Exercise Report

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| **Subject of this exercise:** | “A/D and D/A converters” (#7) |
| **Students:** | <me>  <myself>  <I> |
| **Course/code:** | <course>, <group> |
| **Date & time:** | 20<YY>. <MM>. <DD>. |
| **Lecturer today:** |  |

Equipment in use, device under test

|  |  |  |
| --- | --- | --- |
| Oscilloscope | Agilent 54622A | MY4< > |
| Signal generator | Agilent 33220A | MY4< > |
| Digital multimeter (6½ digit) | Agilent 33401A | MY4< > |
| Analog Devices MicroConverter Evaluation Board | VIK-II-07 | W/O No.: < > Unit No.: < > |

Exercises

1. DAC - static characteristics

1.1. Measure the offset and the amplification error (linearity) with a high-precision multimeter!

What we have done is the following:

This is how we measured/calculated the offset and the LSB values:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Input code* | *Measured Voltage* |  |  | *Calculated Voltage* |
| 0 |  |  | Offset: |  |
| 4095 |  |  | LSB: |  |

1.2. Measure the output Voltage of the “DAC1” D/A Converter at some smartly chosen values within the whole input range!   
Use MATLAB to plot the so-called *endpoint-line* (the line segment that is fitted between the two endpoints of the transfer function), and then illustrate and point out the differences (if any) with the real characteristics!   
Determine the integral non-linearity (INL); scale all results with LSB!

We have wired up things like this:

We have used these input codes and yielded these output values:

We have made this MATLAB code to plot the nice figures below:

%MATLAB code

The transfer characteristics (fitted onto some smartly chosen input/output values) and the endpoint-line:

The INL-plot:

See below what we have learnt here:

1.3. Measure the output Voltage of the “DAC1” D/A Converter at some neighboring input codes, and evaluate the differential non-linearity (DNL); use LSB again for scaling all results!

Wiring remained the same. If someone wants to repeat this measurement any time in the future, then these steps have to be carried out:

Now we have made this MATLAB code to plot the nice figures below:

%MATLAB code

The DNL-plot:

We have understood here that ... .

2. DAC - dynamic characteristics (settling time, glitch)

2.1. Measure the settling time of both the “DAC0” and the “DAC1” outputs when input code is changing from 0 to . Observe the output results on the oscilloscope!

We have wired up things like this:

That’s what we can see on the oscilloscope:

We again learnt here something:

2.2. Measure the glitch area on the “DAC1” output when input code is changing from 0111…1 to 1000…0!

The wiring was changed:

Oscilloscope had these nice figures:

This was new for us:

3. Quantization error

Compare the two DAC output for a sine wave when one output is quantized down to 4 bits only! Observe the quantization error (the difference of the two signals) as well!

Wiring:

This is what we can see:

The thing we will always remember from doing this is the following:

4. A/D converter

Sample some periods of a sine wave signal with proper frequency!   
Plot the histogram of the output with MATLAB, and compare it with the histogram of an ideal sine wave!

Wiring:

MATLAB turned to be very useful because we can write this:

%MATLAB code

... and have got this:

And, at last, now we know this:

The End.