Data Conversion Chain — 20-02-2017

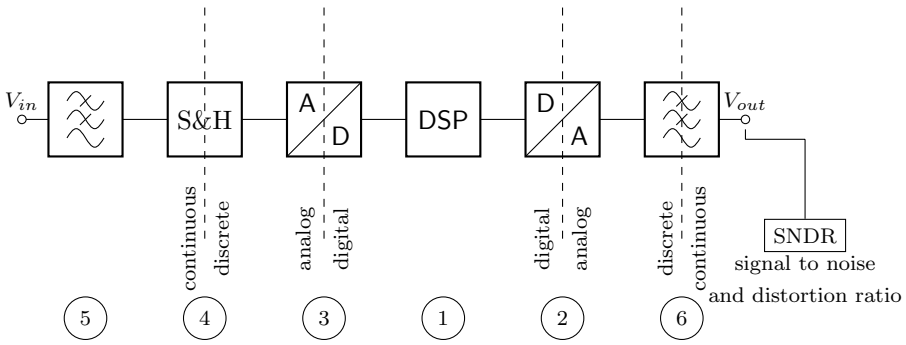

Figure 1: A typical signal chain

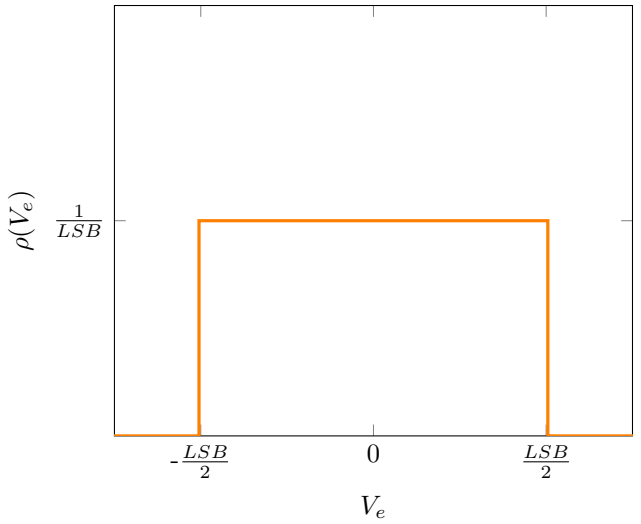

Figure 2: Probability density function of the quatizer error

(1) DSP

The equivalent ouput voltage can be expressed with 1. It's maximum can be described with 2

$$V_{eq} = V_{ref}\left(\sum_{i=1}^{N} b_i 2^{-i}\right) \tag{1}$$

$$V_{eq} = V_{ref}\left(1 - 2^{-N}\right) \tag{2}$$

This is a representation in UINT. In most realworld impelemntations INT using 2's complement is required. Sometimes if there is peak currents, Gray-Code is to be used to minimize peak currents!

The quantizer-error is defined with equation 3.

$$V_e = V_{in} - V_{eq} \tag{3}$$

Since the quantizer error has the probability density function of white noise[1], it can be depicted with the function seen in 2.

The white noise is assumed because the digital signal is a sequence of pulses. If this is fouriertransformed a constant spectral density is received.

[1] White noise means that the noise has the same amplitude for every frequency.

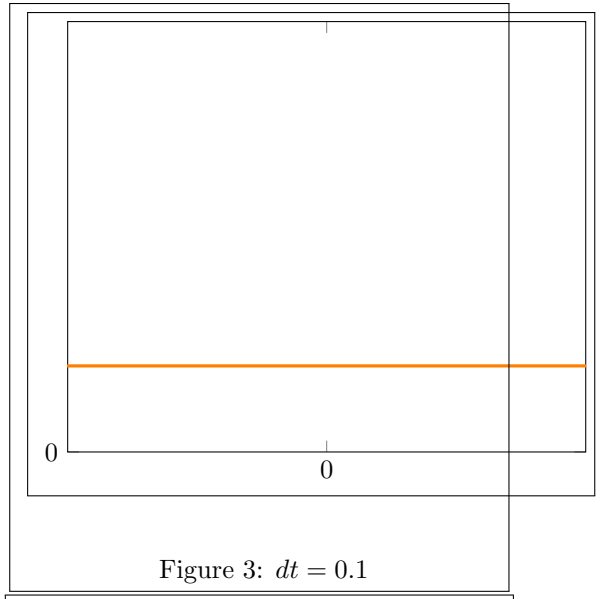

Figure 3: $dt = 0.1$

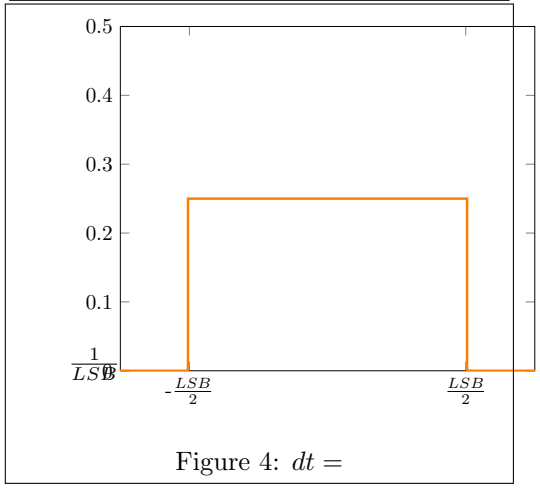

Figure 4: $dt =$

(2) **D/A**

(3) **A/D**

(4) **S&H**

(5)(6) **LP**