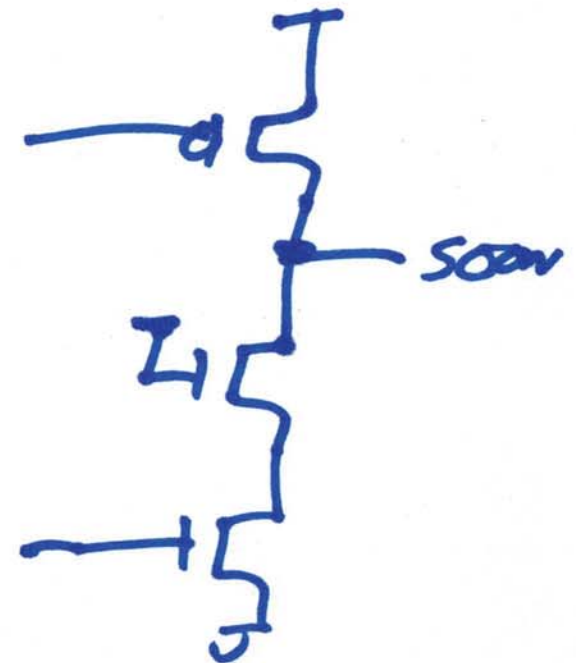
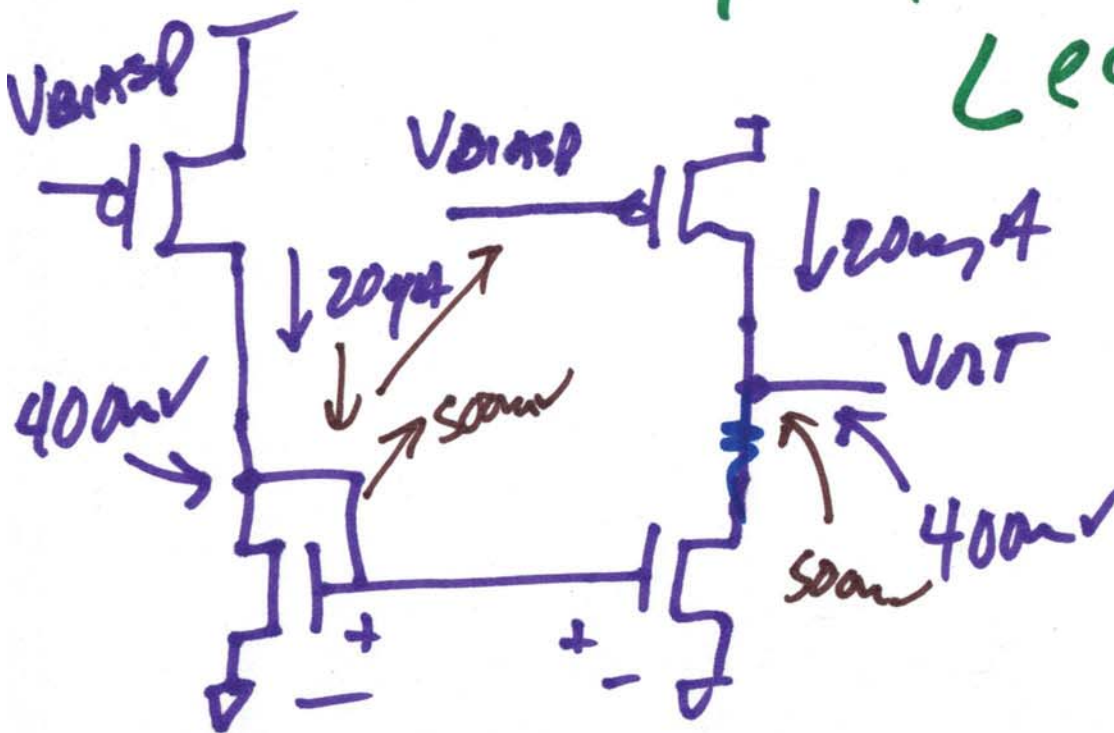


ECG 720

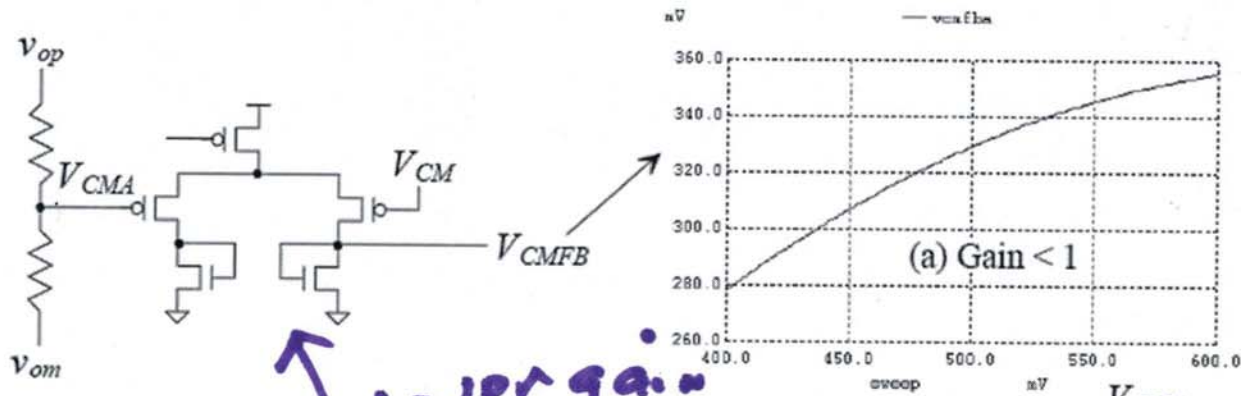
# Advanced Analog IC Design

2/23/16

Lecture 11



1)



