Prototyping a Modular Analog Synthesizer

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About this paper

Description

This paper describes an attempt to design and assemble a basic monophonic synthesizer prototype consisting of some standard modules that are to be found in virtually every classical synthesizer device, such as an oscillator, an envelope, and a filter.

The first sections represent the research on the history and theoretical background of analog synthesizers in general and modular systems in particular. These findings are applied to building an experimental device. First, different circuit concepts will be introduced for each module, so that the most suitable ones can be identified, whereby comprehensibility and prices of electronic components play a significant role in the choice of a circuit design. The process of building the prototype includes working with an oscilloscope to examine and verify the shape of various waveforms before and after modulation.

To make it playable with a keyboard, a MIDI input module is added. It features an Arduino microprocessor to convert digital MIDI messages into control voltage outputs that other modules can connect to. It is the only digital component of the synthesizer, while tone generation and processing are analog.

Motivation and Goal

The project was inspired by the film *moog*, a documentary about Dr. Robert Moog, electronic instrument pioneer and inventor. Its goal is to attain a better understanding of the working of electronic components and circuits as well as their influence on audio signals. Another goal is to create a functional synthesizer that is fun to play and experiment with and therefore obtain some practical experience in the field of artificial sound generation.

1 Introduction

2 History of the synthesizer

2.1 In the beginning

2.2 Relevance in today's electronic music

3 Theory of analog sound synthesis

3.1 Wave Synthesis

To generate any sound it is necessary to create an air pressure wave that oscillates at the frequency of the desired note. This pressure wave can be generated electronically with a so called oscillator.

Base Sound Basic Sound

Different approaches to oscillation

influence on timbre and color of the sound

trying to get a wide variety of possible base sounds established different wave types from soft (sine) to fat (saw) to harsh (square)

3.2 Processing

Subtractive synthesis - filtering and amplitude subtraction

3.3 The modular approach

4 Building a concrete prototype

4.1 Voltage Controlled Oscillator

4.2 Voltage Controlled Filter

4.3 Voltage Controlled Amplifier

4.4 Input and Output

5 Conclusion

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Bibliography

Declaration of academic honesty

Appendix

Preliminary bibliography