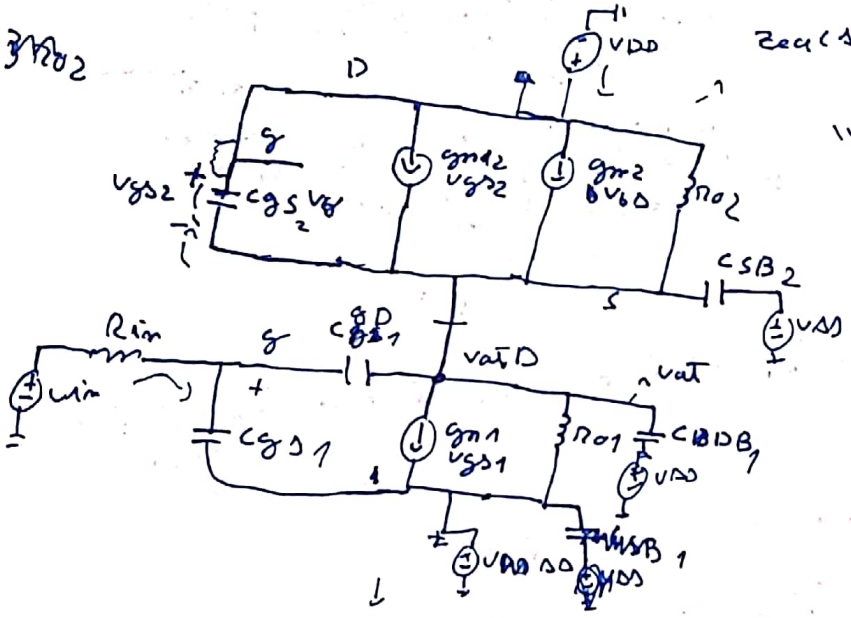
CS - diode - mos stage

$\frac{1}{g_{m2}+g_{mb}+\frac{1}{r_{o2}}} = Zeq\,1$

→ as small signal controlled BY $\frac{W}{n}$ equal to resistio

Low frequenc

"high" frequenc



$Zeq(1) = \frac{1}{g_{m2}+g_{mb}+\frac{1}{r_{o2}} + r_{o2}C_{gs}+v} = \frac{1}{g_{m2}+g_{mb}+\frac{1}{Zeq}}$

$= \frac{R}{\frac{R_{o2}}{R_{o2}(g_{DD2}+1)}}$

↓

Aprox The same results with an added resistance

↓

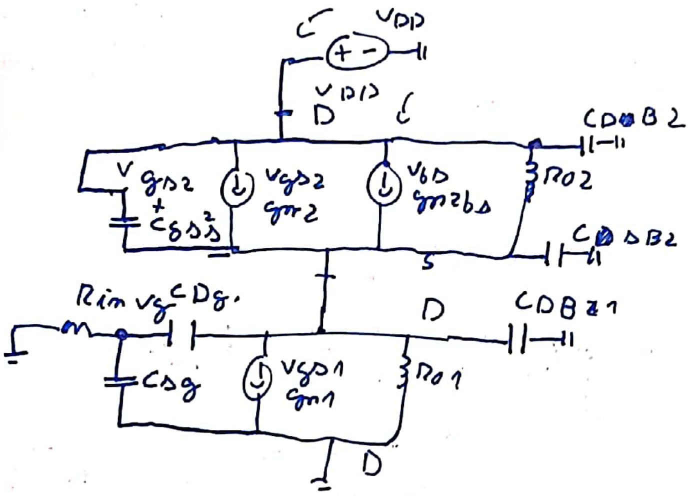
It negates The A- gain

A+ equal To Resistance
But RD its a for low a frequency Dependent part making The gain drop

A−)

A+ gain

$$\frac{R_{o2}}{R_{o2} C_{gs} s + 1} = Z_{eq1}$$



$$g_{m2}(V_{DD} - V_{out}) + g_{m2}(V_{out}) + \frac{V_{DD} - V_{out}}{Z_{eq1}} + C_{DB2} V_{DD} = 0$$

sum of currents at vg

$$\frac{V_g}{R_S} + (V_g) C_{Sg} + (V_g - V_{out}) C_{Dg} s = 0$$

$$V_g = \frac{V_{out} C_{Dg} s}{\frac{1}{R_{in}} + C_{Sg} s + C_{Dg} s} = \frac{V_{out}}{\frac{1}{R_D} + C_{Sg} s + C_{Dg} s}$$

$$\frac{V_{out}}{R_{o1}} + (V_{out} - V_g) C_{Dg} + V_{out} C_{DB1} s + V_{out} C_{SB2} s$$ → sum of currents at vout