Lower gain to improve CMFB stability

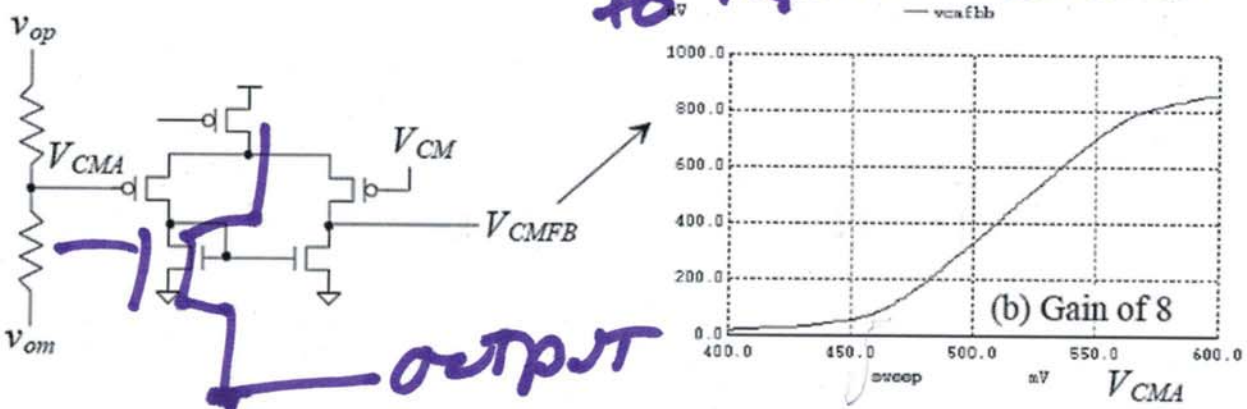
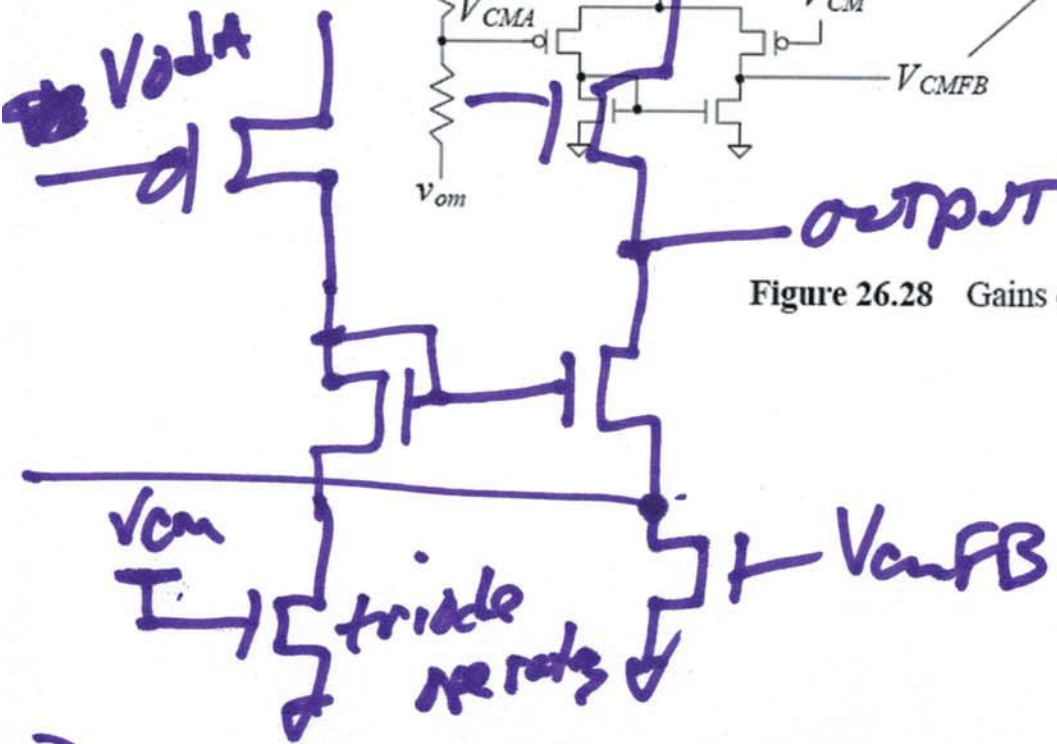


Figure 26.28 Gains of CMFB amplifiers.



2)

A portion of the output buffer.

