HarmonicPulser
User Guide

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Introduction

HarmonicPulser is a rhythm-focused sequencer. It is not a synthesizer: it does not generate its own synth engine sound, but produces timing events and MIDI note output that you can route to external instruments.

Its core idea is mathematical hit placement. Two user-selected functions are plotted together, their intersection points are calculated, and those points determine where hits are placed along the time axis.

Unlike pre-produced live sets, there are no guarantees here. Grooves can fall apart, tensions can build, and a pattern can suddenly open up or collapse. That instability is part of the instrument.

1   What HarmonicPulser Does

HarmonicPulser is a macOS app that draws two functions on the same graph and finds their intersections. You choose the MIDI notes, while the app specializes in deriving note spacing over time from intersection positions, shaping rhythm along the timeline.

2   Quick Start

1. Select each of the two displayed functions and adjust their parameters.
2. Move the sliders to shape both curves.
3. Watch the graph and intersection list update in real time.
4. Choose the `MIDI Out` destination (`Auto` or a specific MIDI device).
5. Choose the MIDI channel (1–16) for external MIDI output.
6. Open the Debug panel to inspect intersections and MIDI preview while playback sends MIDI on the selected destination and channel.

3   Functions and Parameters

Each displayed function slot ($f(t)$ and $g(t)$) can use any of these three function types.

3.1   Harmonic Function

The harmonic function is:

$$\sin(\alpha t) + \frac{\cos(\beta t)}{\gamma} + \frac{\sin(\delta t)}{\epsilon} \tag{1}$$

Parameter ranges:
- $\alpha, \beta, \gamma, \delta, \epsilon$: from 1 to 10

3.2   Line Function

The line function is:

$$\alpha + \beta t \tag{2}$$

Parameter ranges:
- α: from -1 to 1
- β: from -1 to 1

3.3 Product Trigonometric Function

The product trigonometric function is:

$$\sin(\alpha t) \cdot \sin(\beta t) \cdot \cos(\gamma t) \tag{3}$$

Parameter ranges:
- α: from 0.1 to 10
- β: from 0.1 to 10
- γ: from 1 to 10

4 Reading the Graph

4.1 Normalized Time

The horizontal axis is normalized: one full period maps to one bar.
- $t = 0$: bar start
- $t = 1$: bar end

The plotted domain includes a small margin before 0 and after 1 for visual padding.

4.2 Intersections

Each intersection entry shows:
- **t**: normalized position on the bar
- **y**: intersection value
- **sign**: + when the primary function is rising at that point, − when it is falling

5 Controls

5.1 Window Size

HarmonicPulser is designed for a desktop window. The main window now uses a minimum content size of 1080 x 960, and a minimum visible area of about 1100 x 990 or larger is recommended so the full interface remains comfortable on screen.

The Debug window is separate. It opens at about 700 x 460 and is most comfortable when allowed more width, especially when viewing intersections and MIDI preview together.

5.2 Sliders

All function parameters are continuous sliders, so you can fine-tune shapes while watching immediate updates.

5.3 LFO Controls

Each parameter can be animated with an LFO:
- Enable the `LFO` checkbox on a parameter row.
- Set a minimum and maximum value with the dual-handle slider.
- Choose the LFO speed multiplier from the dropdown.
- Use `STOP LFO` to freeze all active LFO parameters at their current values.

5.4 Zero Shortcut

When a parameter can be zero, its label appears as a small framed box. Click that box to set the parameter directly to 0.

5.5   Debug Panels

The Debug window includes scrollable panels for:
- intersections
- MIDI preview

5.6   MIDI Out Destination

Use the `MIDI Out` picker in the main transport controls to select where MIDI is sent:
- `Auto`: HarmonicPulser chooses an available destination automatically
- a specific device: forces output to that selected MIDI destination

Use the refresh button next to `MIDI Out` if devices change while the app is running.

5.7   MIDI Channel

Use the `MIDI Channel` picker in the main transport controls to select the output channel from 1 to 16 (default: 1).

6   MIDI Behavior

Current MIDI conversion behavior:
- one note per intersection
- note timing follows normalized intersection position
- notes are selected by the MIDI dropdown menus (not automatic chromatic ascent)
- the bracketed note [ ] is an optional cycle-start note at $t = 0$; set it to `NONE` to disable
- within each cycle, note slots are assigned in order; when there are more hits than available slots, the sixth (fallback) note repeats until the next cycle
- velocity is scaled from 1 to 127 from intersection values
- note duration is fixed to 1/64
- runtime playback sends MIDI on the selected `MIDI Out` destination and `MIDI Channel`

7   Presets

HarmonicPulser includes built-in preset collections for:
- function shapes
- velocity behavior

Use preset pickers to load a starting point, then refine with sliders.

8   Suggestions and Ideas

1. Experiment with short pulses or burst-like function shapes at fast BPM values to create dense rhythmic textures.
2. HarmonicPulser can provide a useful rhythmic accompaniment to more organic materials such as field recordings, room tones, or unstable acoustic textures.
3. In a DAW, the note and velocity data from HarmonicPulser can easily be remapped to other destinations, including synth pitch and many other modulation parameters.

9   Support

For support, questions, bug reports, or feedback, contact:
- marco.the.movie@gmail.com