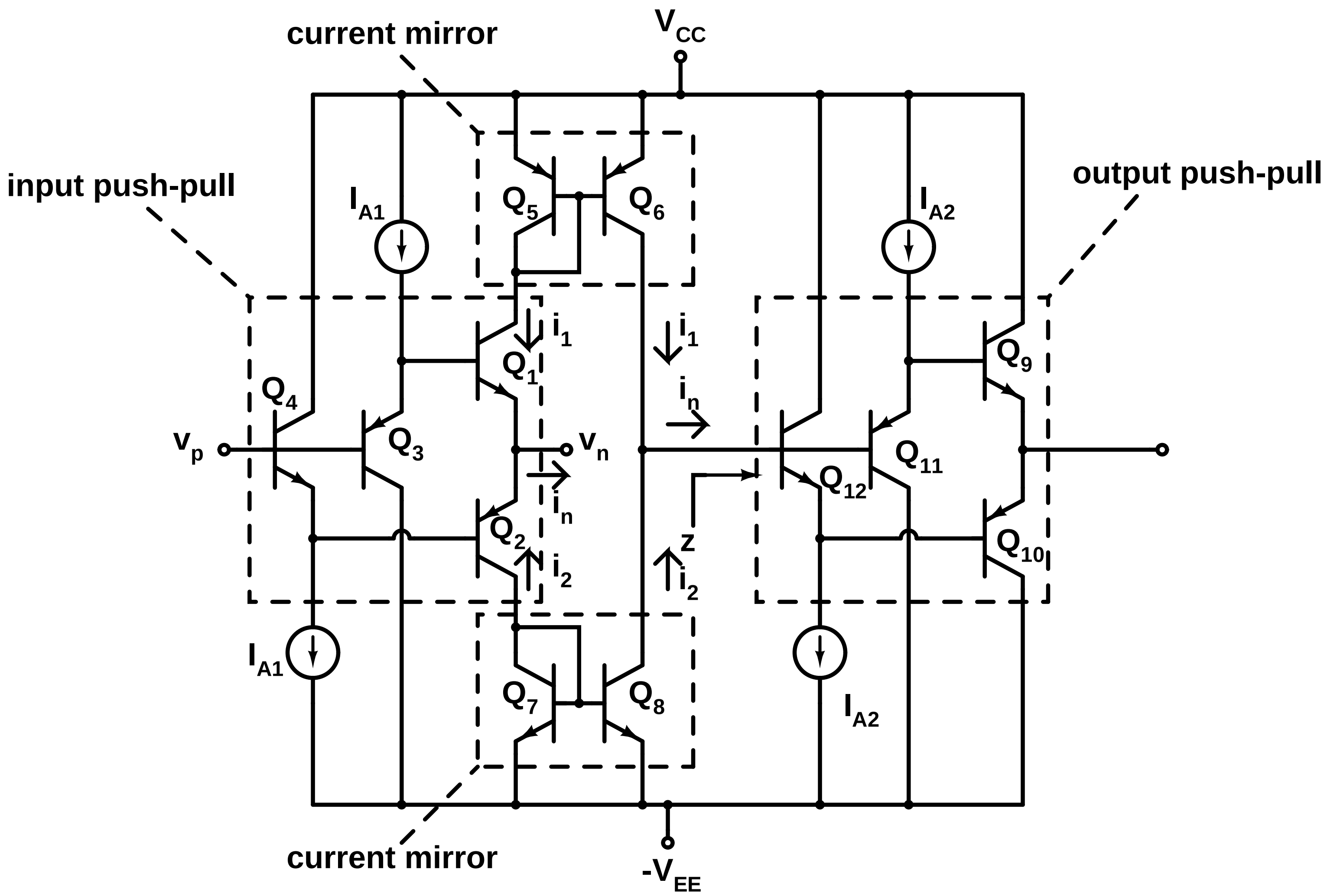
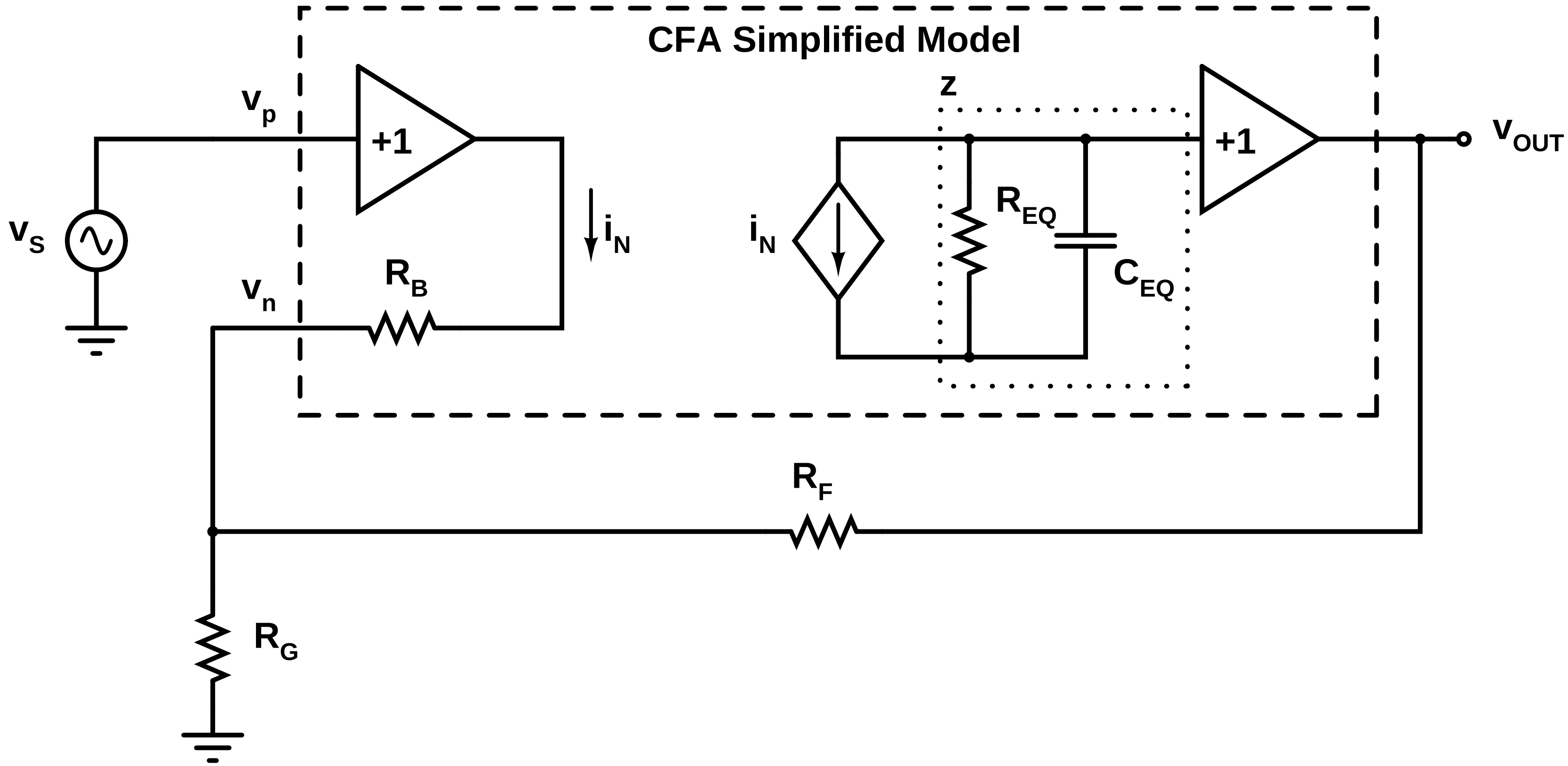
Current-feedback Amplifiers