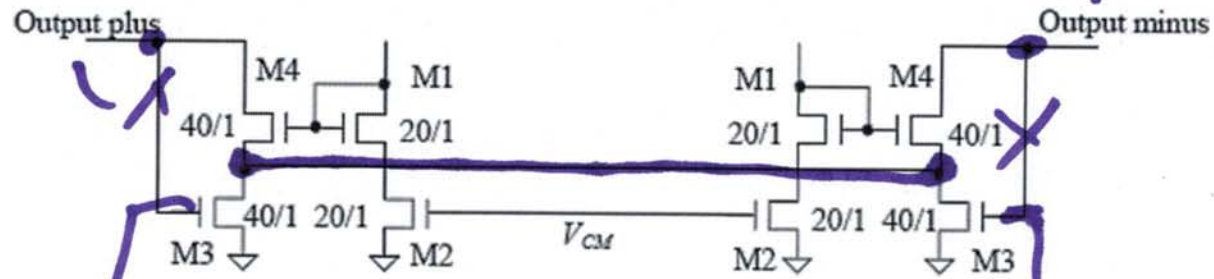
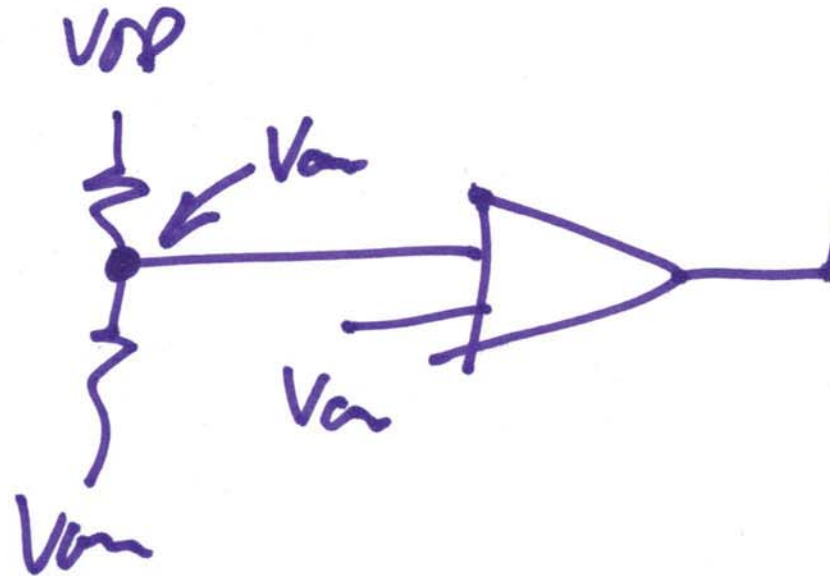


Figure 26.37 Using triode-operating MOSFETs to balance the outputs (bad).



3)

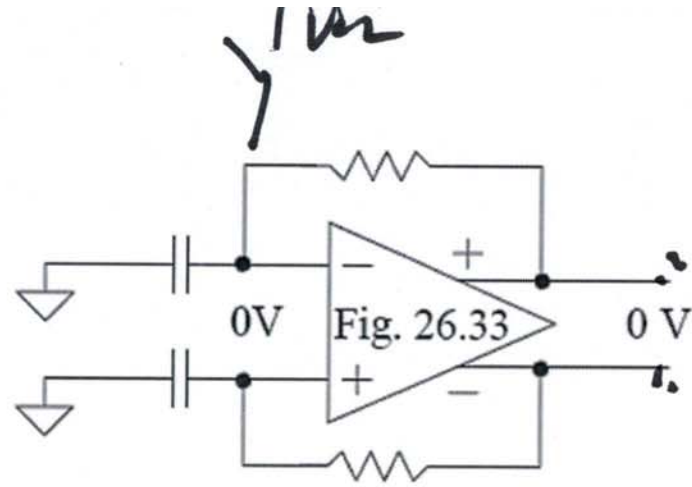
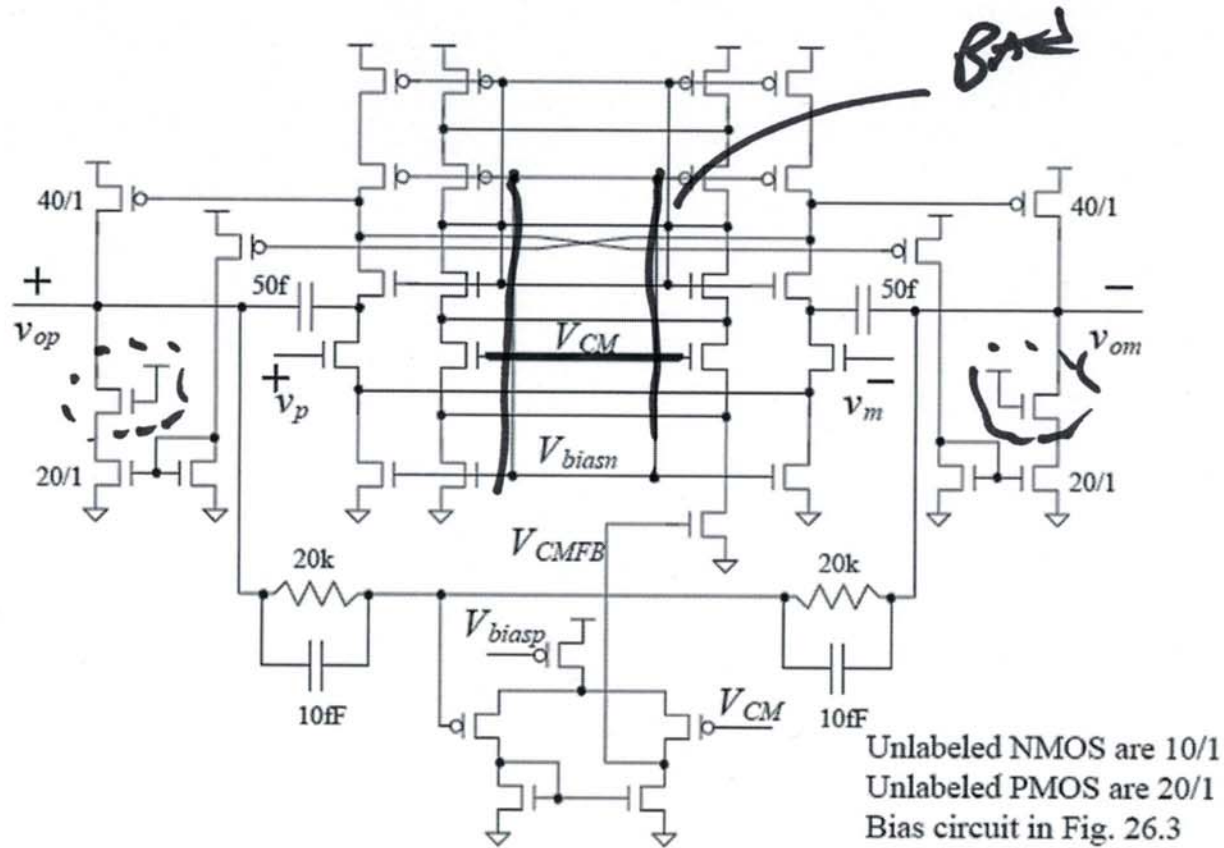


