Virtual Reed Organ

An Attempt to program a sonic model based on the physical functioning of the instrument from a fenomenological point of view: `ReedOrgan.pch2(D)` and `Reed Organ.pch2`. The first patch shows the simplest implementation and can be loaded into both the NMGDemo and the hardware. The second patch, `ReedOrgan.pch2`, is a more detailed version and can only be used in the Nord Modular G2 hardware. Finally `ReedOrgan+.pch2`, the same instrument but with four independent stops of reeds.

The reeds

A strip of metal is fixed in a precisely fitting frame. The frame is placed on a so-called wind chamber from where air can be blown against the tongue (pressure wind), or from the top air can be sucked (suction wind). As can be seen in figures 1 to 4, the reed is blown out of the recess. The air can then escape and the tongue springs back to its rest position, nicely in the recess of the frame. Then the process starts again. This results in a cyclic interruption of the air.

How it works

The reed performs a back and forth switching movement and interupts in this way the air flow. This results in a signal that is very similar to a pulse wave. On the understanding that the speed of the 'changeovers' obviously does not go as fast as happens in a pulse wave oscillator.

A pulse oscillator model

This free reed model can be approached quite nicely by means of the already mentioned pulse oscillator followed by a simple 6 dB per octave low pass filter. The filter ensures that the transition time of the transitions from low to high increases. This gives a better simulation of the reality. You'll find this in module group 5. FREE REED in the patch image.

Air flow and reed movement

By pressing a key a valve is opened so that the airflow can set the reed in motion. The reciprocating reed is now slowed down by flowing air when springing back. That means that the time of back and forth movement will not be equal.

Subtle Pulse Width Modulation

Translated to the pulse oscillator model, this means that the pulse width will more or less be modulated depending on the wind pressure. Module 1 simulates the opening of the valve, which is done by means of an ADR envelope generator that provides the pulse oscillator signal with an amplitude envelope.

At the same time, this envelope also controls the pulse width of the oscillator. In reality, small random variations occur in the airflow. The simulation of this is realized with a RandomA and a LevelModulator module under number 2 in the patch image.

Vox Humana/Tremolo
Almost every reed organ also had a provision for cyclically varying the driving airflow. A LfoC module together with Mix1-A forms this 'vox humana' model under number 3. The braking effect of the air when the reed springs back, results in pulse width modulation. It will also have a (minimal) influence on the vibrational periodicity of the reed. The air inhibits the return movement. Therefor the pitch is fractionally lowered. This effect is all the clearer as the tongue is smaller and thinner and the airflow stronger.

Airflow force
With a very powerful airflow the pitch will be modulated downwards. A well-known technique in playing blues mouth harmonica. You see this pitch modulation realized in part 4 in the patch image. The slightly random modulated envelope signal is inverted in a Level Converter and applied as a control signal to the Pitch Control input of the pulse oscillator. Finally, in part 6 you see the simulation of the sound box resonance. This is realized with a simple EqPeak module.

Deviation of Equal Temperd Tuning
In the patch for the hardware, `ReedOrgan.pch2`, a simulation was also included to obtain the not exactly Equal Tempered Tuning (ETT). The Clavia soft- and hardware simulates this ETT with a gruesome precision that can never be realized in acoustic reality. This is especially evident when you play an octave interval. That is exactly the periodicity ratio 1 to 2. This exact ratio 1:2 don't sounds like an octave. It's more like the same tone with many more overtones. Due to a light form of stretched ETT the octaves come apart and to life. Also included in the hardware patch is a simulation of the placement of the reeds in the stereo image: the bass sounds on the left with gradual transition more and more to the right in the image for the treble reeds.

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internet

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