Krummenacher loop

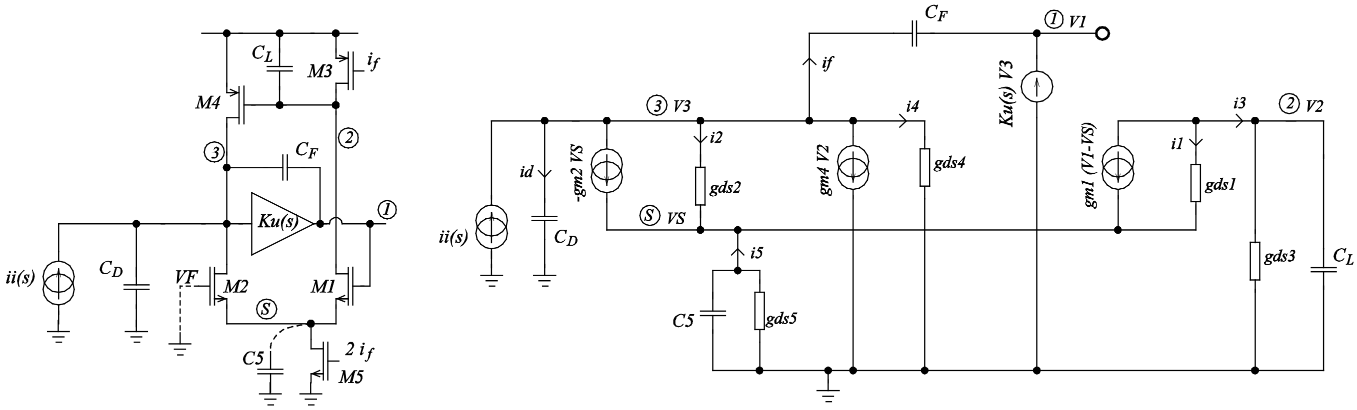

Fig1. Krummenacher feedback for n+-on-p- detectors.

Transmittance function T(s)=V1(s)/ii(s) can be found solving following equations.

Voltages:

$V1 = Ku(s)V3$ $\qquad\qquad Ku(s) = -\frac{Ku}{1+s\,\tau_{P0}}$

Currents:

$i1 = gds1\ (V2 - VS)$

$i2 = gds2\ (V3 - VS)$

$i3 = (gds3 + s\ Cl)\ V2$

$i4 = \ gds4\ V3$

$i5 = -(gds5 + s\ C5)\ VS$

$if\ = s\ Cf\ (V3 - V1)$

$id\ = s\ Cd\ V3$

Currents at N2;

$gm1\ V1 + i1 + i3 = 0$

Currents at NS:

$-gm2\ VS + i2 + i5 + gm1\ (V1 - VS) + i1 = 0$

Currents at N3;

$ii - id + gm2\ VS - i2 - \ if\ - gm4\ V2 - i4 = 0$

Assumption: $g_{m1} = g_{m2} = g_{m1,2}$

Assuming that the circuit is stable i.e. all poles are well separated one can find the zeroes and poles of the circuit:

$$Z_1 = \frac{g_{ds1} + g_{ds3}}{Cl}$$

$$Z_2 = 2\,\frac{g_{m1,2}}{C5}$$

$$P_1 \approx 2\,\frac{g_{m4}}{Cl}$$

$$P_2 \approx \frac{g_{m1,2}}{2\,Cf}$$

$$P_3 \approx 2\,\frac{g_{m1,2}}{C5}$$

$$P_4 \approx \frac{Cf\ Ku}{Cd\ \tau_{P0}} = \frac{Cf}{Cd} GBP$$