- v_n follow v_p unconditionally
- v_p: high input impedance and low bias current
- v_n: low impedance and high current sourcing/sinking capability
- $i_n \approx 0$ during quescient operation (only error current)
- i_n is mirrored into the output section
- $v_{OUT} = z i_n$
- z is the *transimpedance gain* (like open-loop gain in VFA)

Simplified Model



- Assume $i_p = 0,\ v_p = v_n,\ R_B \approx 0$
- $v_{OUT} = z i_n$
- $v_S = \left(\frac{v_{OUT} - v_S}{R_F} + \frac{v_{OUT}}{z}\right) R_G$
- $v_S \left(\frac{1}{R_G} + \frac{1}{R_F}\right) = \left(\frac{1}{R_F} + \frac{1}{z}\right) v_{OUT}$
- Assuming $z \gg R_F$,

$$\frac{v_{OUT}}{v_S} = \frac{\frac{1}{R_G} + \frac{1}{R_F}}{\frac{1}{R_F} + \frac{1}{z}} = \left(1 + \frac{R_F}{R_G}\right) \frac{1}{1 + \frac{R_F}{z}} \approx 1 + \frac{R_F}{R_G}$$

Bandwidth

- Since $z = \frac{R_{EQ}}{1+sR_{EQ}C_{EQ}}$

$$A(s) = \left(1 + \frac{R_F}{R_G}\right) \frac{1}{1 + \frac{R_F}{R_{EQ}} + sR_F C_{EQ}} \approx A_0 \frac{1}{1 + sR_F C_{EQ}}$$

  where $A_0 = 1 + \frac{R_F}{R_G}$.

- Select bandwidth with R_F, gain with R_G.

- Notice that stability is determined by loop gain $a\beta = \frac{z}{R_F}$.

- R_F should never be zero since then $a\beta \to \infty$.

- R_F is key for stability; optimal value for R_F is about $1k\Omega$.