

Oefenopgaven EE1320 Meettechniek

– college 5: Analooq-digitaal omzelters¹

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Regtien: opgave 15.10, 15.11, 18.2, 18.6, 18.12, 18.13

4.5 What is the minimum sampling frequency required for unambiguous signal reconstruction, in case of a signal $1 \cdot \sin(\omega t)$ with 10% 3rd harmonic distortion and 2% 5th harmonic distortion.

4.7 The inaccuracy of a Successive Approximation ADC depends on discharging of the hold capacitor in the sample-and-hold switch during conversion. Calculate the maximum acceptable voltage drop in a 10-bit conversion for a conversion time per bit equal to 10 μs , $C_h = 1 \text{ nF}$ and a droop current $I_{\text{droop}} = 1 \text{ nA}$.

4.8 The following statements are made with respect to operation of the Successive Approximation ADC:

1. The SA ADC reveals a high PSRR in case of a clock frequency equal to an integer multiple of the mains frequency.
2. The SA ADC requires a sample-and-hold switch to avoid errors due to glitches in the input signal.

Select the correct answer:

- a. Statement 1 is false and statement 2 is false
- b. Statement 1 is false and statement 2 is true
- c. Statement 1 is true and statement 2 is true
- d. Statement 1 is true and statement 2 is false

¹ De weergegeven opgaven die niet uit Regtien komen zijn afkomstig uit R.F. Wolffenbuttel, "Measurement of Electrical and Non-electrical quantities", editie 2010.

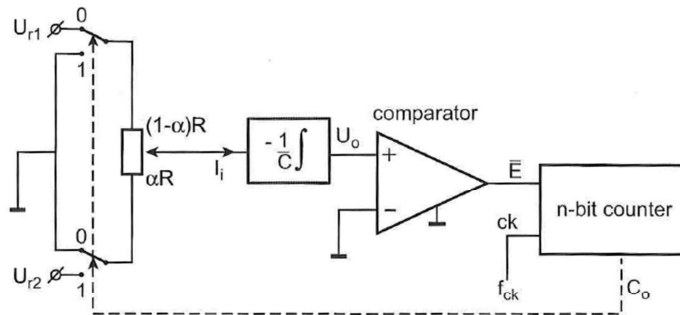


Figure 4.27, Using the dual-slope ADC for angular position sensor readout.

A modified dual-slope ADC structure is used for angular encoding of α of a potentiometric sensor ($0 \leq \alpha \leq 1$, see Section 5.5), as shown in Fig. 4.27. The integrator has an ideal current sensing input ($Z_i = 0$) and supplies an output voltage, U_o , proportional to the time-integrated input current, I_i . The switches are operated simultaneously using digital control line c_0 . During the constant period $T_0 = 2^n / f_{ck}$, S_1 and S_2 are in position '0'. During the subsequent counting period T_1 , S_1 and S_2 are in the position '1' and the integrator is discharged until the level $U_o = 0$ is detected in the comparator.

4.12 Express T_1 in T_0 and α in case of reference voltages equal in absolute value:
 $U_{r1} = -U_{r2} = U_r$