MY SYNTHESIZER LABORATORY

- ***A NOSTALGIC RETROSPECTIVE***
- ***THREE KIND OF REAL SYNTHESIS***
- ***THE MANUAL***

⌘ *A NOSTALGIC RETROSPECTIVE*

The synthesizers of today are amazing. The reason is that they use recordings of real instruments. Even sounds from older synthesizers are recordings of, well, older synthesizers. That is why they sound so great.

However, this was not possible to achieve in the early days of sound synthesis. The sound is stored in digital memories, same as the memory in your computer. Memories were simply far too expensive. The memory used in a modern synthesizer contains memory that would have costed hundreds of thousands of dollars, or even many million dollars. And the amount of memory was simply not available on the market.

Therefore, vintage synthesizers had to make the sound, to synthesize it. That is why they are called synthesizers. The synthesizers of today really are not synthesizers, because they do not synthesize the sound. Still we call them synthesizers, and that is all right. They do not only use recorded sounds, but also modify and enhance them to make an as real musical experience as possible, which is part of what 'real' synthesizers do after having synthesized a sound.

In the youth of the synthesizers there were two different philosophies regarding the use of synthesizers. Some people adapted both of those; some preferred their choice, while some even disliked synthesizers just because they did not sound like 'real' instruments.

The philosophies were of course those that the synthesizer could be used to replace real instruments, or to constitute a new kind of instrument.

It is true that they were a poor substitute for 'real' instruments, but did they really need to be that? Synthesizers could create amazing sounds never heard before, so to me it is absolutely a new kind of instrument. I see no reason not to think that way. There are so many different kinds of instruments, and many are inferior to the synthesizer, if thought of as competitors. But thinking of instruments as competitors and only use the most versatile instrument is really not a good idea. That would rule out a lot of instruments, like a drum, that cannot play different pitches, the didgeridoo, which still makes very interesting sounds etcetera. I could continue making examples, but I imagine you get the picture. The old style synthesis could make sounds no one even thought about using in music.

Thanks to a lot of musicians and composers the synthesizers came to be used as its own type of instrument. I will not list any names, bands or records, but I must mention that I remember when a friend played Pink Floyd's album Umma-Gumma for me. I had never heard anything like it before, and I loved it immediately. Since then I have heard and collected a lot of albums, and many of them used synthesizers to create fantastic fantasy sounds.

My Synthesizer Laboratory lets you put together your own synthesizer using your own ideas of how to synthesize sounds. If you are too young to remember the days they ruled, you will have a revelation, if you do remember the days, you will have not only a trip down memory lane, you will, have a laboratory that lets you play with sounds anyway you like. That is true even if you are too young to remember those days.

Read more in the next chapter about how it all works and in the chapter 'Manual' how to use the laboratory.

⌘ *THREE KIND OF REAL SYNTHESIS*

There are essentially three ways used to synthesize sound:

- **The addition method**
- **The subtraction method**
- **The frequency modulation method**

Before we get into the different methods, you need to know a few things about sounds. Each sound has a characteristic, a timbre. A tone from e.g. an instrument sounds a certain way. The most fundamental sound is the sine wave. A sine wave is a waveform that cycle in an even way, like a spinning wheel. A point on the spinning wheel goes round and round and never deviates from its path. When a sound with that characteristic hits our ear, we hear a tone that virtually has no characteristic. Or you could call that the lack of characteristic is its character.

If you whistle a tone, you are creating a sound rather similar to a sine wave. If you play a clarinet, you make waves that have a lot more character. So, what is it that makes that character?

Starting with a guy by the name Fourier, and some other mathematicians that followed up his work, a theory was formed. That theory stated that any waveform can be broken down into the sum of a number of sine waves. So, we should be able to create a sound that is similar to that of a clarinet, or any other waveform, if we only could identify, create and put together those sine waves.

The sine waves that create the character of the sound are all of higher frequency than the note played. The note played is the base frequency, and all other sine waves are called 'overtones'. It is those overtones that make the character of the sound.