Figure 26.38 The op-amp in Fig. 26.33 won't turn on in this topology.

START-UP PROBLEMS

4)



**Figure 26.39** Connecting the bias circuit diff-amp's inputs to the common-mode voltage.

5)

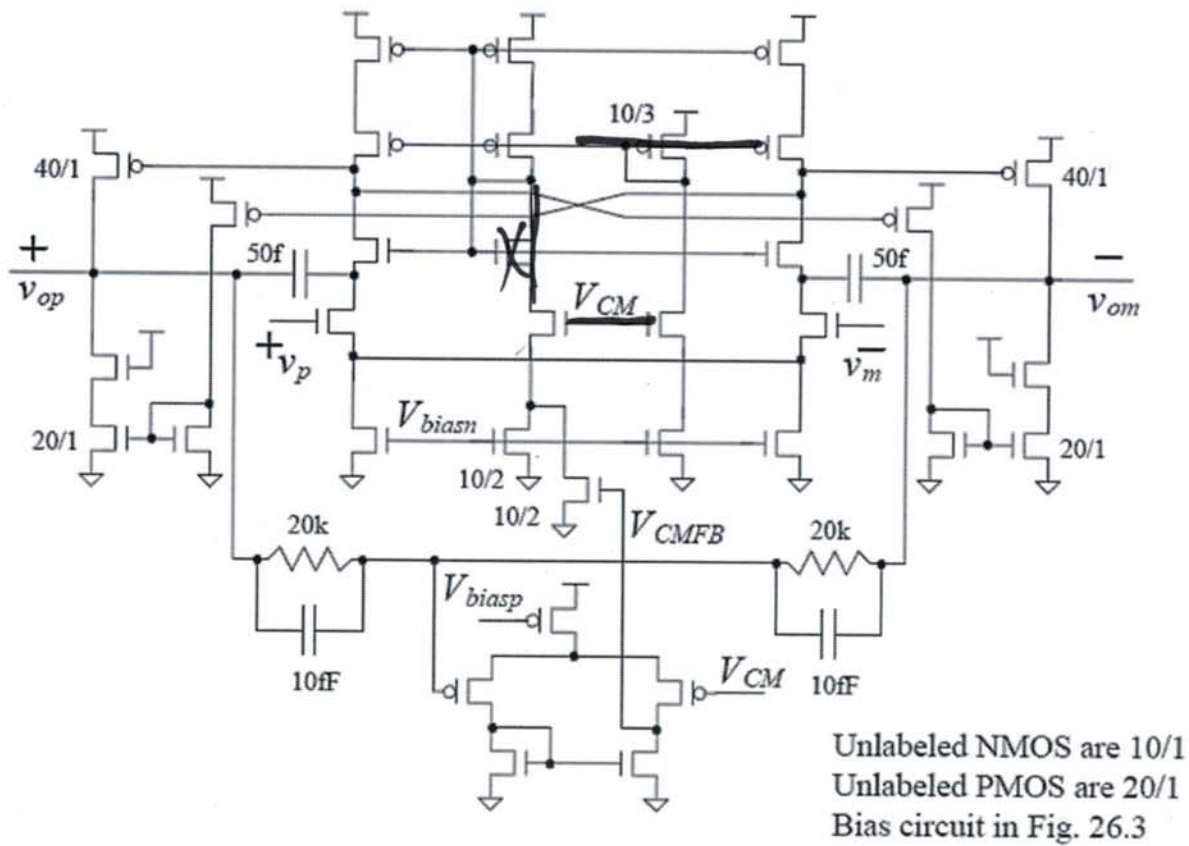
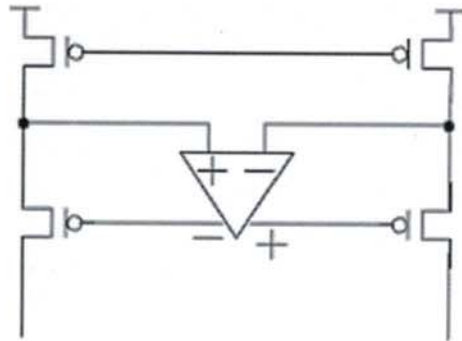


