ADC of Raspberry Pi Pico

*Embedded system*

Assignment 1

Author: Wingren, Jesper

Examiner:Mehdi Saman Azari

Semester: 24HT

Course code: 2DT903

Exercise 1:

**Answer:**

We have the frequencies 1.75, 2 and 3 kHz which gives us a fmax of 3 kHz. Using the Nyquist theorem, we can decide the “best” sampling rate according to it. The Nyquist theorem is that fs ≥ fmax \* 2 = 3 \* 2 = 6 kHz. Giving us a sample frequency of 6 kHz and combined with our given sampling frequency of 5 kHz we can compare using the theorem fs ≥ 6 kHz, replacing fs with 5 kHz gives us that its less leading to aliasing meaning we will not be able to perfectly reconstruct the original signal.

Exercise 2:

**Answer:**

To begin with a 4-bit adc includes 16 levels ranging from 0 to 15 with 0000 to 1111.

Using and Vmax = 5, Vmin = 0.5 we get that the step size is equal to 0,3 V.

Using the midpoint 2,9V and 1000 code we construct the following diagrams.

En bild som visar text, handskrift, Teckensnitt, linje

Automatiskt genererad beskrivningEn bild som visar text, handskrift, Teckensnitt, linje

Automatiskt genererad beskrivningEn bild som visar text, handskrift, linje, Teckensnitt

Automatiskt genererad beskrivningEn bild som visar text, handskrift, Teckensnitt, linje

Automatiskt genererad beskrivning

Exercise 3:

Question 1:

**Answer:**

To calculate the sampling frequency, we first need to compute the conversion time using . We already know the number of cycles which is 96 and to calculate the clock period we take that is 48 MHZ giving us a clock period of 20.85 ns. This then gives us the conversion time of 2 μs which then is used to calculate the sampling frequency. .

Question 2:

**Answer:**

The number of levels can be calculated by 212 giving it 4096 levels. Due to the pico ADC having a Vmax of 3.3 V and a Vmin of 0 V. 0.0008 V = 0.8 mV. So, the Raspberry pi has a resolution of 12 bits meaning it can distinguish 4096 different levels of voltage.

Question 3:

**Answer:**

To get the voltage values and the digital values of the input analog signal a raspberry pi Pico, wires and a potentiometer was used with the given answers shown in the console.

Here is a picture of the setup followed by the code.

En bild som visar Elkabel, elektronik, Elektrisk ingenjörskonst, kabel

Automatiskt genererad beskrivning

En bild som visar text, skärmbild, Teckensnitt

Automatiskt genererad beskrivning

Below are the results printed when turning the potentiometer:

En bild som visar text, bok, papper, Publikation

Automatiskt genererad beskrivning