The sound waves and overtones are created by oscillators. There has been some different kind of oscillators, running in the range from cogwheels via radio tubes to transistor circuits and integrated circuits. Anything that can oscillate can also be used to create a tone.

My Synthesizer Laboratory is made in such a way that you can not only create sounds using any of those three methods, but you can also combine them.

Now back to the three different methods.

The addition method **uses mostly sine waves. One is for the base frequency. Then waves of higher frequencies are added to the sound in order to make the characteristic of the sound.**

Just think of a Hammond style organ. It has a number of sliders with different overtones that can be added by adjusting the sliders. Even a church organ uses a similar method where different sets of pipes can be added by pulling their respective knobs.

Just because we add the overtones, this method is called addition synthesis.

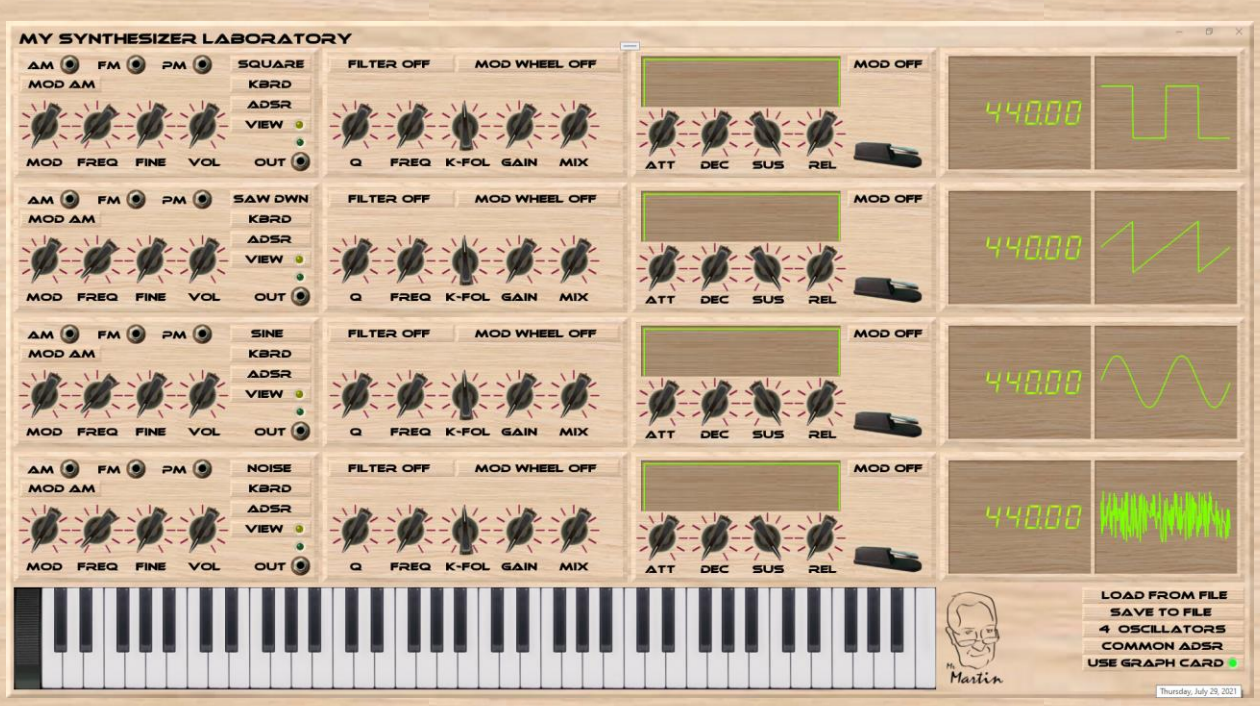
The subtraction method **works the other way around, and is the most common type used by vintage synthesizers. In this method a waveform that already has a lot of overtones is used, and a filter is then used to reduce the overtone spectra.**

The square wave and the saw-tooth wave are typical waves used in subtraction synthesis. If you ever saw an old-fashion synthesizer you probably noticed that those waveforms were available to select.

