E151 Lecture 23 – Op-Amp Design

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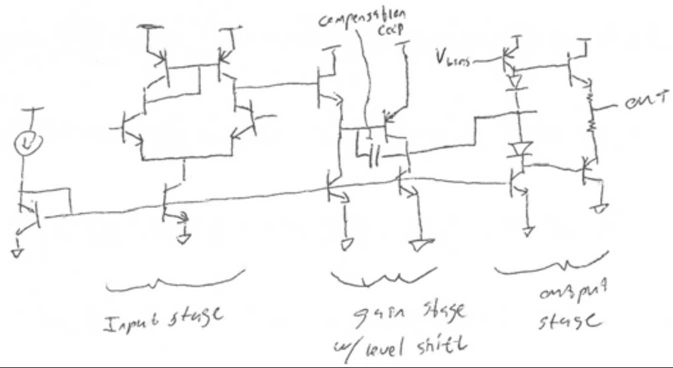
Disclaimer

These are notes for Prof. Spencer to give the lecture, they were not intended as a reference for students. Students asked for them anyway, so I'm putting them up as a courtesy. Remember that they are not intended as a substitute for attending lecture.

We Can Make an Op-Amp from Our Pieces

- Already have differential input and 0 output impedance (for large vO)
- Need infinite gain and DC coupling (use level shifts to achieve that)
- Input common mode range (b/c feedback shrinks DM, rail-to-rail)
- Input bias current
- Input offset voltage
- Output swing (rail-to-rail)
- Mirror biasing is handy

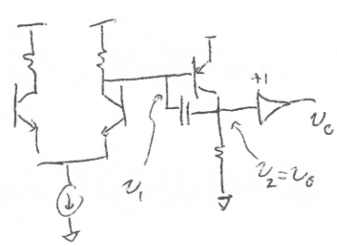


Compensation Capacitance and Slew Rate

- Op-amps always in feedback (why we care about input CM range)
- If you hear feedback, always think stability → CC makes look 1st order
- But big caps limit dV/dt at op-amp output, called slew rate

– slewing behavior

– straight lines (ramp) except where slope small



$\frac{dv_0}{dt} = \frac{dv_2}{dt} \Rightarrow v_2 = v_1 + CQ$

SO $SR = I_{tail}/C_c$

OR, if big Cl

$SR = I_{bias,out}/C_L$