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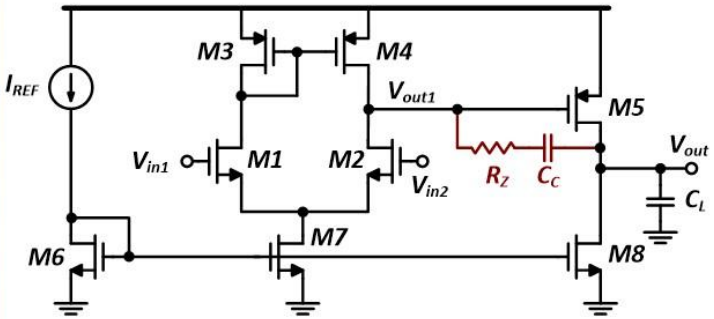
Thursday Analog Quiz



Assume all transistors are biased in SI and the square-law is valid. If IREF is halved (x 0.5), the DC gain is multiplied by how much?

gain of stage 1: A_{v_1}

gain of stage 2: A_{v_2}

$$A_{V_{total}} = A_{v_1} \cdot A_{v_2}$$

$$A_{v_1} = g_{m_2} \cdot R_{out_1}$$

$$\frac{I_{REF}}{2} \Rightarrow I_2 = \frac{I_{REF}}{2} \times \frac{1}{2} \Rightarrow I_2 \times \frac{1}{2}$$

$$g_m = \sqrt{2 I_D \frac{W}{L} V_{OV}} \Rightarrow g_m \times \frac{1}{\sqrt{2}}$$

$R_{out} \times 2$ as $r_o = \frac{1}{\lambda I_D}$

$$A_{v_1} \times \frac{2}{\sqrt{2}}$$

$$A_2 = g_{m_5} R_{out_2}$$

$$I_5 = I_{REF} \Rightarrow I_{REF} \times \frac{1}{2} \Rightarrow I_5 \times \frac{1}{2}$$

$g_{m_5} \times \frac{1}{\sqrt{2}}$ and $R_{out_2} \times 2$ so

$$A_{v_2} \times \frac{2}{\sqrt{2}}$$

$$A_V \times \frac{2}{\sqrt{2}} \times \frac{2}{\sqrt{2}} \Rightarrow A_{V_{total}} \times 2$$