Today:
- Active Load Examples
- Current Source $V_{BIAS}$ Generators
- Problem 4 moves to HW #4

Last Time -

**Diode-Connected PMOS Load**

$$A_N = -\frac{g_{m_1}}{g_{m_2}} = -\frac{\mu n (wL)_1}{\sqrt{M_p (wL)_2}}$$

**PMOS Current Source Load**

$$A_N = -\frac{g_{m_1} (r_{o1}) (r_{o2})}{g_{d1} + g_{d2}}$$

$$= g_{m_1} (r_{o1}) (r_{o2})$$

**Ex. Multistage Actively-Loaded MOS Ckt.**

$$V_{BSAS1}$$

$$V_{BSAS2}$$

$$V_{DS}$$

$$R_s$$

$$M_1$$

$$M_2$$

$$M_3$$

$$M_4$$

$$R_0 = \frac{1}{g_{m_4}}$$

$$R_0 = \frac{1}{g_{m_4}}$$

$$R_s$$

Why $V_{DS}$?
W_H = \frac{1}{\frac{1}{T_0} + \frac{1}{\bar{T}_0} + \frac{1}{T_{gr4}}}
Node 3 is very isolated from nodes 2 & 1, hence this is due to cascading.

Whenever you see a lot of isolation between nodes, then each node can be associated with a distinct pole.

So:
(i) Node 3 contributes the dominant pole: \( \omega = \frac{1}{C_0} \)

(ii) Capacitance associated at node 2 & 3 contributes the 2nd pole: \( \omega = \frac{1}{C_0 + C_3} \)

Transistor Current Source: How do we get \( V_{ESAR}, V_{ESAB} \)?

Ideal Current Source

Actual Current Source

Want \( R_o \rightarrow \infty \) for ideal!