Figure 26.40 Making the op-amp more practical.

b)



**Figure 26.41** How not to implement GE in an op-amp (unless the added amplifier employs CMFB).

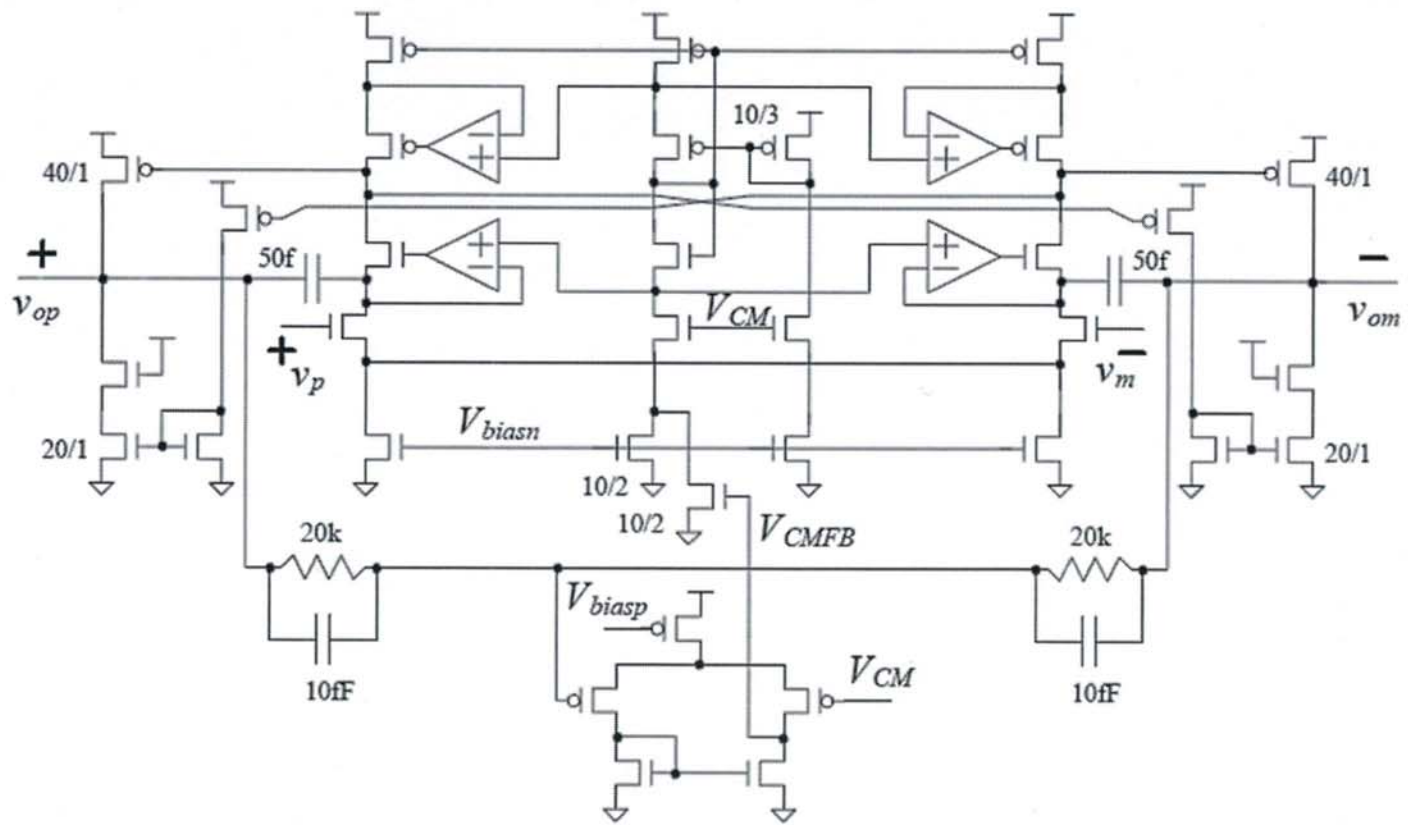


Figure 26.42 Adding gain-enhancement to the op-amp.

