Grape - Product Description

Audio Programming - Synthesizer Design

THE UNIVERSITY of EDINBURGH

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Product Introduction

Grape is a retro synthesizer for R&B and electronic music (also including sound, trap, house, and EDM). The core function is to provide music producers with various customized parameters (envelope, filter, chorus, flanger, reverberation, and pan) in the following three aspects of timbre synthesis:

- Dynamic and variable depth phase modulation based on sine wave.
- Hybrid oscillator based on four simple waveforms (sine wave, square wave, triangle wave, sawtooth wave).
- Built-in sound source sample (you can also use the effector of the synthesizer to process, and include some inspirational clips!).

User Value

In terms of differentiated functions, there are mainly three highlights. First, Grape allows the user to set the ”modulation depth” in the phase modulation phase. This idea comes from the Dx7 modulation principle of Yamaha. One of the most basic waveforms of Dx7 is a sine wave that is cyclically modulated 7 times. The depth parameter range of Grape is [1, 10], which means that after the most basic sine wave is modulated, this output result can be used as the input of the next phase modulation at most, that is, the modulated signal can be modulated for 10 times. In this range, the change of sound is obvious: especially when combined with filters. When the low-pass filter and Notch filter is in the range of 3000 to 5000 Hz, the low-frequency carrier signal and high-depth value are used for modulation, and the resulting voice will have a ”rustling sound” in the middle and high-pitch areas (see preset ”spring leaves”). This is suitable for making Fx timbre in R&B or atmosphere music, which can increase the feeling of steam on the basis of music rhythm. On the contrary, if the high-frequency carrier signal and low-depth value are used for modulation, the characteristics of the obtained voice color in the bass area are more obvious. In this case, the sound is obviously distorted and a large number of harmonics appear. Once again, add the LFO that changes the cut-off frequency, and we get a deep and terrible sound effect (see preset ”hell alarm”). This is suitable for adding exaggerated bass in House and EDM music. Secondly, in the filter function, it can be selected from linear cut-off frequency and LFO cut-off frequency with controllable waveform and frequency. The linear cut-off frequency can directly produce the effect of frequency sweeping, while LFO can be combined with resonance to amplify and produce the vibrato effect at a specific frequency. This can produce exaggerated ”wow” (see preset ”Homeless cat”, ”Toy gun”), which is also

applicable to the exaggerated voice of Trap and EDM. Finally, unlike the traditional manual control of pan shift, Grape uses LFO automatic pan shift to enable users to define a frequency at which the left and right channels play the audio in the buffer circularly. This solves the problem that the volume of the left and right channels may not be balanced due to manual adjustment of the pan.

In terms of basic functions, users are allowed to stack the four most basic waveforms, and the mixing proportion can be adjusted. ADSR is controllable. At the same time, the oscillator can also be mixed with noise, and the mixing ratio can be adjusted. At the same time, the depth, feedback, center delay, proportion of delay signal, and original signal in the chorus effect can be customized. Room size, damping, and dry-wet ratio in reverberation effect.

In terms of expanded functions, it provides users with built-in audio sources. In this version, four small sampling packages are provided. Including drum, inspiration clip, Fx, and atmosphere background music. These audio are sampled, which means that users can not only add them to their own music but also add effectors to this audio because Grape treats samples as well as sound elements such as oscillator and noise!

User Journey and Technical Solutions

The synthesizer GUI allows users to select waveform mode and interact with variable parameters. The process and functional architecture are shown in the figure below.

