1. GmC biquad transfer function

\[
H(s) = \frac{V_{\text{out}}(s)}{V_{\text{in}}(s)} = \frac{s^2 \left( \frac{C_X}{C_X + C_B} \right) + s \left( \frac{G_{m5}}{C_X + C_B} \right) + \left( \frac{G_{m2} G_{m4}}{C_A (C_X + C_B)} \right)}{s^2 + s \left( \frac{G_{m3}}{C_X + C_b} \right) + \left( \frac{G_{m1} G_{m2}}{C_A (C_X + C_B)} \right)}
\]

We want a lowpass transfer function

\[
H(s) = \frac{k_o}{s^2 + \frac{a_h}{Q} s + a_o^2}
\]

with \( a_h = 2\pi \times 10\,\text{MHz} \), \( Q = 1 \), and \( k_o / a_o^2 = 5 \).

Take all capacitances in the circuit to be a reasonable value; for example \( C = 5\,\text{pF} \). We must now find \( G_{m\cdot m4} \):

\[
G_{m1} = G_{m3} = a_h C = 0.314\,\text{mA/V}
\]
\[
G_{m3} = a_h C / Q = 0.314\,\text{mA/V}
\]
\[
G_{m4} = k0 C / a_h = 5 \times G_{m\cdot m3} = 1.57\,\text{mA/V}
\]

We have to choose \( G_{m5} = 0 \) and \( C_X = 0 \).
\\[ C_n \cdot C_2 V_o(n) = C_2 V_o(n-1) - C_1 V_i(n) \]

\[ \Rightarrow C_2 V_o(z) = C_2 z^{-1} V_o(z) - C_1 V_i(z) \Rightarrow \frac{V_o(z)}{V_i(z)} = \frac{-C_1/C_2}{1 - z^{-1}} \]

1.5)

\( C_{p2} \) is always discharged since its voltage is virtually ground.

During \( \Phi_1 \), \( C_{p1} \) is charged to \( V_i(n)C_{p1} \).

This charge will be transferred to \( C_2 \) during \( \Phi_2 \). Therefore:

\( C_2 V_o(n) = C_2 V_o(n-1) - C_{p1} V_i(n-1) - C_1 \)

\[ \Rightarrow \frac{V_o(z)}{V_i(z)} = -\frac{C_1 + C_{p1}}{C_2} z^{-1} \]

\[ \frac{1}{1 - z^{-1}} \]