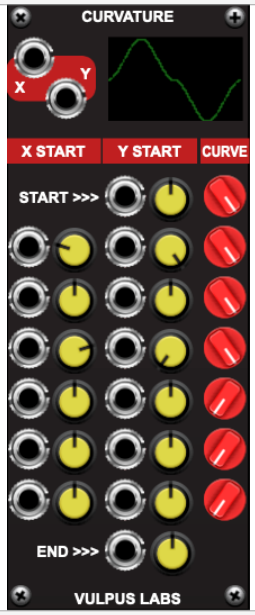
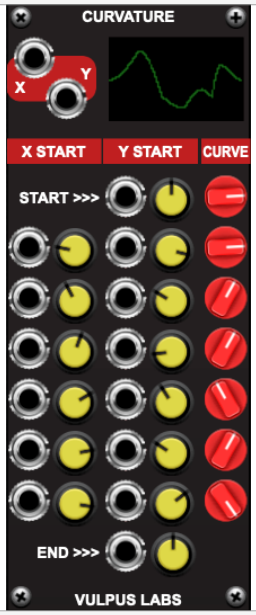
For input "x" values between these points points, intermediate "y" values are generated, based on the shape of the segment curve defined for each point.

It is helpful to be able to visualise this, which is why **Curvature** incorporates a handy oscilloscope showing the values of "y" as "x" sweeps from -5v to +5v.

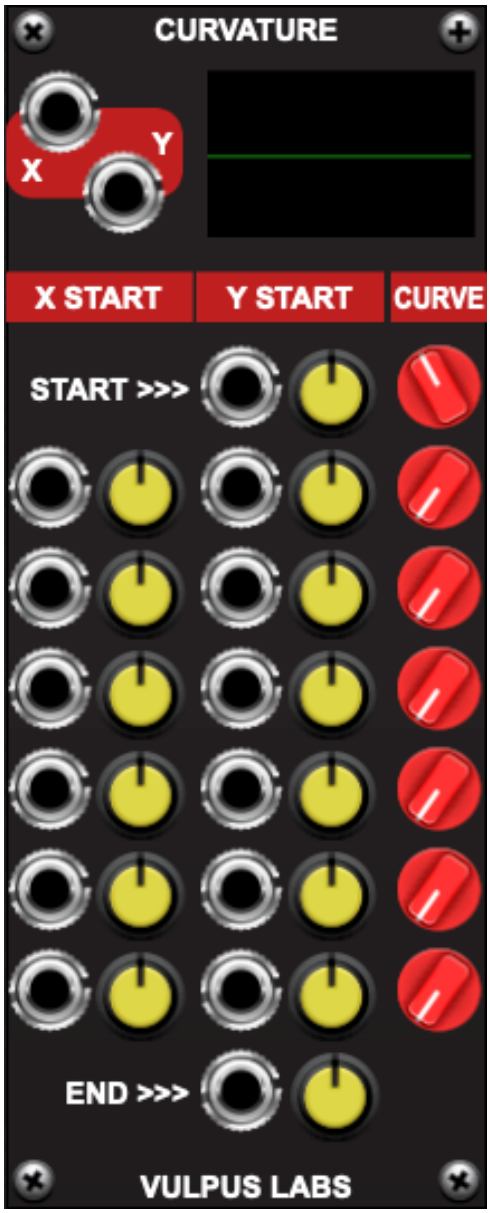
The available segment curve shapes are:

- "Step" - the segment is a flat line at its start point's "y" value, jumping instantaneously to the next point's start "y" value at the end.
- "Linear" - the segment is a straight line from its start point's "y" value to its end point's "y" value.
- "Quarter sine" - the segment is shaped like the first quarter of a sine wave, i.e. the rising curve from y=0 to y=1 between x=0 and x=pi/2 for y=sin(x). The rate of change is faster at the beginning of the segment and slower at the end.
- "Inverse quarter cosine" - the segment is shaped like the first quarter of a cosine curve, turned upside down. The rate of change is slower at the beginning of the segment and faster at the end.
- "Sinusoid" - the rate of change is slower at the beginning and end of the segment, and faster in the middle.

Example curves

		
The default curve: a linear segment from (-5v, 0v) to (5v, 0v) with no intermediate points.	The “identity” curve: a linear segment from (-5v, -5v) to (5v, 5v) with no intermediate points.	A “saturation” curve: a sinusoid segment from (-5v, -5v) to (5v, 5v), no intermediate points.
		
A “sine wave” curve: • Quarter sine (-5v, 0v) to (-2.5v, 5v) • Inverse quarter cosine to (0v, 0v) • Quarter sine to (2.5v, -5v) • Inverse quarter cosine to (5v, 0v)	The “sine wave” curve only with the segment types set to “sinusoid”.	A more irregular curve with six segments defined.

Usage



Pass an input signal into the “x” input, and take the voltage-converted signal from the “y” output.

Controls for the curve are arranged in rows, with one row for each point in the curve. Each point has a knob and CV input jack controlling its “y” value, a knob and CV input jack controlling its “x” value if it is not the start or end point, and a “curve” knob controlling the shape of the curve between that point and the next.

If the CV input is connected, the value sent to the jack entirely overrides the value set by the knob.

Credits and Acknowledgements

Curvature was written by Dominic Fox in April 2023.

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