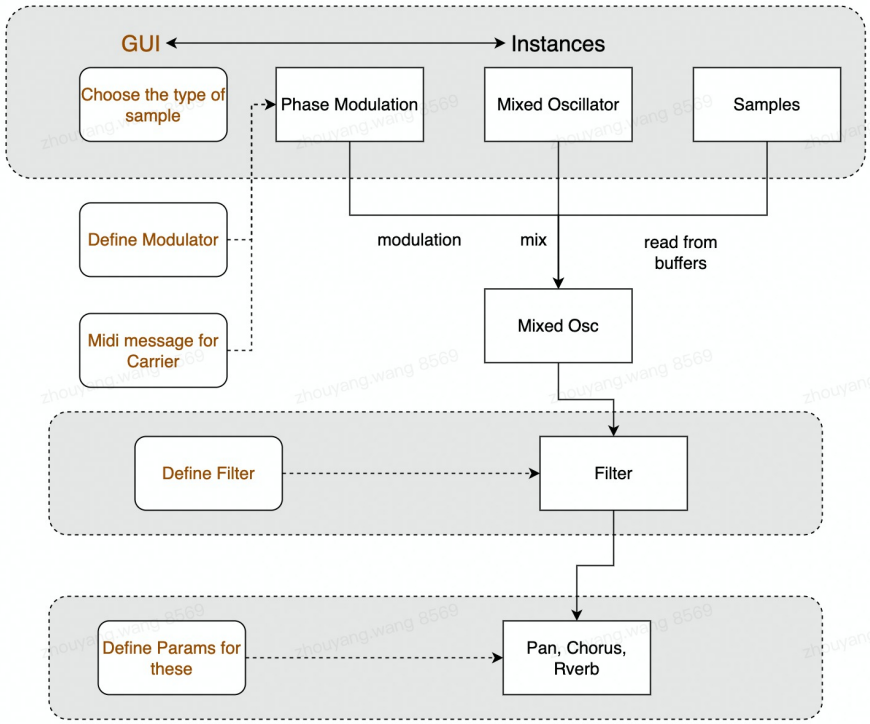

Figure 1: Flow Chart of the Synth

In the phase modulation mode, the carrier signal is a sine wave whose frequency is the midi pitch currently pressed by the user. The user can select the waveform (sine wave, square wave, triangular wave, sawtooth wave) of the modulation signal, the frequency of the modulation signal, and the modulation depth. Here I use a separate Class ”PhaseModulation” to encapsulate the phase modulation process. All relevant parameters are synchronized between MySynth and Prosser through the value tree. In phaseModulation, a while loop is used to control the number of ”self-modulation”.

In mixed oscillator mode, Grape provides two wavetables. In the process of sound design, we will find that the combination of ”pure” sine wave and the other three waveforms with more harmonic components will produce a very diverse sound. For example, the sine wave and square wave generate a warm electric piano timbre at a ratio of 0.92 (see preset ”Warm E-piano”); At the ratio of 0.57 for triangular wave and sawtooth wave, after the high-frequency component is retained, bright but not harsh sounds like animals are produced (see preset ”Homeless cat”).

In addition to the sample loop, there are some parameters that are effective for the samples generated periodically or the overall results. Such as ADSR, filter, and overall volume. Similar to phase modulation, I created a filter class to encapsulate all filtering processes. The advantage of this is that in Mysynth, Grape doesn't need to care about how these two ”huge” functions are implemented. Grape just need to create instances and call member functions. Five filters are provided, including the common all-pass filter, low-pass filter, high-pass filter, band-pass filter, and Notch filter. It can rapidly attenuate a certain frequency, restrain the resonance point of the control system, and eliminate vibration without affecting the control effect through an accurate frequency notch of the resonance point. In terms of sound processing, its effect is smoother.

Coming Soon!

In the next version, new functions will be released:

- Inspiration record: Do you sometimes feel inspired, but sometimes you feel that your creation has encountered a bottleneck? Grape will support importing inspiration clips and managing them for you. When you click ”Get Inspiration”, a random inspiration once recorded by you will appear.
- Upload your own audio files: Grape will support drag upload, sample your own audio clips and unlock all synthesizer functions!
- More comfortable interaction interface: In fact, this version of GUI is not very friendly for user experience. Grape will use listeners to make each component more closely related. For example, after selecting a drop-down box, the unselected content will not be displayed at this level.
- ...

Notes for recordings

Demo1 and Demo3 are two short improvisations. Demo2 is a segment of Hayao Miyazaki's animation. I think it is very suitable for this voice, so I tried it. For Demo1, I used some

samples (kick, hit, snare, train); For Demo3, it all comes from my voice and parameters. Since I have not set the automatic quantization in Reaper, the rhythm may be a little misaligned. It will improve later!