8)



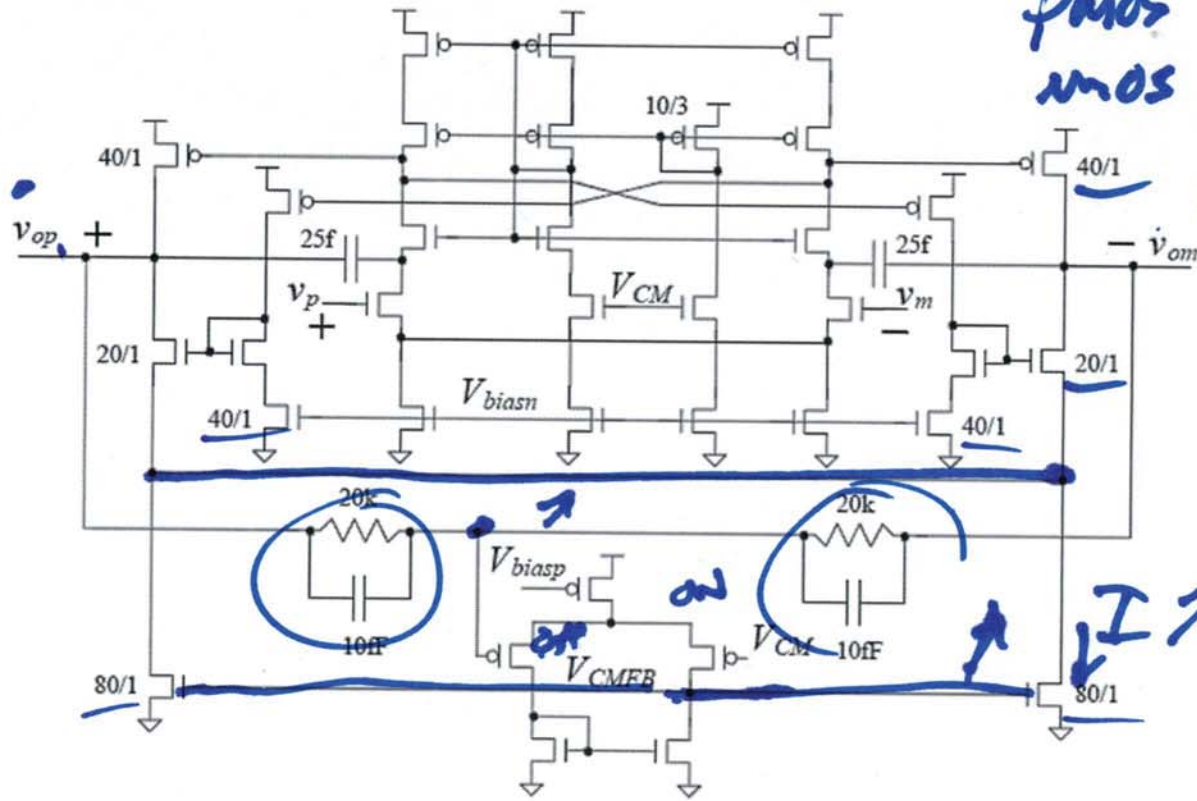


Figure 26.43 Providing CMFB through just the output buffer. Using an amplifier with triode-operating MOSFETs for CMFB (good).

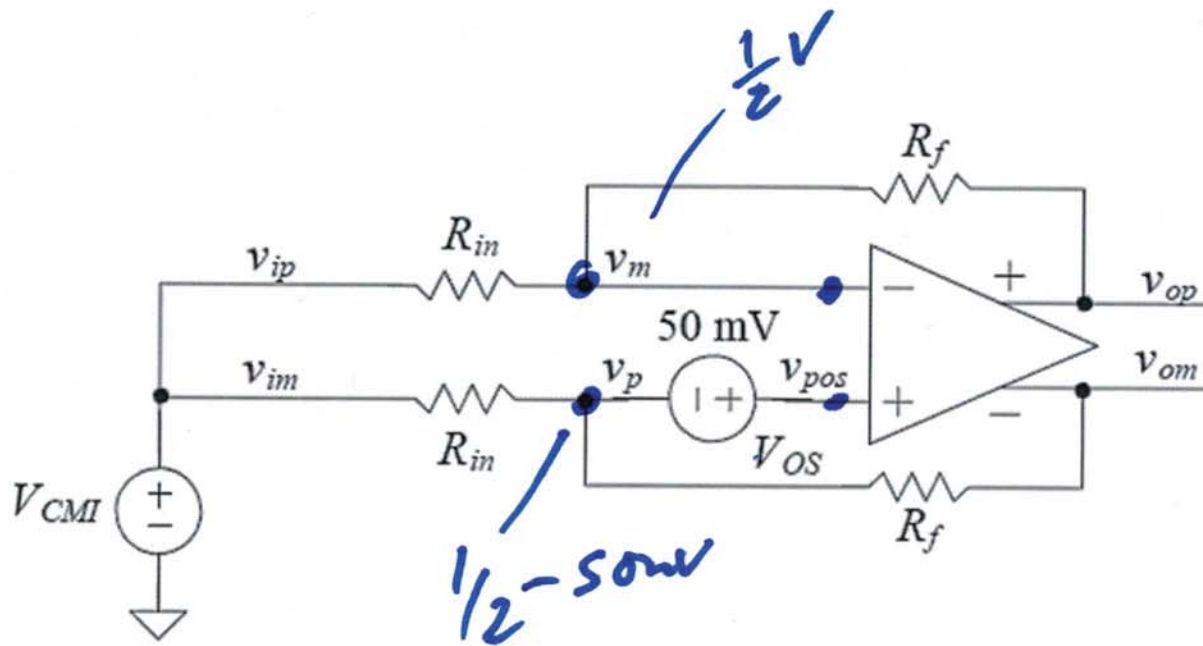


Figure 26.46 How an offset voltage causes an imbalance in the outputs.

