Exercise 5: DA Converters

Purpose of the lecture is to get familiar with:

- D/A converter realized with resistor divider
- DNL and INL calculations of D/A converters

Exercise 1: Prepare the DAC model realized with resistor divider and calculate the DNL and INL.

Figure 1 shows 3 bits DAC realized with resistor divider. Realize DAC model in Matlab environment. The model is shown in Figure 1. Plot the ideal and real DAC transfer functions and calculate DNL, DNL_rms and INL. Unit resistor R0 is equal to 10kΩ. Instead of binary values (b_0, b_1, b_2) use numbers from 0 to 7 which should be used for calculation of output voltage. The DAC reference voltage V_{ref} is 2V.

Tabel 1: Ideal and real DAC data

Input code	Ideal DAC output voltage	Real DAC output voltage	DNL	INL
0				
1				
2				
3				
4				
5				
6				
7				

DNL_rms=

$$V_{out}(k) = V_{ref} \cdot \frac{\sum_{i=1}^{k} R(k)}{\sum_{i=1}^{N+1} R(k)}; k = 1...N$$

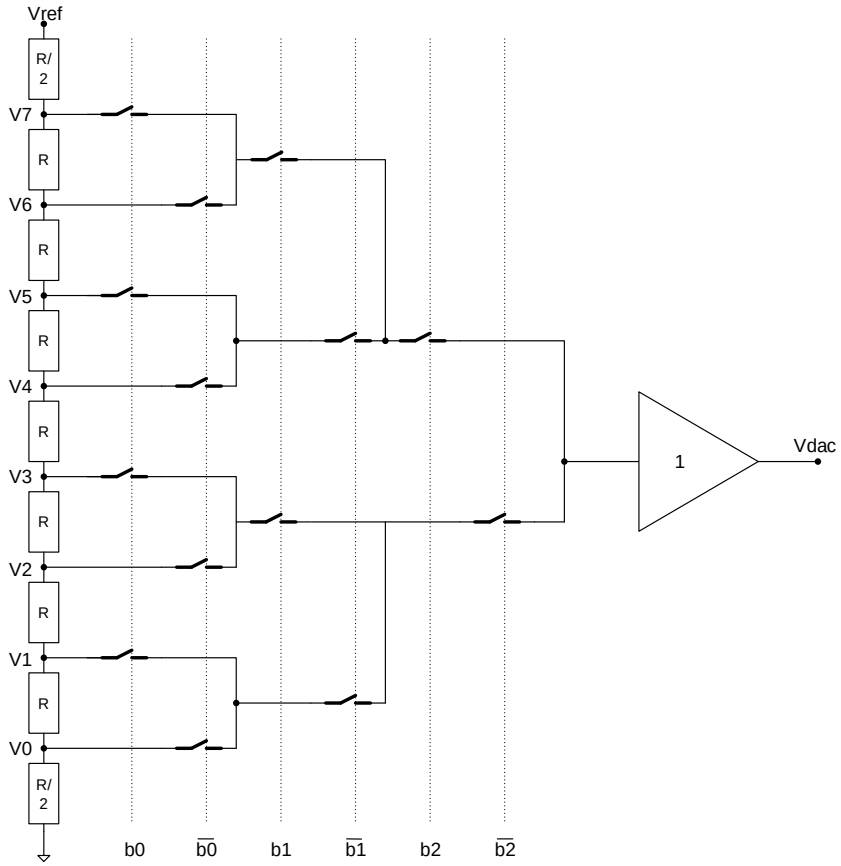

Figure 1: 3-bits DAC, realized with resistor divider.

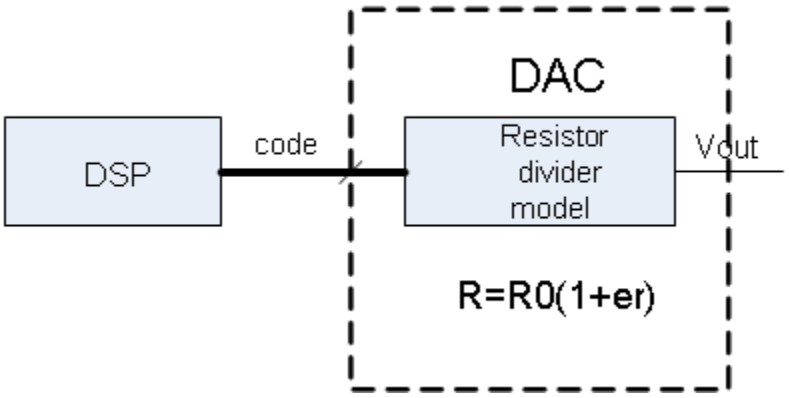

Figure 2: DAC realization in Matlab environment.

$$R_i = R_0\left(1+\varepsilon_r\right)$$

To model real resistance use relative error ε_r, which should be generated with Matlab code below:

```
eps_r=log((1:length(R)).^2).*0.1;
```