Analog Synthesizers: Improving Pitch Stability with Modern Technology

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Introduction

[1]
A Schmidt Analog Synthesizer

- Analog synthesizers were once ubiquitous in music in the middle to late 20th century
- Digital synthesizers have now become the norm, but many still value the sound analog produces
- Analog synthesizers drift (go out of tune) with changing temperatures, making them unsuitable for many live performances
- There has been a recent resurgence of interest in analog technology, mostly due to the quality

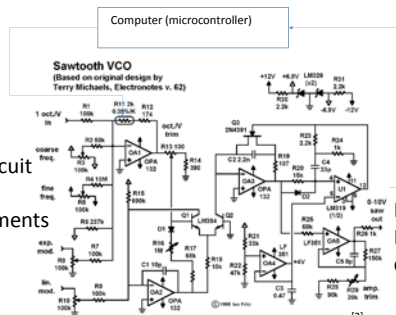## Analog vs. Digital

Analog Signal
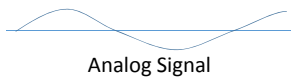
Digital Signal

- Analog signals flow between levels, like anything you would find in nature
- Digital Signals are representations of analog signals made using a computer approximation
- If enough data is used, digital signals can sound similar to analog

Objectives:

- Recreate vintage circuit design
- Add digital controls to the circuit
- Connect a computer which monitors output frequency
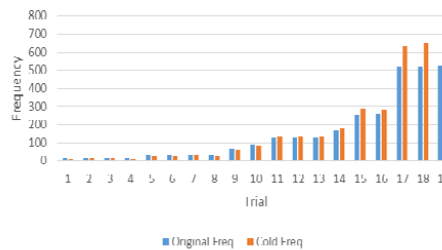- Tune output note to correct frequency

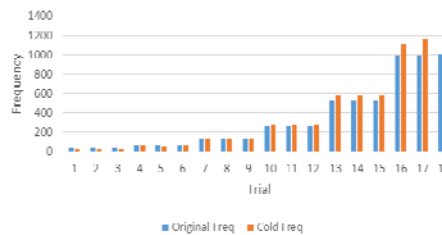Adjust circuit based on measurements
Monitor Frequency out
[2]

Frequency Change with Freeze Spray (unmodified circuit)

Frequency Change with Freeze Spray (modified circuit)

The Design

- Based on vintage sawtooth synthesizer design
- Updated obsolete components
- Added Arduino Due to monitor pitch and tune circuit

- Original design by Ian Fritz, based on design by Terry Michaels

Left: Circuit Diagram plus abstract representation of modifications
Above: Constructed circuit and Keyboard input

Results

- Testing consisted of spraying the circuit with freeze spray, which reduced temperature to around -40 degrees
- Percent change for the unmodified circuit ranged from -12% change at 32 Hz to +28% change at 520 Hz
- Percent change for modified circuit ranged from -10% at 32 Hz to +11% change at 520 Hz
- The pitch still occasionally shifts randomly, often wavering or even completely raising the tuning of the entire circuit

Summary and Conclusion

- Modifications clearly improved temperature response for the circuit
- Circuit still not able to adapt to extreme conditions, but under normal conditions, actually performs its function as a musical instrument
- There are still some issues with pitch stability, which are most likely due to electrical noise and exposed wires
  - Moving the project onto a printed circuit board would likely eliminate this issue
- This project demonstrated that digital controls can effectively be used to improve the performance of analog synthesizers
  - Further research and improvement would be necessary before converting this into a commercial product

Acknowledgements

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- Ian Fritz

[1]: http://www.synthtopia.com/content/2011/04/26/best-of-musikmesse-2011-the-schmidt-analog-synthesizer/
[2]: http://home.comcast.net/~ijfritz/sy_cir2.htm