Analog Function Generator – Group 02
Feasibility Report

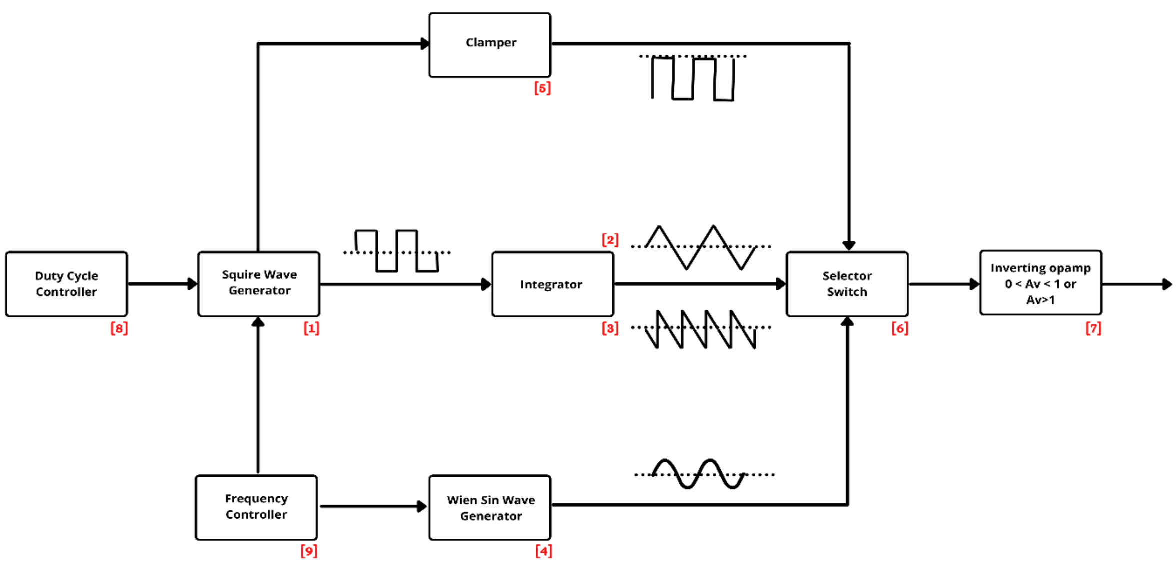
1. Introduction

The main objective of the project is to make an analog function generator that is capable of generating a square, triangular, sine and a sawtooth waveform with minimum possible distortion and highest possible accuracy. Currently, function generators are commonly used in generating required waveforms in applications like AM/FM, Phase Locked Loops and in development, test and repair of electronic equipment. Most commonly used electronic circuit elements in modern waveform generators are Exar XR2206 and the Intersil ICL8038 integrated circuits. Now these circuits mainly use Direct Digital Synthesis in this process. Although these modern implementations use programmed ICs and chips, our goal is to make a fairly accurate function generator that is simple and cost effective, utilizing easy to access components in a fully analog approach.

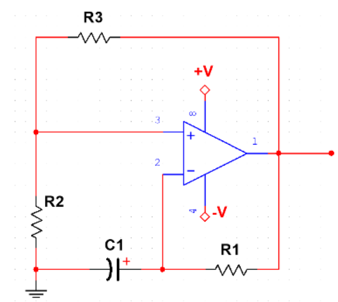
2. Alternative Approaches

Our plan is to implement the project in a fully analog way. But as mentioned above the easier approach is to use digital ICs. But our method is cost effective and also good for our understanding on analog components like Op-Amps.

3. Block Diagram



4. Methodology



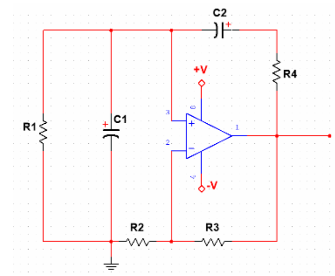
[1]. First a square waveform is generated using an Op-Amp, resistors and capacitors.

[2]. A triangular waveform is generated using the square waveform output of [1] in conjunction with another Op-Amp as an integrator.

[3]. An inverted saw tooth waveform is generated by changing the duty cycle of the square waveform output in [1], to 99%. Here an inverted waveform is generated since all these signals go through an inverting amplifier in the next step [7].

[4]. Op-Amp Wien bridge oscillator is used to generate a sinusoidal waveform. The upcoming method in step [9] will be used to change the frequency of this wave as well.

[5]. Here a clamper is used to convert the alterative square wave to a completely negative square wave. The reason for this is we are required to generate a completely positive square waveform and also all our waves go through an inverting amplifier in the next step [7].



[6]. We will use a selector switch to route the outputs of each individual units ([2],[3],[4],[5]) to the final fine tune unit [7].

[7]. After generating basic shapes using above methods, we use some additional circuitry to fine tune the final output as expected. Since we have to get a variable amplitude, Op-Amp is used as an inverting amplifier to get the desired gain for the output, which can be greater or smaller than one. An inverting amplifier is used instead of a non-inverting amplifier, since we need to get a gain as well as an attenuation.

[8]. The charge and discharge cycles of the capacitor in the square wave generator is separately controlled using a variable resistor and two diodes. By doing this we can change the duty cycle of the output of [1].

[9]. The frequency of the generated square waveform is changed using another variable resistor.

5. Project Flow and Timeline

	October				November				December			
Week	st	nd	rd	th	st	nd	rd	th	st	nd	rd	th
Project feasibility report												
Research on the project												
Simulation testing												
Physical components testing												
Design the enclosure and PCB												
Final implementation												

6. Conclusion

According to the methodology and the outline of the project timeline we already drafted in this report, we can conclude that this project is well within the feasible range of our team. The background research and details are already gathered and the project will go to the simulation phase afterwards. Although the date for a physical development cannot be finalized, everything will be 3D simulated as well. So, we can conclude that this project is feasible.

7. Reference

[1]. https://www.youtube.com/watch?v=F-E_bo8wjv8

[2]. https://www.ques10.com/p/22759/explain-triangular-wave-generator-using-opamp

[3]. https://www.electronics-notes.com/articles/analogue_circuits/operational-amplifier-op-amp/wien bridge-sine-wave-oscillator-generator.php

[4]. Floyd, Thomas L. Electronic devices: electron flow version / Thomas L. Floyd. — 9th ed.