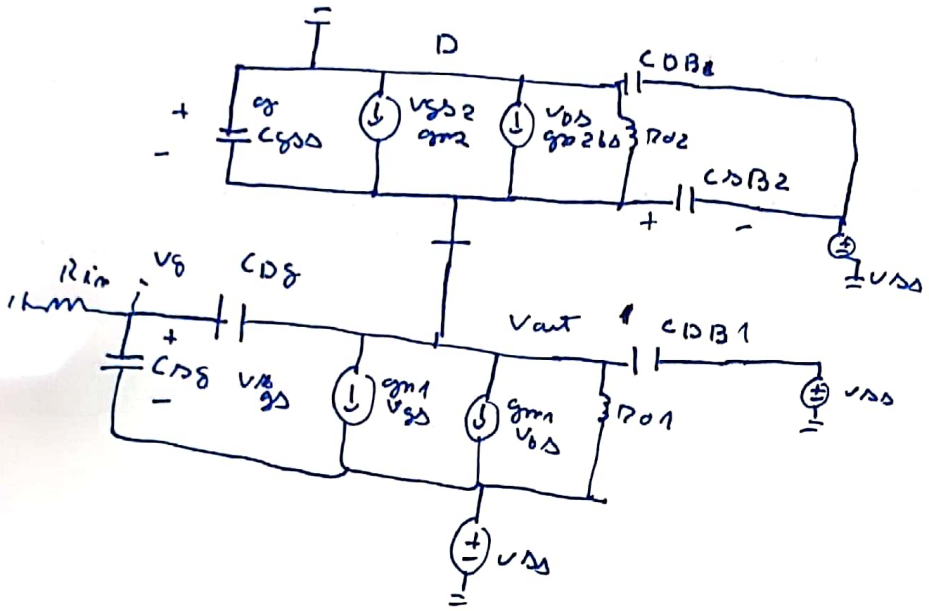
$$- g_{m2}(V_{DD} - V_{out}) - g_{m2b}(-V_{out}) + \frac{V_{out} - V_{DD}}{Z_{eq1}} + g_{m1} V_g$$

$$V_{out}\left(\frac{1}{R_{o1}} + C_{gD} s + C_{DB1} s + C_{SB2} s + g_{m2} + g_{mb2} + \frac{1}{Z_{eq1}}\right) + \frac{1}{\frac{1}{R_{in}} + C_{Sg} s + C_{gD} s}(g_{m1} - C_{gD} s)$$

$$- V_{DD}\left(g_{m2} + \frac{1}{Z_{eq1}}\right) = 0$$

$$A^+ = \frac{g_{m2} + \frac{1}{Z_{eq1}}}{\frac{1}{R_{o1}} + C_{gD} s + C_{DB1} s + C_{SB2} s + g_{m2} + g_{mb2} + \frac{1}{Z_{eq1}} + \left(\frac{1}{\frac{1}{R_{in}} + C_{Sg} s + C_{DgS}}\right)(g_{m1} - C_{gD} s)}$$

A- gain



$Z_1 = \frac{1}{C_{GSD} \parallel r_{O2}}$

Vg currents

$$\frac{V_g}{R_{in}} + (V_g - V_{out}) C_{DGD} + (V_g - V_{SS}) C_{SGD} = 0$$

$$V_g \left(\frac{1}{R_{in}} + C_{DGD} + C_{SGD} \right) = V_{out} C_{DGD} + V_{SS} C_{SGD}$$

$$V_g = \frac{V_{out} C_{DGD} + V_{SS} C_{SGD}}{\left(\frac{1}{R_{in}} + C_{DGD} + C_{SGD} \right)}$$

Sum of currents at

$$(V_{out} - V_{SS})(C_{SB2} + C_{DB1}) - V_{in} g_{m2} (-V_{out}) - g_{m2D} (V_{DD} - V_{out}) + \frac{V_{out}}{Z_1} + g_{m1} (V_g - V_{SS}) + g_{m1} (V_{out} - V_g) C_{DG}$$

$$V_{out} \left(C_{SB2} + C_{DB1D} + g_{m2} + g_{m2D} + \frac{1}{Z_1} + C_{DGD} + \frac{C_{DGD}}{\left(\frac{1}{R_{in}} + C_{DGD} + C_{SGD} \right)} \right.$$

$$\left(g_{m1} - C_{DGD} \right) - V_{SS} \left(C_{SB2D} + C_{DB1D} + g_{m2D} + g_{m1} \right.$$

$$+ \frac{C_{GDGD}}{\left(\frac{1}{R_{in}} + C_{DGD} + C_{SGD} \right)} \left(g_{m1} - C_{DGD} \right)$$

$$A^{-} = \frac{C_{\Delta} B_2 + C_{D} B_2 + g_{m2} b_{\Delta} + g_{m1} + \frac{C_g \Delta}{\frac{1}{R_{in}} + C_{DGS} + C_{SGS}} (g_{m1} - C_{DGS})}{(C_{\Delta} B_2^{\Delta} + C_{D} B_{\frac{\Delta}{1}} \Delta + g_{m2} + g_{m2} b_{\Delta} + \frac{1}{Z_1} + C_g D \Delta + \frac{C_g D \Delta}{\frac{1}{R_{in}} + C_{DGS} + C_{SGS}} (g_{m1} - C_{DG}$$