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Implementation of ADC using Verilog

Mini-Project Synopsis

submitted to

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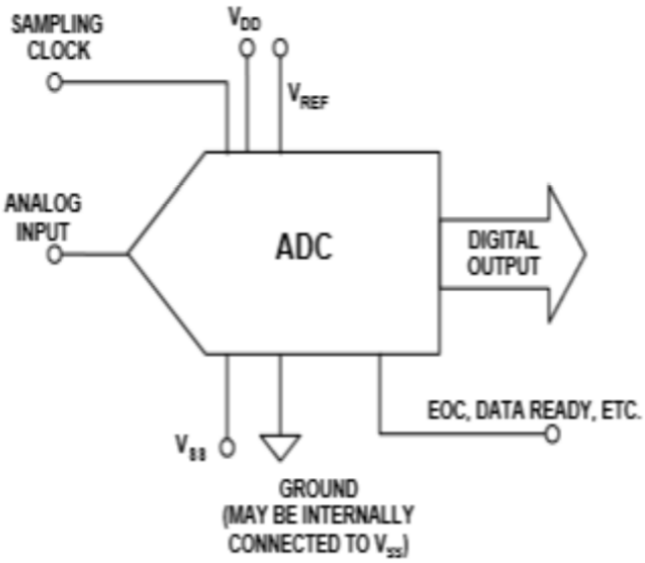
Objective

An Analog to Digital converter (ADC) is crucial component in video, radar, communications, high-speed data acquisition and measurement systems. ADC decides the overall accuracy of such systems. Many times, the input to ADC in an application is different than standard signals such as sine wave or triangular wave. As ADC parameters are dependent on input frequency and other test conditions so parameters determined using standard signals are not useful. Therefore, dynamic testing of ADC under application conditions is needed.

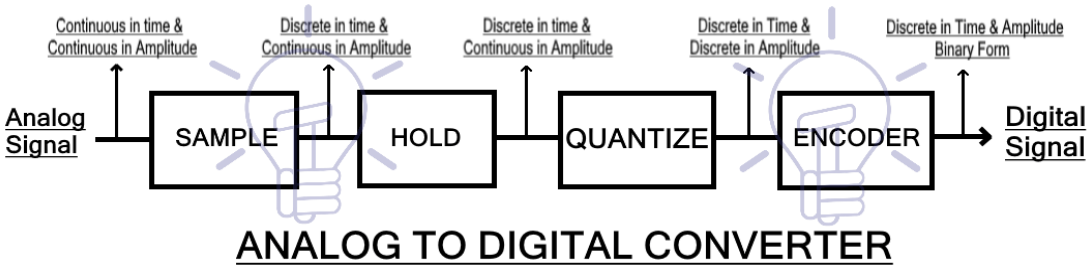
The idea of project involves implementation ADC for low power and with greater bandwidth of input signals using better architecture of ADC.

Block Diagram/Flowchart

The basic ADC function is shown in figure. This could also be referred to as a quantizer. Most ADC chips also include some of the support circuitry, such as clock oscillator for the sampling clock, reference (REF), the sample and hold function, and output data latches. In addition to these basic functions, some of these ADC's have additional circuitry built in. These functions include multiplexers, sequencers, auto-calibration circuits, programmable gain amplifiers (PGAs), etc.



The general block diagram for ADC is as shown in fig.,



ANALOG TO DIGITAL CONVERTER

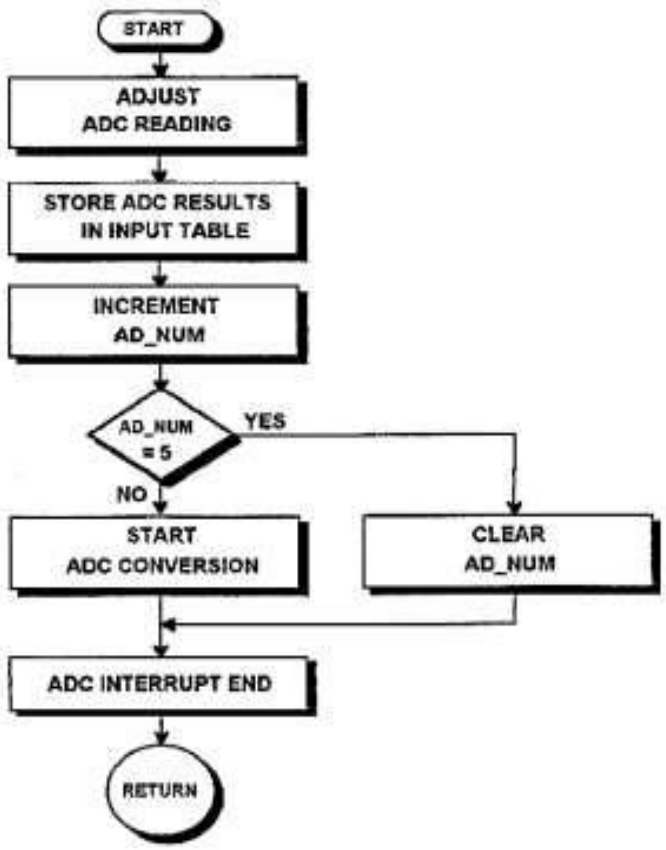
An ADC may also provide an isolated measurement such as an electronic device that converts an input Analog voltage or current to a digital number representing the magnitude of the voltage or current.

An ADC converts a continuous-time and continuous-amplitude analog signal to a discrete-time and discrete-amplitude digital signal. The conversion involves quantization of the input, so it necessarily introduces a small amount of error or noise. Furthermore, instead of continuously performing the conversion, an ADC does the conversion periodically, sampling the input, limiting the allowable bandwidth of the input signal.

Types of ADC's

1. FLASH ADC ARCHITECTURE
2. PIPELINED ADC ARCHITECTURE
3. DUAL SLOPE ADC ARCHITECTURE
4. DELTA-SIGMA ADC ARCHITECTURE
5. SUCCESSIVE APPROXIMATION ADC ARCHITECTURE

Flowchart for general ADC implementation



Applications

- **Cell phones** operate on the digital voice signal. Originally the voice is in analog form, which is converted through ADC before feeding to the cell phone transmitter.
- **Images** and **videos** captured using camera is stored in any digital device, is also converted into digital form using ADC.
- Medical Imaging like **x-ray** & **MRI** also uses **ADC** to convert images into Digital form before modification. They are then modified for better understanding.
- Music from the **cassette** is also converted into the digital form such as **CDs** and **thumb drives** using **ADC** converters.
- **Digital Oscilloscope** also contains **ADC** for converting Analog signal into a digital signal for display purposes & different other features.
- **Air conditioner** contains **temperature sensors** for maintaining the room temperature. This temperature is converted into digital form using ADC so that onboard controller can read & adjust the cooling effect.

In today's modern world, almost every device has become the **digital version** of itself & they need to have ADC in it. Because it must operate in digital domain which can be only acquired using **analog to digital converter (ADC)**.

Software Requirements

Cadence tool for the implementation and simulation of Verilog HDL.