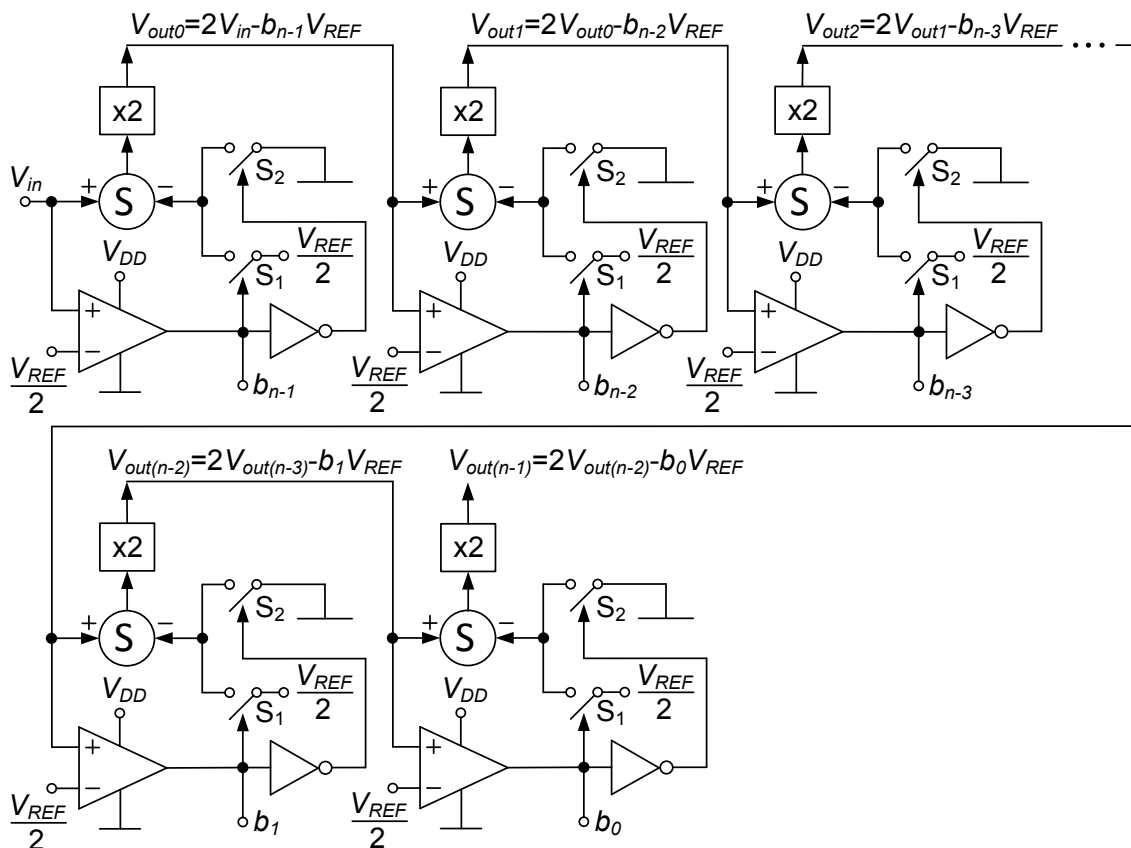


zadatak 1

Utvrđiti rezultat *pilepline* algoritamske analogno-digitalne konverzije, slika 1, 7-bitne rezolucije, za ulazni napon:

- a) $V_{in}=830 \text{ mV}$,
- b) $V_{in}=435 \text{ mV}$,
- c) $V_{in}=98 \text{ mV}$.

Poznat je referentni napon $V_{REF}=1 \text{ V}$.



Slika 1

Rješenje

a)

$$V_{in}=0.83 \text{ V} > V_{REF}/2 \Rightarrow b_6=1 \Rightarrow V_{out0}=2V_{in}-V_{REF}=0.66 \text{ V}$$

$$V_{out0}=0.66 \text{ V} > V_{REF}/2 \Rightarrow b_5=1 \Rightarrow V_{out1}=2V_{out0}-V_{REF}=0.32 \text{ V}$$

$$V_{out1}=0.32 \text{ V} < V_{REF}/2 \Rightarrow b_4=0 \Rightarrow V_{out2}=2V_{out1}=0.64 \text{ V}$$

$$V_{out2}=0.64 \text{ V} > V_{REF}/2 \Rightarrow b_3=1 \Rightarrow V_{out3}=2V_{out2}-V_{REF}=0.28 \text{ V}$$

$$V_{out3}=0.28 \text{ V} < V_{REF}/2 \Rightarrow b_2=0 \Rightarrow V_{out4}=2V_{out3}=0.56 \text{ V}$$

$$V_{out4}=0.56 \text{ V} > V_{REF}/2 \Rightarrow b_1=1 \Rightarrow V_{out5}=2V_{out4}-V_{REF}=0.12 \text{ V}$$

$$V_{out5}=0.12 \text{ V} < V_{REF}/2 \Rightarrow b_0=0 \Rightarrow V_{out6}=2V_{out5}=0.24 \text{ V}$$