$$v_{op} = \frac{V_{OS}}{2} \left( 1 + \frac{R_f}{R_{in}} \right) + V_{cm}$$

Shift  
in common-mode

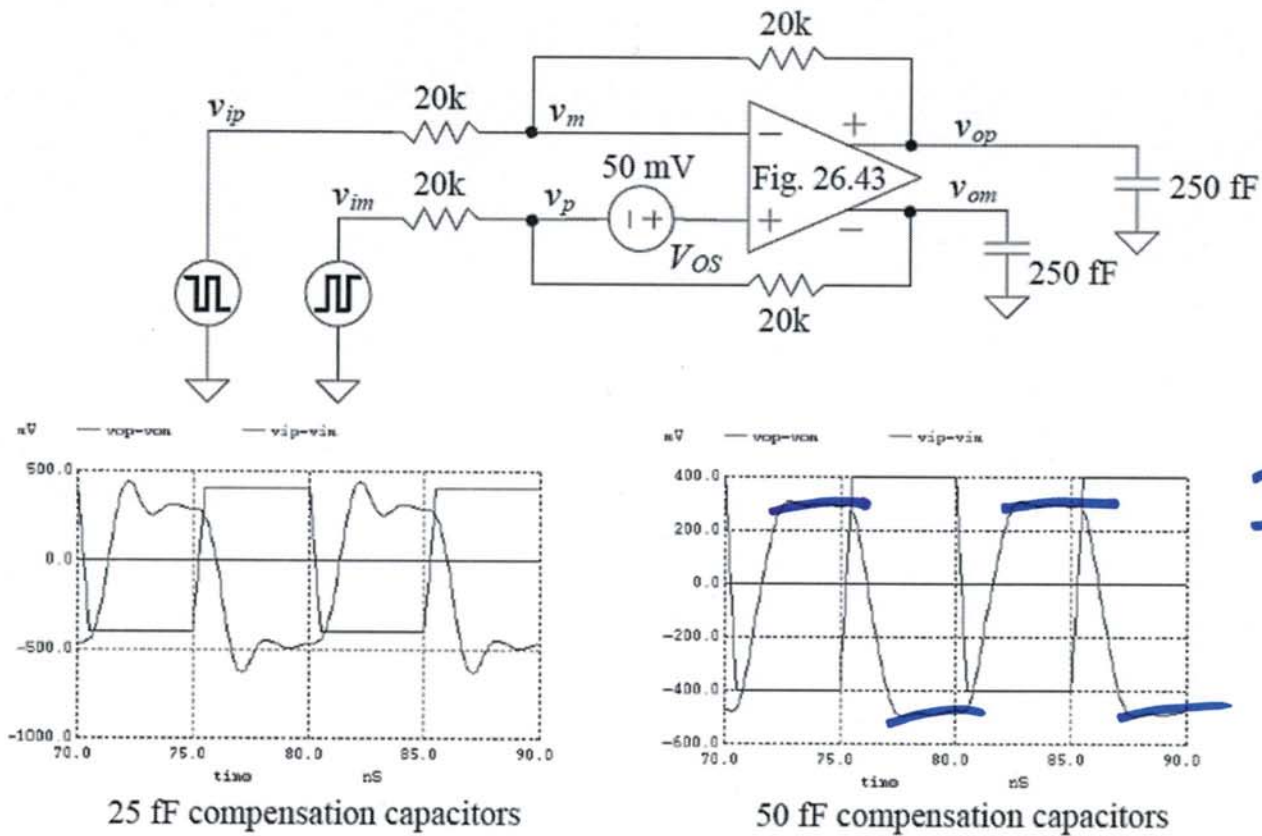


Figure 26.45 How an offset can affect the step response (compensation).



