

EN2072

Assignment 1

A sinusoidal signal ($y(t)$) with frequency (f) 400 Hz and an amplitude (A) of 1 (a.u) is given in figure1. Consider a duration of 10 ms.

$$y(t) = A * \cos(2 * \pi * f * t)$$

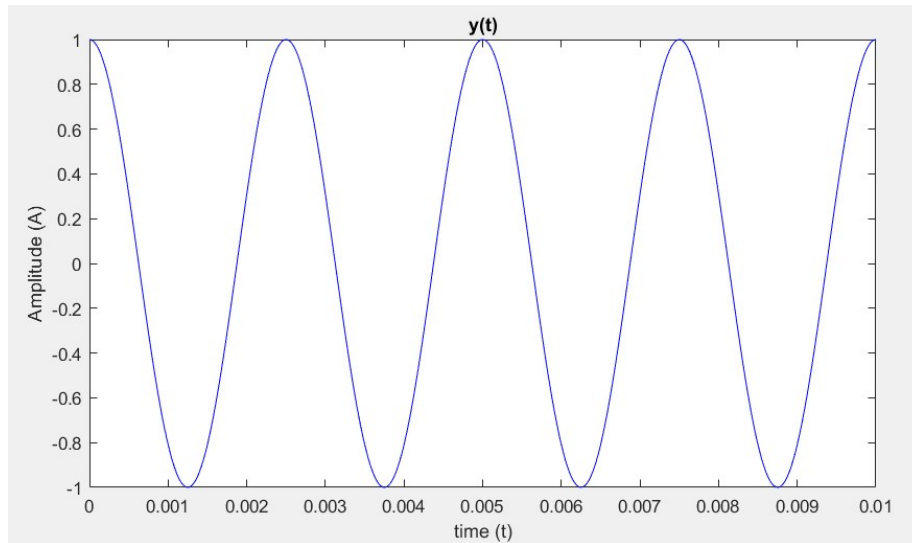


Figure 1

1. Obtain the plot of the given signal using matlab (for 10 ms duration).
2. Find the Nyquist sampling frequency (f_{nq}).
3. Sample the signal (use ideal sampling) at Nyquist sampling rate (f_{nq}) and plot the sampled signal using matlab.
4. Sample and plot the signal at 2 times Nyquist rate ($2f_{nq}$) and one-half of the Nyquist rate ($f_{nq}/2$) along with the signal sampled at Nyquist rate (f_{nq}) in the same plot. State your observations.
5. It is required to have a SN_qR ratio greater than 25dB. What is the minimum number of bits (n_b) required per a sample and number of minimum quantization levels (L) required?
6. Quantization output values are chosen to be the middle value in the relevant zone (figure 2). Write a matlab function to take a sampled value, number of quantization levels (L) and range (maximum amplitude) and to output the quantized value.

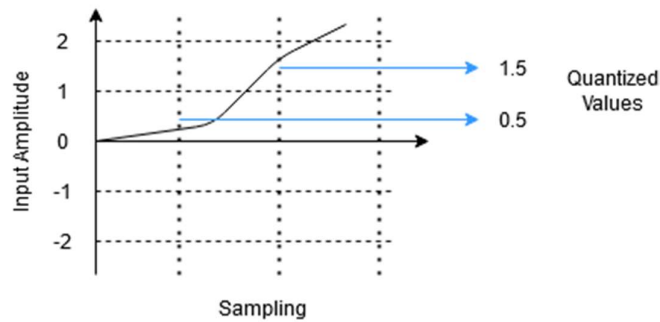


Figure 2

7. Sample the signal at 8 times Nyquist sampling frequency ($8f_{nq}$) and quantize it using above created function.
8. Quantize the sampled signal in 7 for $L*2$ and $L/2$ quantization levels. Plot the graphs and state your observations.