v2.0.1

Bezier

Bezier is a smooth random voltage generator, which is using bezier curves for interpolation between consecutive values. Bezier curves is an algorithms that allows to generate curved lines of different character, from smooth to spiky, based on limited set of parameters.

General algorithm

1. At frequency defined by parameter FREQ a new random value between -5V and 5V is generated. Every time that new value is generated, a trigger is sent to port TRIG. By default random value is drawn from uniform distribution, so there's no tendency in the distribution of random values. It can be also drawn from normal distribution, such that new values would tend to be closer to mid-point rather than extremities. This can be adjusted from context menu switch.
2. Module interpolates from previous value to newly generated value following the curve parametrised by CURVE knob. At 12 o'clock interpolation is linear, when fully clockwise interpolation follows rounded curve, and fully counter-clockwise interpolation generates spiked shape. Result of interpolation is fed to OUT port, while inverted signal (relative to OFFSET) is being sent to port OUT with a dash. Lastly, GATE output continuously sends signal equal to maximum value out of 0 and generated curve.
3. Interpolation finishes by the moment when next value is generated, and steps 1-3 are repeated.

Few details:

- Output signal is always limited to -5..5V range.
- Output signal can be scaled using LEVEL knob, which attenuates signal from 0% to 100%.
- Frequency cannot be synced.

Modulation

Both frequency and level can be modulated with external signal. By default, modulation is sampled and applied only at the time when new random value is drawn. This behaviour can be altered by context menu switches, allowing continuous modulation of frequency and/or level.
Frequency can be freely modulated without limitation.

Level, when modulated with external signal, by default would be clipped to 0 to 100%. This can be altered by context menu

Clipping

Given that output is limited to -5..5V range, when offset is applied the resulting curve can start clipping. This is handled differently depending on switch value:

- **CLIP** Curve is simply clipped between -5V and 5V.
- **FOLD** Curve is folded back from the clipping value.
- **WRAP** Curve jumps to the opposite limit and continues the movement.

