



Microtecnología y
Sistemas Embebidos

Instituto Politécnico Nacional

Centro de Investigación en Computación

VLSI avanzado

Tarea 1 - Diseño de amplificador
operacional simple de una etapa

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POR:

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1. Cálculo de parámetros

$$\frac{V_{out}}{V_{in}} \approx \frac{g_{mb3}g_{m1}g_{m2}+g_{mb4}g_{m1}g_{m2}-g_{mb4}g_{m2}g_{m3}-g_{m1}g_{m2}g_{m3}+g_{mb3}g_{m1}g_{m4}-g_{m1}g_{m2}g_{m4}-g_{m1}g_{m3}g_{m4}+g_{m2}g_{m3}g_{m4}}{g_{mb3}g_{m2}g_{m5}-g_{m2}g_{m3}g_{m5}+g_{mb3}g_{m4}g_{m5}-g_{m3}g_{m4}g_{m5}}$$

$$V_A \approx \frac{g_{mb4}g_{m1}+g_{mb4}g_{m3}-g_{m1}g_{m4}-g_{m3}g_{m4}}{g_{mb3}g_{m2}-g_{m2}g_{m3}+g_{mb3}g_{m4}-g_{m3}g_{m4}} \times V_{in}$$

$$jV_{in} = \frac{I_{in}}{sC_m}?$$

$$V_D \approx \frac{-g_{m6}}{sC_r} \times V_A$$

$$V_{in} \approx \frac{I_{in}}{sC_m} + \left(\frac{-g_{m9}}{sC_m} \times V_D \right)$$

$$V_{in} \approx \frac{I_{in}}{sC_m} + \left(\frac{g_{m6}g_{m9}}{s^2C_mC_r} \times V_A \right)$$

$$V_{in} = \frac{I_{in}}{sC_m} + \left(\frac{(g_{m6}g_{m9})(g_{mb4}g_{m1}+g_{mb4}g_{m3}-g_{m1}g_{m4}-g_{m3}g_{m4})}{(s^2C_mC_r)(g_{mb3}g_{m2}-g_{m2}g_{m3}+g_{mb3}g_{m4}-g_{m3}g_{m4})} \times V_{in} \right)$$

$$\left(1 - \frac{(g_{m6}g_{m9})(g_{mb4}g_{m1}+g_{mb4}g_{m3}-g_{m1}g_{m4}-g_{m3}g_{m4})}{(s^2C_mC_r)(g_{mb3}g_{m2}-g_{m2}g_{m3}+g_{mb3}g_{m4}-g_{m3}g_{m4})} \right) V_{in} = \frac{I_{in}}{sC_m}$$

$$V_{in} = \frac{I_{in}}{sC_m \left(1 - \frac{(g_{m6}g_{m9})(g_{mb4}g_{m1}+g_{mb4}g_{m3}-g_{m1}g_{m4}-g_{m3}g_{m4})}{(s^2C_mC_r)(g_{mb3}g_{m2}-g_{m2}g_{m3}+g_{mb3}g_{m4}-g_{m3}g_{m4})} \right)}$$

$$V_{in} = \frac{I_{in}}{sC_m - \frac{(g_{m6}g_{m9})(g_{mb4}g_{m1}+g_{mb4}g_{m3}-g_{m1}g_{m4}-g_{m3}g_{m4})}{(sC_r)(g_{mb3}g_{m2}-g_{m2}g_{m3}+g_{mb3}g_{m4}-g_{m3}g_{m4})}}$$

$$\frac{W_9}{L_9} = \frac{1}{20}$$

$$V_{b1} = 0.5V$$

$$C_m = 18pF$$