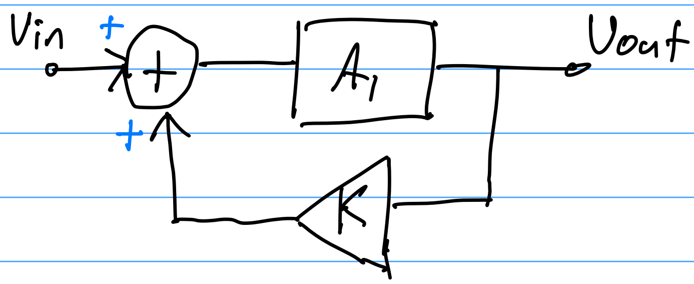
Each stage has a transfer function

$$H_1(s) = \frac{-g_m R_D}{1 + \frac{s}{w_p}}$$

where $w_p = \frac{1}{R_D C}$.

$\therefore$ The open loop amp. has $A_1 = -\frac{(g_m R_D)^3}{(1+\frac{s}{w_p})^3}$.



A_1 is negative $\therefore$ Neg. feedback requires a $+$ at the adder

$\therefore$ Loop gain $= -KA_1$.

$$\therefore \text{Loop gain } T = -\underset{K=1}{K} A_1 = \frac{+(g_m R_D)^3}{(1+\frac{s}{w_p})^3}.$$

Subst $s = jw$, $w_p = \frac{1}{R_D C}$ and set $T = -1$.

$$\frac{(g_m R_D)^3}{(1 + jwR_D C)^3} = -1$$

$$\begin{aligned}
-(g_m R_D)^3 &= (1 + jwR_D C)^3 \\
&= (1 + jwR_D C)(1 + 2jwR_D C - w^2 R_D^2 C^2) \\
&= 1 + 2jwR_D C - w^2 R_D^2 C^2 + jwR_D C \\
&\quad - 2w^2 R_D^2 C^2 - jw^3 R_D^3 C^3 \\
&= 1 + 3jwR_D C - 3w^2 R_D^2 C^2 - jw^3 R_D^3 C^3.
\end{aligned}$$

LHS is real $\therefore$ RHS is real. $\therefore$ Take imag. part $= 0$.

$$3wR_D C - w^3 R_D^3 C^3 = 0$$

$$3 - w^2 R_D^2 C^2 = 0$$

$$\therefore w^2 = \frac{3}{R_D^2 C^2}$$

$$\therefore f_{osc} = \frac{\sqrt{3}}{2\pi R_D C}.$$