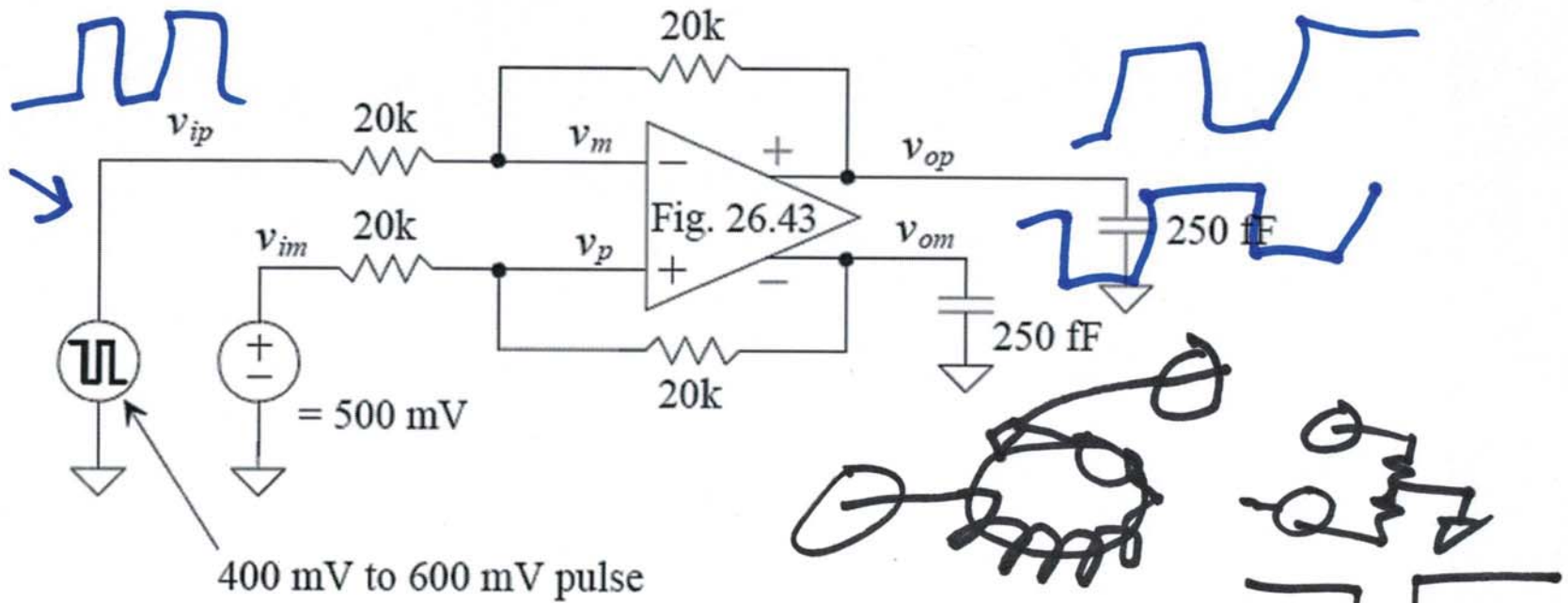
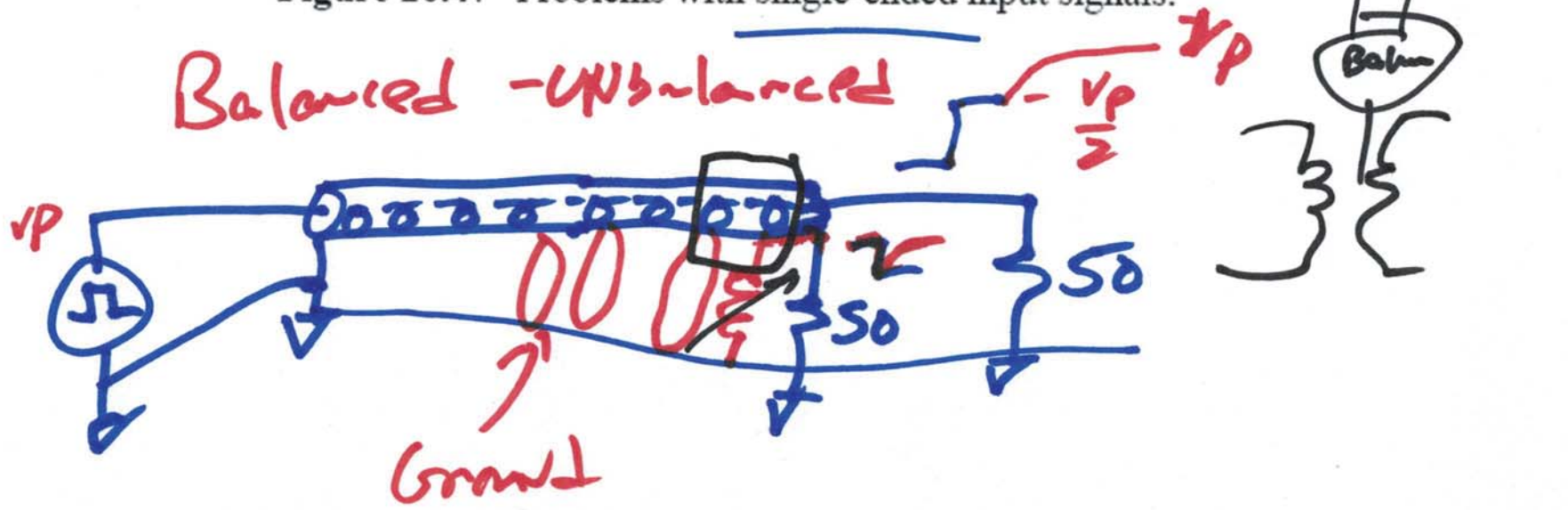


Figure 26.47 Problems with single-ended input signals.



12)