INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION

Edited by

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Chapter 7

NYQUIST-RATE ANALOG-TO-DIGITAL CONVERTER

MA LI YA, SHEROZ KHAN, ANIS NURASHIKIN

An analog-to-digital converter (ADC) is a signal-processing electronic circuit device, which produces an equivalent digital output from an analog input. In this chapter, some typical Nyquist-rate ADCs (or traditional ADC) and their circuit designs are introduced.

7.1. ANALOG-TO-DIGITAL CONVERTER BUILDING BLOCK

An ADC is a device that takes in an analog signal as input, samples it at a certain rate, and quantizes the sampled input into its digital output signal. As shown in Fig. 7.1, it is a building block of a normal analog-to-digital converter. As we mentioned in the last chapter, the anti-aliasing filter limits the input spectral content to avoid aliasing during signal sampling. The sample and hold circuit samples the analog input signal at the each discrete time nT_s(the sampling frequency $f_s = 1/T_s$), and holds it over the sampling period, T. Then the quantizer approximates to fit the sampled signal's amplitude into one of the ADC's quantization levels. Finally, the binary encoder converts the digital signal to an n-bit binary code word.

ADCs are typically characterised by two important parameters, resolution and sampling rate. The resolution determines the number of bits in each sample output, and the sampling rate determines the maximum bandwidth of the sampled signal. ADCs can be categorized according to their sampling rate, namely Nyquist-rate converter and oversampling converter.

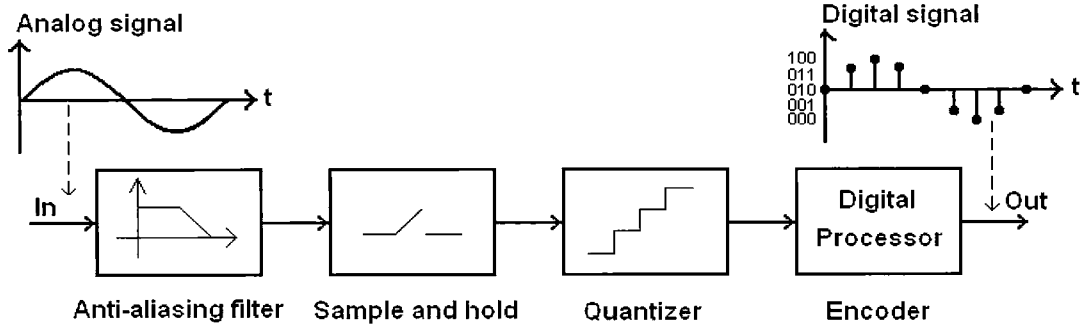

Fig. 7.1: Block diagram of a general ADC.