Dakle, na izlazu analogno-digitalnog konvertora je **1101010**.

$$V_{in} = \frac{\sum_{i=0}^{n-1} 2^i b_i}{2^n} V_{REF} = \frac{2^0 \cdot 0 + 2^1 \cdot 1 + 2^2 \cdot 0 + 2^3 \cdot 1 + 2^4 \cdot 0 + 2^5 \cdot 1 + 2^6 \cdot 1}{128} \cdot 1 \text{ V} = 0.828125 \text{ V}$$

b)

$$V_{in} = 0.435 \text{ V} < V_{REF}/2 \Rightarrow b_6 = 0 \Rightarrow V_{out0} = 2V_{in} = 0.87 \text{ V}$$

$$V_{out0} = 0.87 \text{ V} > V_{REF}/2 \Rightarrow b_5 = 1 \Rightarrow V_{out1} = 2V_{out0} - V_{REF} = 0.74 \text{ V}$$

$$V_{out1} = 0.74 \text{ V} > V_{REF}/2 \Rightarrow b_4 = 1 \Rightarrow V_{out2} = 2V_{out1} - V_{REF} = 0.48 \text{ V}$$

$$V_{out2} = 0.48 \text{ V} < V_{REF}/2 \Rightarrow b_3 = 0 \Rightarrow V_{out3} = 2V_{out2} = 0.96 \text{ V}$$

$$V_{out3} = 0.96 \text{ V} > V_{REF}/2 \Rightarrow b_2 = 1 \Rightarrow V_{out4} = 2V_{out3} - V_{REF} = 0.92 \text{ V}$$

$$V_{out4} = 0.92 \text{ V} > V_{REF}/2 \Rightarrow b_1 = 1 \Rightarrow V_{out5} = 2V_{out4} - V_{REF} = 0.84 \text{ V}$$

$$V_{out5} = 0.84 \text{ V} > V_{REF}/2 \Rightarrow b_0 = 1 \Rightarrow V_{out6} = 2V_{out5} - V_{REF} = 0.68 \text{ V}$$

Dakle, na izlazu analogno-digitalnog konvertora je **0110111**.

$$V_{in} = \frac{\sum_{i=0}^{n-1} 2^i b_i}{2^n} V_{REF} = \frac{2^0 \cdot 1 + 2^1 \cdot 1 + 2^2 \cdot 1 + 2^3 \cdot 0 + 2^4 \cdot 1 + 2^5 \cdot 1 + 2^6 \cdot 0}{128} \cdot 1 \text{ V} = 0.4296875 \text{ V}$$

c)

$$V_{in} = 0.098 \text{ V} < V_{REF}/2 \Rightarrow b_6 = 0 \Rightarrow V_{out0} = 2V_{in} = 0.196 \text{ V}$$

$$V_{out0} = 0.196 \text{ V} < V_{REF}/2 \Rightarrow b_5 = 0 \Rightarrow V_{out1} = 2V_{out0} = 0.392 \text{ V}$$

$$V_{out1} = 0.392 \text{ V} < V_{REF}/2 \Rightarrow b_4 = 0 \Rightarrow V_{out2} = 2V_{out1} = 0.784 \text{ V}$$

$$V_{out2} = 0.784 \text{ V} > V_{REF}/2 \Rightarrow b_3 = 1 \Rightarrow V_{out3} = 2V_{out2} - V_{REF} = 0.568 \text{ V}$$

$$V_{out3} = 0.568 \text{ V} > V_{REF}/2 \Rightarrow b_2 = 1 \Rightarrow V_{out4} = 2V_{out3} - V_{REF} = 0.136 \text{ V}$$

$$V_{out4} = 0.136 \text{ V} < V_{REF}/2 \Rightarrow b_1 = 0 \Rightarrow V_{out5} = 2V_{out4} = 0.272 \text{ V}$$

$$V_{out5} = 0.272 \text{ V} < V_{REF}/2 \Rightarrow b_0 = 0 \Rightarrow V_{out6} = 2V_{out5} = 0.544 \text{ V}$$

Dakle, na izlazu analogno-digitalnog konvertora je **0001100**.

$$V_{in} = \frac{\sum_{i=0}^{n-1} 2^i b_i}{2^n} V_{REF} = \frac{2^0 \cdot 0 + 2^1 \cdot 0 + 2^2 \cdot 1 + 2^3 \cdot 1 + 2^4 \cdot 0 + 2^5 \cdot 0 + 2^6 \cdot 0}{128} \cdot 1 \text{ V} = 0.09375 \text{ V}$$