MEEC/MIEEC

Signal Conversion

SAR ADC Exploiting Split-CDAC

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1 ARRANJAR TITULO

Para analisar o circuit primeiro dividir porque é diferencial. e analisar primeiro o DacCirc Explicar que o codigo]e dividido em dois codigos Falar dos split caps

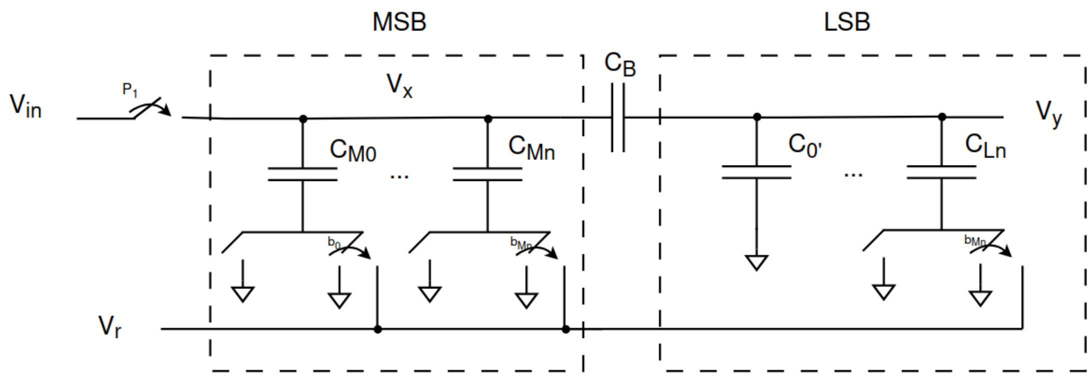
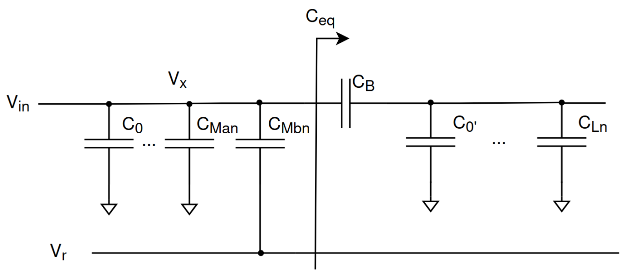


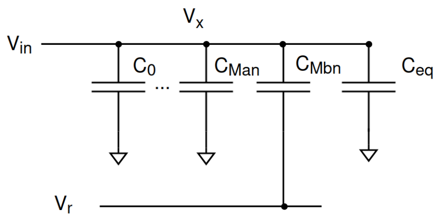
Figure 1: Simplified DAC circuit

explicar fases

1.1 Phase 1



(a) Complete Circuit



(b) Simplified Circuit

Figure 2: Phase 1 circuit

Where:

$$C_{eq} = C_B // \overbrace{\left(C_{0'} + \sum_{i=0}^{Ln} C_i \right)}^{S_{LC}} \tag{1}$$

$$\begin{aligned} Q_{\phi 1} &= V_x^{\phi_1} \cdot C_{M0} + V_x^{\phi_1} \cdot \sum_i C_{Mai} + (V_x^{\phi_1} - V_{ref}) \cdot \sum_i C_{Mbi} + V_x^{\phi_1} \cdot C_{eq} \\ &= V_x^{\phi_1} \left(C_{eq} + \underbrace{C_{M0} + \sum_i C_{Mai} + C_{Mbi}}_{S_{MC}} \right) - V_{ref} \cdot \sum_i C_{Mbi} \end{aligned} \tag{2}$$

1.2 Phase 2

Dizer que pode ser analisado sem split

For the second phase the capacitors are either connected to ground or V_{ref} METER REF AO CIRCUIT COM OS NOS VX e VY. Therefore:

$$Q_{Mn} = (V_x^{\phi_1} - V_{ref} \cdot b_{Mn}) \cdot C_{Mn} \tag{3}$$

The equation 3 represents the charge stored on the capacitor C_{Mn}, where the subscript Mn denotes the n-th bit capacitor within the MSB code block, and the term b_{Mn} is the value associated with the mentioned bit.

$$\begin{aligned} Q_{\phi_2} &= (V_x^{\phi_2} - V_{ref} \cdot b_{Mn}) \cdot C_{Mn} + (V_x^{\phi_2} - V_y^{\phi_2}) \cdot C_B \Leftrightarrow \\ \Leftrightarrow Q_{\phi_2} &= V_x^{\phi_2} \left[C_B + \sum_{n=0}^{Mn} C_{Mn} \right] - V_y^{\phi_2} \cdot C_B - V_{ref} \cdot \underbrace{\sum_{n=0}^{Mn} C_{Mn} b_{Mn}}_{S_{MB}(code)} \end{aligned} \tag{4}$$

Now V_y can easily be analysed with superposition:

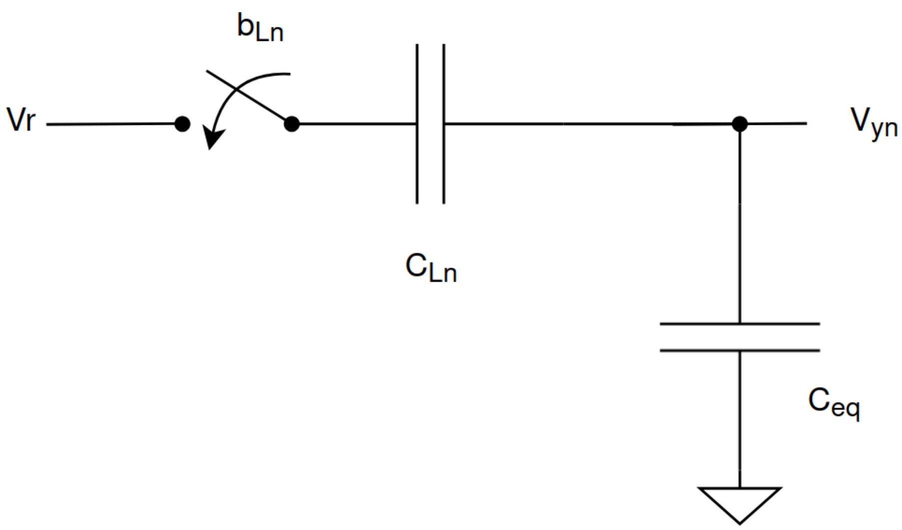


Figure 3: V_y superposition circuit ARRANJAR OUTRO TITULO

EXPLICAR

It is important to note that there is a special case for the source V_x.

$$V_{yn}^{\phi_2} = \frac{C_{Ln}}{C_B + C_{B0'} + \sum_i C_{Li}} \cdot b_{Ln} \cdot V_{ref} \tag{5}$$

$$
\begin{aligned}
V_y^{\phi_2} &= V_x^{\phi_2}\frac{C_B}{C_B + C_{0'} + \sum_i C_{Li}} + \sum V_{yn}^{\phi_2} = \\
&= \frac{V_x^{\phi_2}\cdot C_B + V_{ref}\cdot \overbrace{\sum_i b_{Li}\cdot C_{Li}}^{S_{LB}}}{C_B + C_{0'} + \sum_i C_{Li}}
\end{aligned} \tag{6}
$$

Solving the equations ... meter ponte e palha
python:

$$
\boxed{V_x(code) = V_i + V_{ref}\frac{S_{MB}(code)\cdot(C_B + S_{LC}) + S_{LB}(code)\cdot C_B - S_{LC}\cdot\sum C_{Mbi}}{C_B(S_{LC} + S_{MC}) + S_{LC}S_{MC}}} \tag{7}
$$

References