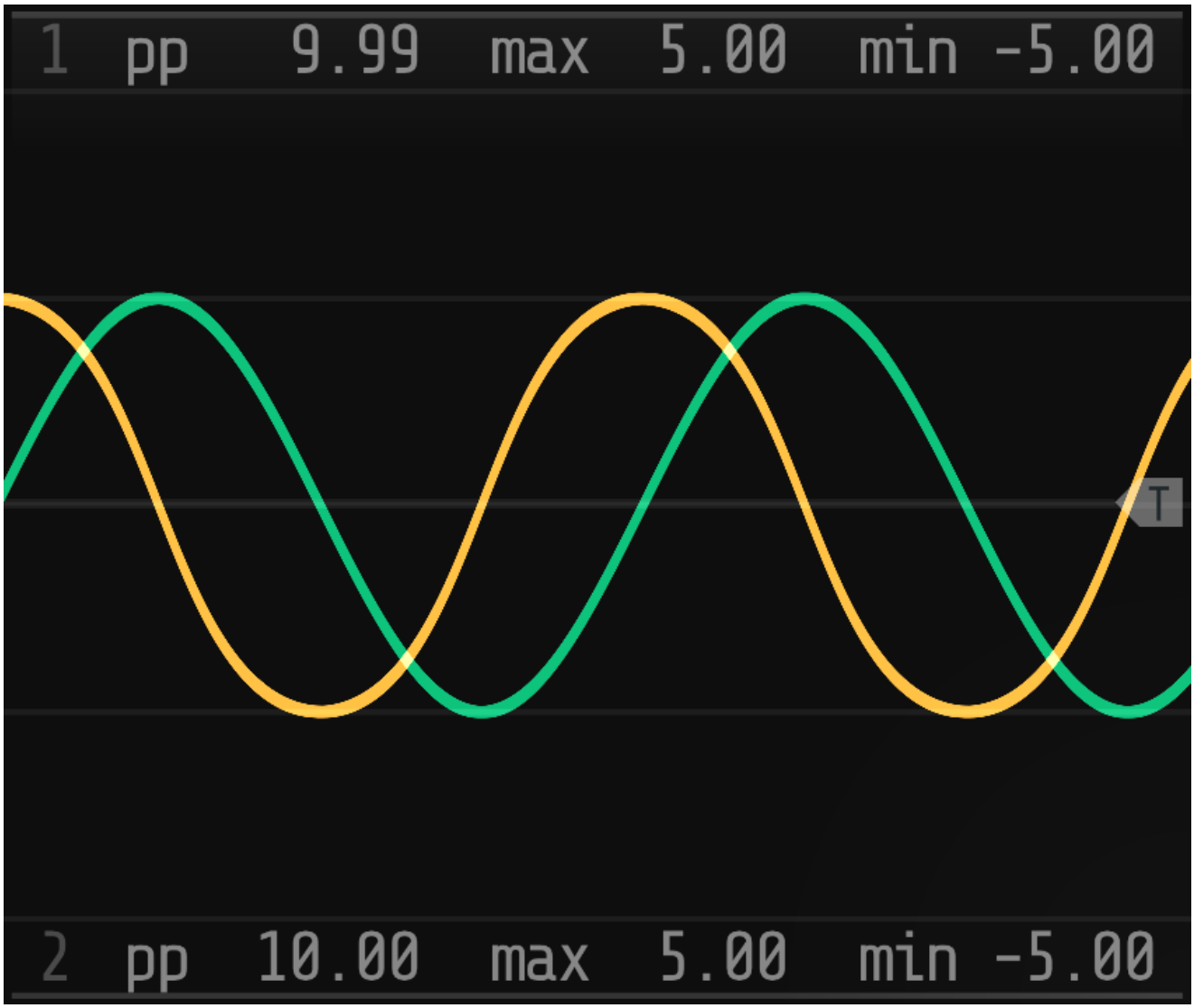
Context Menu Options

- **Continuous Level Modulation / Continuous Frequency Modulation** When turned off, modulation is sampled only when new random value is drawn; when on, modulation is applied continuously.
- **Asymmetric Curve** When on, curve will have asymmetry, such that curve will start smoothly and end spiky, or vice-versa, depending on the CURVE parameter.
- **Distribution** Uniform for equal probability for any random value, and Normal for values to more likely be closer to mid-point (0 or offset value).
- **Post-modulation Level Clip** Sets the clipping for level post-modulation but pre-offset.

