Analog Voltage Generation based on Gray Coded Digital Data

R.V.Rohinth Ram
Department of Electronics Engineering,
Madras Institute of Technology Campus, Anna University
rohinthram2014@gmail.com

***Abstract*—This paper presents a design of voltage generation based on the input Gray code data. The circuit makes use of both analog and digital blocks making it a mixed signal design. An astable multivibrator is employed to generate clock for the FSM based Gray to Binary code converter. A DAC converts the so obtained binary data to analog voltage. This circuit finds application where the speed of motor shaft can be controlled.**

I. Circuit Details

Most of the signals are analog in nature. So analog signals need to be converted into digital signal for processing because digital signal processing is robust. After the processing by the processor the digital signal need to converted back to analog signal. Here comes the role of DAC (Digital to Analog Converter). A n-bit Digital to Analog Converter takes a n-bit digital input and convert it to corresponding analog voltage with respect to the reference voltage. Voltage divider concept is used in potentiometric DAC. Gray codes are widely used to prevent spurious output from electromechanical switches and to facilitate error correction in digital communications but computer performs operation on binary data. So, Gray code should be converted into binary data. Convertion of Gray to binary is done with help of Finite State Machine using verilog HDL. Figure 1 shows the reference circuit diagram and Figure 3 shows the resultant waveforms.

The motor shaft speed is measured using LASERs, we obtain Gray code in general which is converted to binary and correspondinly output voltage is generated that can be used to control the speed.

II. Implemented Circuit Diagram

The block diagram of presented mixed signal circuit is as shown in figure 1

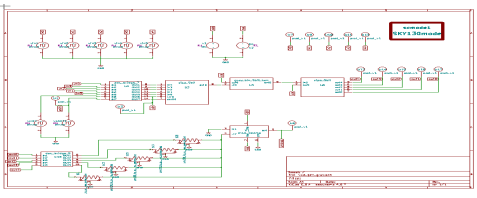

Figure 1. Block Diagram

III. State Diagram

The block diagram of presented mixed signal circuit is as shown in figure 2

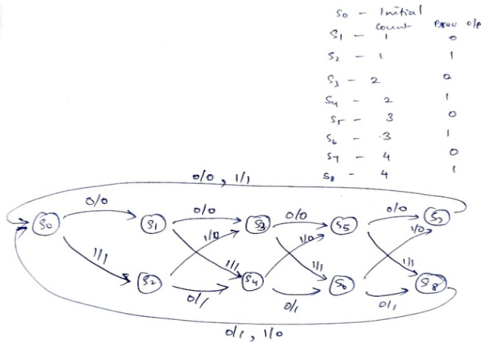

Figure 2. State diagram of FSM based Gray to binary code converter

IV. Circuit Waveform

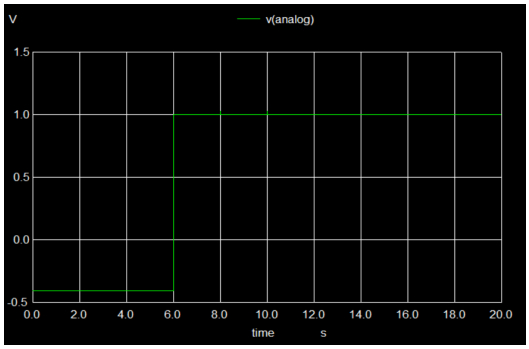

Figure 3. Circuit Analog Waveform

References

[1] https://github.com/rohinthram/gray_binary_cnvt_fsm