The frequency modulation **method is a bit special. As far as I know it was Yamaha that invented, or more correct, invented the use of frequency synthesis, to sound synthesis with their DX series of synthesizers. Frequency modulation had been used for other purposes before that, but as far as I know, never for sound synthesis.**

The frequency modulation uses two or more sine waves, usually all or some of them using the base frequency, the frequency corresponding to the keyboard key pressed. When modulating a sine wave with another sine wave that has the same frequency or a multiple of it, that creates overtones. This is because the modulated oscillator changes frequency following the value of the modulating oscillator, but still comes to the end of the cycle at the correct time. Thus, the base frequency is still there, but since the oscillator changes frequency *within* each cycle, overtones are created.

⌘ *THE MANUAL*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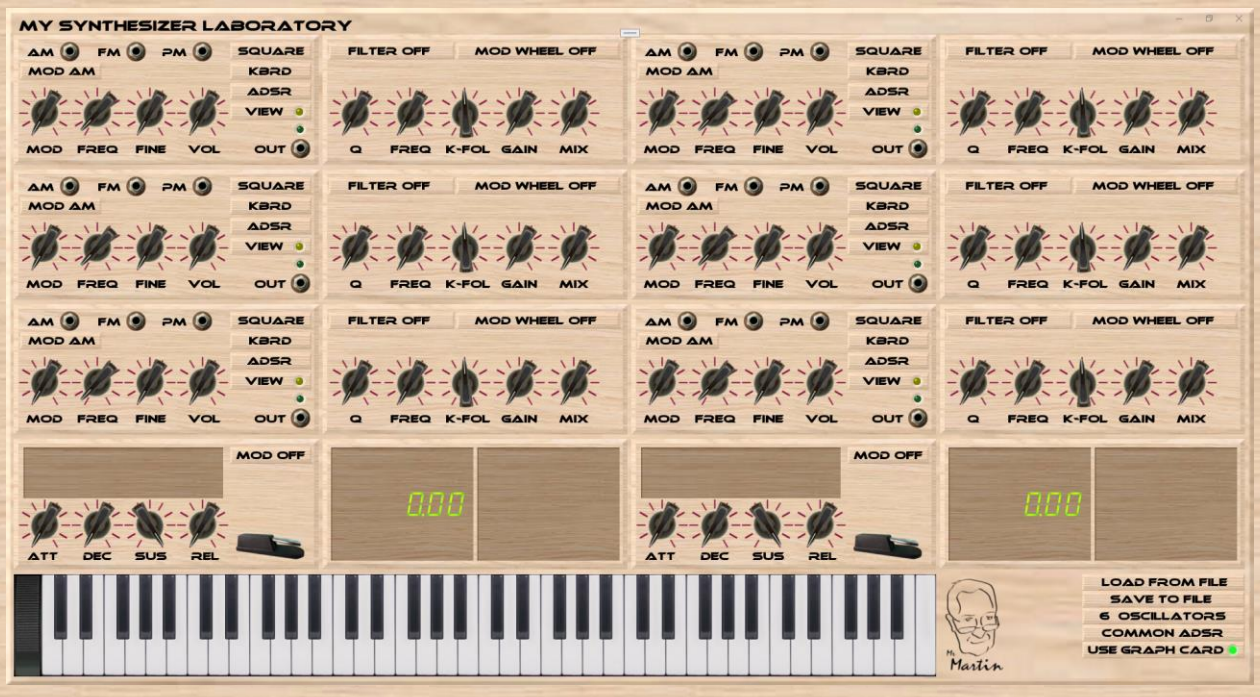
Thursday, July 29, 2021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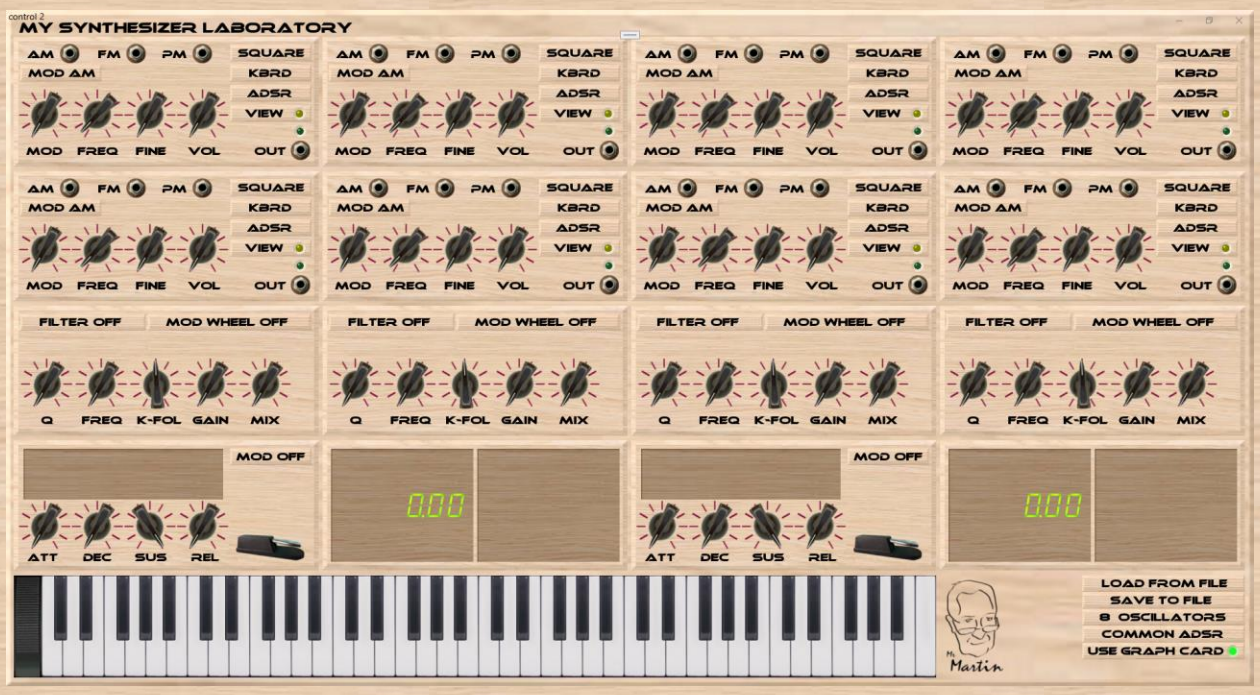
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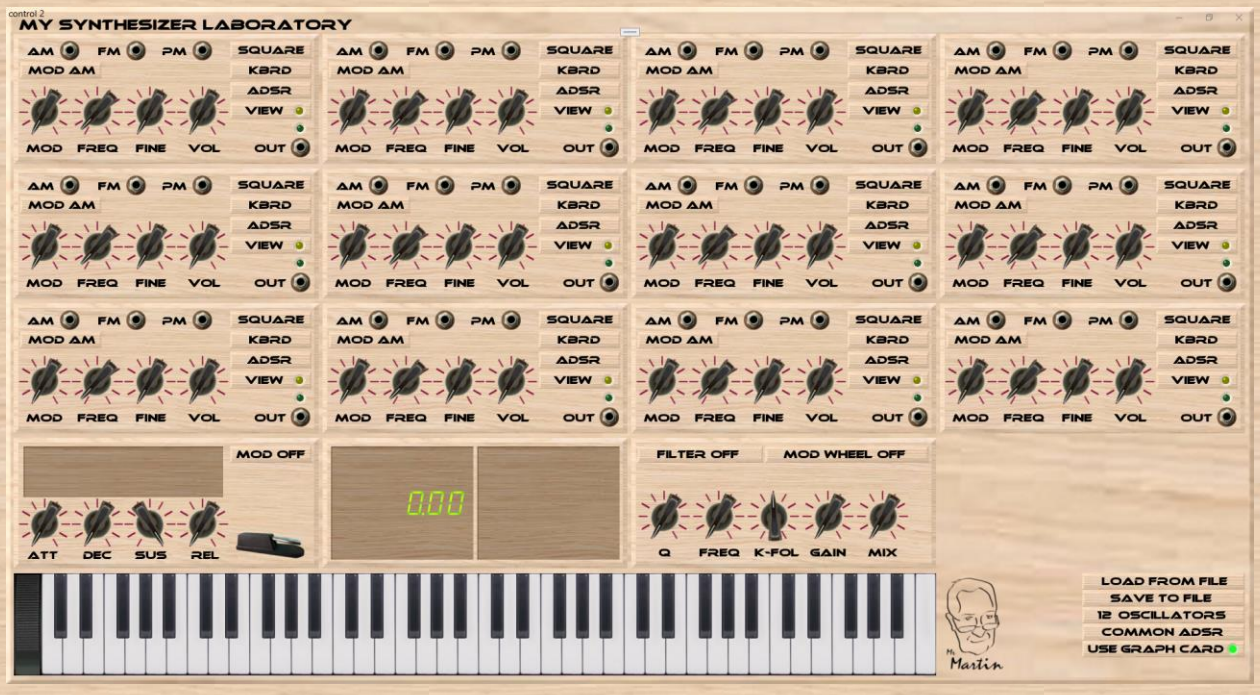
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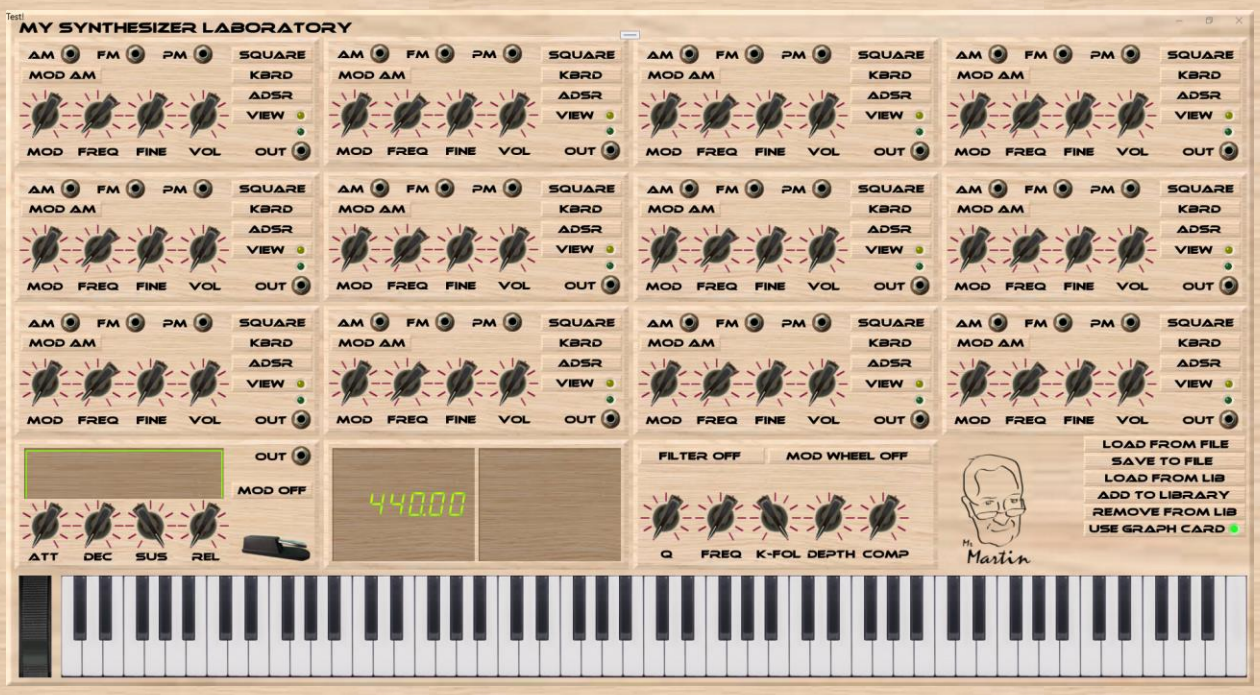
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