slew rate

compensation

compensation

1 stage - probably not a problem
- if it is just add cap at output

2 stage - almost always a problem

Keep away from -180 when \(|\omega| = 1\)

How to compensate?
- Push second pole higher. Hard!
  - Lower output cap or resistance
- Lower gain - bad
  - Push first pole lower. Hit \(w_1\) before \(w_2\)
  - Fine, but lowers useful bandwidth
- Split poles push \(w_1, w_2\)
  - magic!

Last time
Slew rate - nonlinear effect when

\[ V_{o2} = V_{o1} + V_c \]
\[ \frac{dV_{o1}}{dt} = \frac{dV_{o2}}{dt} \]
\[ \frac{dv_{n2}}{dt} \]

or more transistor turns off

Slew rate negative

\[ \frac{dv_{n2}}{dt} = -1.15 \cdot C_{o2} \]

with \( C_c \)
\[ w_1 = \frac{1}{R_{o1} C_{o1}} \]
\[ C_{o1} = C_1 + C_C (1 + AV_{b,0}) \]
\[ w_2 = \frac{g m_2}{C_1 + C_L + \frac{C_C L}{C_0}} \]
\[ \approx \frac{g m_2}{C_1 + C_L} \text{ if } C_1 \gg C_0, C_L \gg C_L \]

2 other high freq issues:
RHP zero from \( L \)
pole/zero doublet from mirror

\[ g m_2 \frac{V_{o1}}{V_{o1} - V_{o2}} \rightarrow \frac{g m_4 V_{o1} + (V_{o2} - V_{o1}) s C_L}{s (g m_4 - s C_L)} \]

\[ V_{o1} = i_{o2} \]

Right half plane zero

RHP zero