Digitizing Analogue Instruments for Computer Music

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Abstract. Virtual instruments have a wide variety of usages and vary from digitizing audio samples of real instruments and recreating brand new virtual instruments that do not exist. Virtual instruments help music composers to compose music more easily and quickly, they also provide composers with new ideas and concepts for traditional music composition. The biggest attraction of virtual instruments is that the sound produced is real. They produce an excellent quality of sound, are stable, and parameters are automatable in real time, such as the opening and closing of filters, the changing of envelope decay times, bending pitch, and so on.

Keywords: Virtual instrument, MIDI, VST (Virtual Studio Technology), Modulation, Mapping, Phase shift, ADSR, Multi-sampling.

1 Introduction

The initial idea of MIDI was that when a composer played one MIDI synthesizer's keyboard and attached a cable from its MIDI out to another synth's MIDI in, the second synth would take the messages from the first synth, which included the notes to play, thus layering the sound of the two devices. Other performance MIDI data, such as pitch bends and modulation wheel moves, could be transmitted as MIDI data [1]. MIDI has been expanded to allow for more complex types of communication. MIDI remains popular for sequencing, live control of synths and samplers from master keyboards, and studio control. It is used for sending patch data from synth to storage device, and synchronization via MIDI time code.

2. Digital music technology

2.1 Virtual instrument

A virtual instrument can act like a MIDI track with respect to recording and note editing, but is more like digital audio when it comes to plug-in processing,

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automation, and mixing. Today's software synths are in some ways superior to the devices they wish to emulate. They produce an excellent quality of sound, are stable, and parameters are automatable in real time; such as the opening and closing of filters, the changing of envelope decay times, bending pitch, and so on. Virtual instruments are a global standard and their acceptance has strengthened with time [2].

2.2 Sound mapping

We made the starting point of the guitar source as short as possible and also made sure that there was a natural fade out. Left and right (horizontally) represent pitch and up and down (vertically) represent the velocity layer. Using velocity to determine which instrument plays the sound involves selecting only those notes which have a velocity value above a specific value (half-way, 64, is a starting point) and allocating those notes to a different instrument.

Fig. 3. Sound source layering

Samplers can assign samples to two or more layers of the keyboard. For example, playing with a velocity from 0 to 64 might play one sample, while playing with a velocity from 65 to 127 would play a different one. Sometimes the distinction is not abrupt and samples can blend into each other as velocity changes [3]. Thus, the more velocity layers, the more natural it sounds. Also, an increase of velocity layers can provide users with the ability to operate very detailed techniques.

We divided the velocity into 4 layers; 1 - 29, 30 -59, 60 - 94, and 95 - 127. A greater number of layers produce a better sound, but it imposes a heavy burden on computer capacity and memory.

2.3 Sound effects

Envelopes are split into segments or parts. The time from silence to the initial loudest point is called the attack time, while the time for the envelope to decrease or decay to a steady value is called the decay time [4]. For instruments that can produce a continuous sound, such as an organ, the decay time is defined as the time for the sound to decay to the steady-state sustain level, whilst the time that it takes for the sound to decay to silence when it ends is called the release time. A single sound

source can be created for a variety of string pads by envelope and filters. The envelope is the overall shape of the volume of a sound.

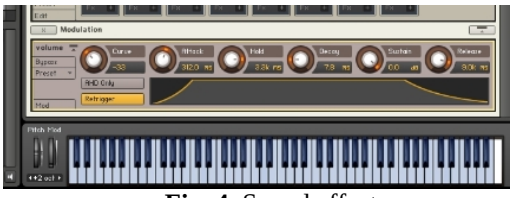

Fig. 4. Sound effect

User can add effects to the insert of Kontakt. Digital reverb, compared to outboard reverb, produces very clear sound, but uses a substantial amount of computer memory. Especially, reverb in Kontakt is designed to simplify the general function and takes minimum computer memory except reverberation. In this paper, modulation and phase shift performed a role to change the original guitar sound to a specific digital sample. We adjusted the phaser for phase shift and the original guitar sound was changed to an electric violin sound. Moreover, an arpeggiator enables a specific auto-arpeggio pattern depending on what pattern users program in Kontakt. Also, the arpeggiator provides more functions, such as a variety of rhythms and tempos.

4 Conclusion

Virtual instruments have plenty of uses, from digitally restoring traditional instruments to creating new digital instruments. The advent of new virtual instruments enables music composers to produce music more creatively than the general music production methods which were relied on for years. Samples are taken of the source sound played at different pitches at the same sample rate. Multi-sample uses a large amount of memory, but provides the most accurate reproduction.

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