Calculation of A_{Ih}

$$A_{Ih} = -Z_A\left(G_{m2} - Y_C\right) = \frac{-G_{m2}R_1}{1 + s\left(C_C R_1 + C_C R_C + C_1 R_1\right) + s^2 R_C C_C R_1 C_1}$$

$$A_{Ih}(0) = -G_{m2}R_1$$

Study of the denominator: $D(s) = 1 + s\left(C_C R_1 + C_C R_C + C_1 R_1\right) + s^2 R_C C_C R_1 C_1$

Since: $R_1 >> R_C,\quad C_C >> C_1$ ⇨ $C_C R_1 + C_C R_C + C_1 R_1 \cong C_C R_1$

⇨ $D(s) \cong 1 + sC_C R_1 + s^2 R_C C_C R_1 C_1$

Poles: *D(s)*=0 ⇨ $$s_{p1}, s_{p2} = \frac{-C_C R_1 \pm \sqrt{\left(C_C R_1\right)^2 - 4R_C C_C R_1 C_1}}{2R_C C_C R_1 C_1}$$

Poles of A_{lh}

$$s_{p1}, s_{p2} = \frac{-C_C R_1 \pm \sqrt{\left(C_C R_1\right)^2 - 4 R_C C_C R_1 C_1}}{2 R_C C_C R_1 C_1} = \frac{-C_C R_1 \pm C_C R_1 \sqrt{1 - 4\frac{R_C C_1}{C_C R_1}}}{2 R_C C_C R_1 C_1}$$

Again, since: $R_1 >> R_C, \quad C_C >> C_1$ ⇒ $\frac{R_C C_1}{C_C R_1} << 1$ ⇒ $\sqrt{1 - 4\frac{R_C C_1}{C_C R_1}} \cong 1 - 2\frac{R_C C_1}{C_C R_1}$

$$s_{p1}, s_{p2} \cong \frac{-C_C R_1 \pm C_C R_1 \left(1 - 2\frac{R_C C_1}{C_C R_1}\right)}{2 R_C C_C R_1 C_1}$$

$$\begin{cases} s_{p1} \cong \dfrac{-2 R_C C_1}{2 R_C C_C R_1 C_1} = -\dfrac{1}{C_C R_1} \\ s_{p2} \cong \dfrac{-2 R_1 C_C + 2 R_C C_1}{2 R_C C_C R_1 C_1} \cong -\dfrac{1}{R_C C_1} \end{cases}$$

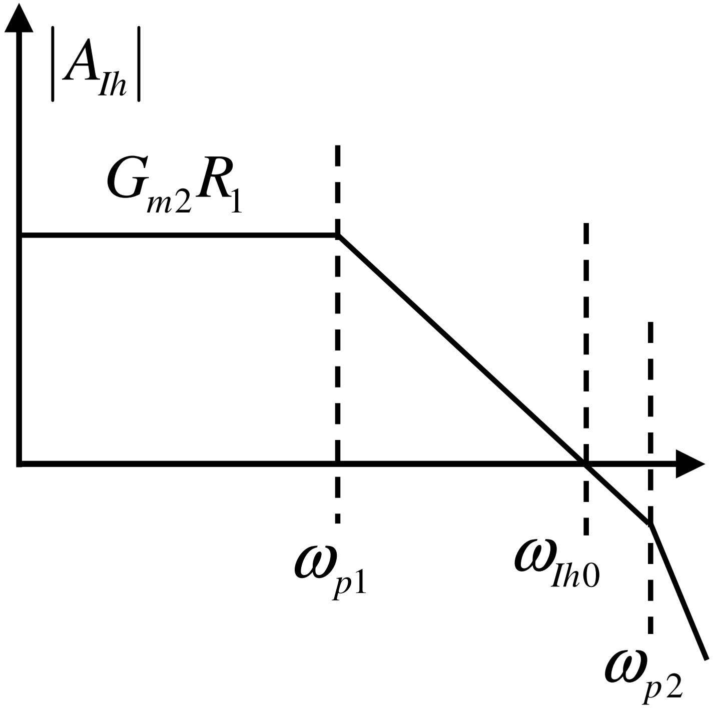
Frequency response of A_{Ih}

$$\begin{cases} \omega_{p1} \cong \dfrac{1}{C_C R_1} \\ \omega_{p2} \cong \dfrac{1}{R_C C_1} \end{cases}$$

$R_1 >> R_C, \quad C_C >> C_1$ ⇒ $\omega_{p1} << \omega_{p2}$

$$A_{Ih} \cong \frac{-G_{m2}R_1}{\left(1+\dfrac{j\omega}{\omega_{p1}}\right)}$$

Up to frequencies $\omega < \omega_{p2}$



$|A_{Ih}| \cong 1$ for:

$$\omega = \omega_{Ih0} \cong G_{m2}R_1\omega_{p1}$$

$$\omega_{Ih0} \cong G_{m2}R_1 \frac{1}{C_C R_1} = \frac{G_{m2}}{C_C}$$

Considerations:

with $R_C = \frac{1}{G_{m2}} : \omega_{Ih0} < \omega_{p2}$ the hypothesis of considering a single pole up to ω_{Ih0} is reasonable.

Recalling:
$$\begin{cases} \omega_2 \cong \frac{G_{m2}}{C_2} : \text{first non-dominant pole of the op-amp} \\ \omega_0 < \omega_2 : \text{0-dB pulsation of the op-amp} \end{cases}$$

And considering that, generally: $C_C \leq C_2$ ⇨ $\omega_{Ih0} = \frac{G_{m2}}{C_C} \geq \omega_2 > \omega_0$

This demonstrates that A_{Ih} becomes unity at frequencies well over the 0-dB frequency of the op-amp. Then, $|A_{Ih}|$ is well greater than 1 for frequencies up to the GBW of the amplifier.