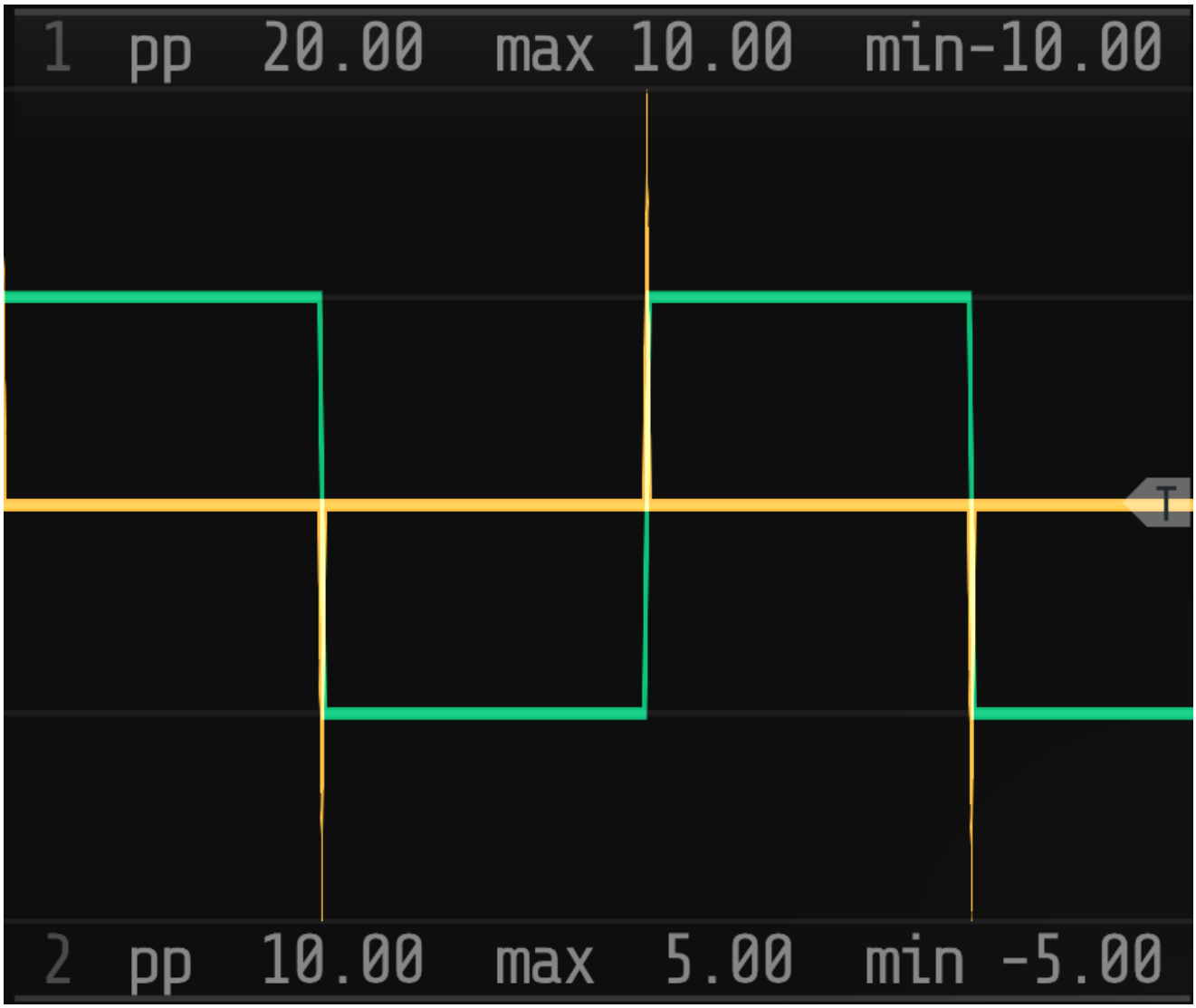
Euler

This module is fairly simple, and it's function is to measure the rate of change of incoming signal. It mathematical sense, it calculates angle of the slope O of function f(x) at point x. Angle of the slope, in this particular case, is always between -90 and 90 degrees, so, it's very easy to normalise it between -10V and 10V, which this module does.

Consider the example: lets take sine output of LFO, and feed it into the module. Set LFO frequency to 1Hz, and Euler's FREQ to 1Hz as well - we'll explain this parameter later. On the scope you'll see two lines - source sine, and resulting signal from Euler, which happens to be a cosine. When sine crosses the 0, angle of it's slope is either -45 or 45 degrees. When normalised, output 0 would be -5v or 5v respectively. When sine reaches minimum or maximum value, it's slope is 0, and output of the module would be 0V.



If you'll feed square wave, resulting output would be short triggers of 10V and -10V, which correspond to slope rising or falling vertically at 90 and -90 angles, respectively:



Now, to FREQ param. Formula for angle of the slope is arctan(rise/step). Here, rise would be volts and step, intuitively, would be seconds - but those are different units, and angle value wouldn't make any sense. Apparently, to bring them to the meaningful relationship, we should involve frequency, ie, we would calculate change in volts of some periodic process with frequency FREQ. That's why in case of Sine with frequency 1Hz we got perfect cosine. Of course, for arbitrary signal it wouldn't work that perfectly, but you can use FREQ parameter to adjust output level to a meaningful or helpful scale. So in other words, you can consider FREQ as sensitivity.