

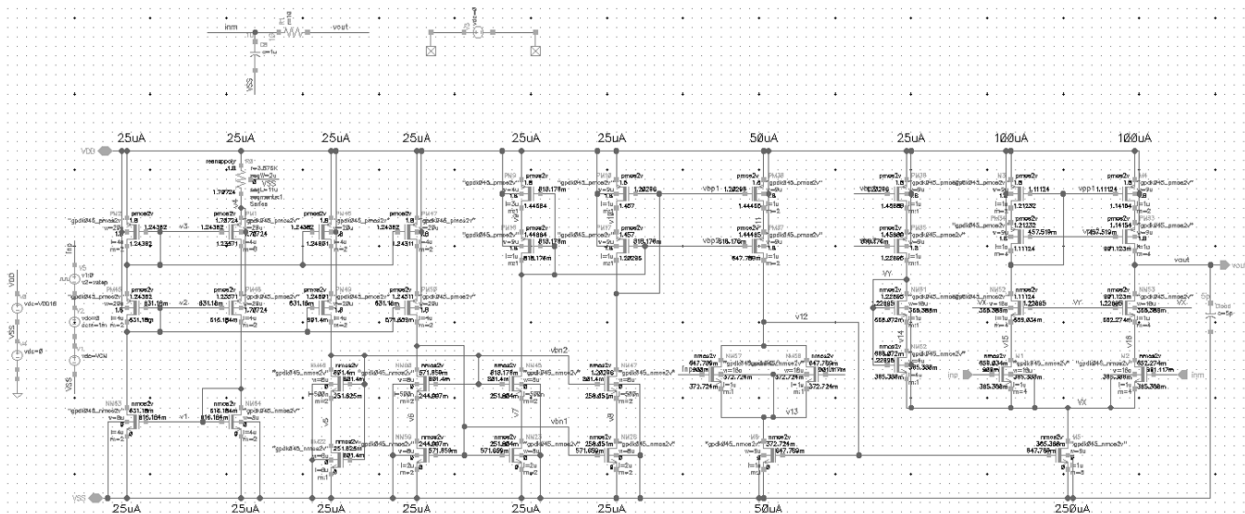
EE223 Homework #4

Oct. 15, 2018

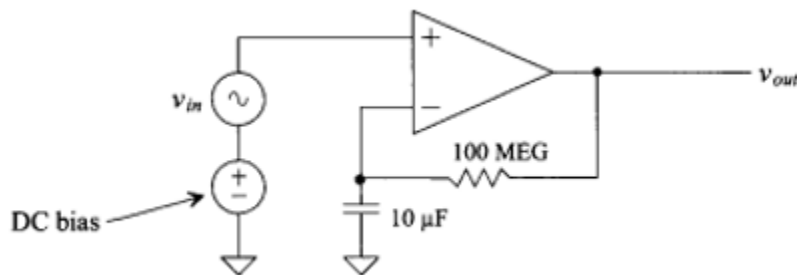
Due: Nov. 5, 2018 6PM. 20% / day will be deducted if you miss the 6 PM deadline.

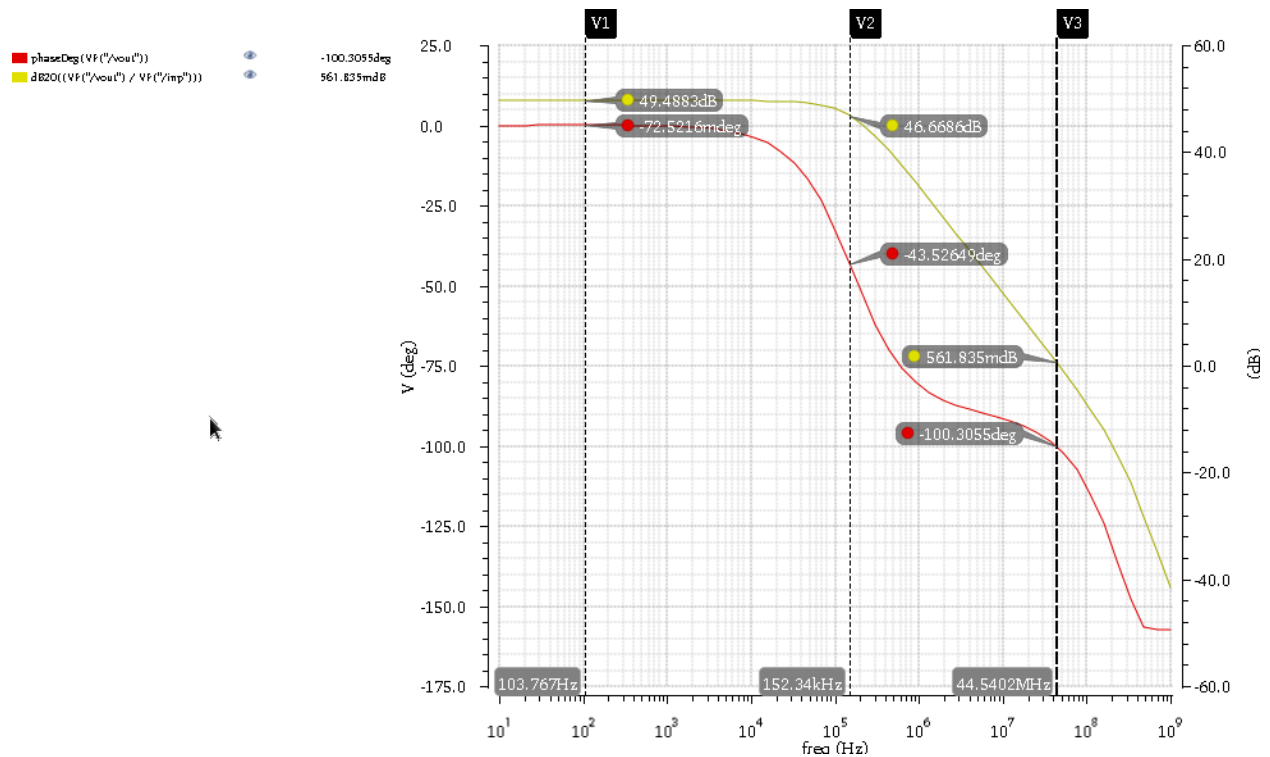
Design of High-Swing Cascode Bias and Cascode OTA Circuit (Total 50 points scaled to 5 points)

In this homework, you will design a cascode Beta multiplier, a high-swing cascode bias circuit, and a cascode OTA shown below. We will be using nmos2v and pmos2v for all circuits based on $V_{DD}=1.8V$ at TT, 27C. Assume the loading capacitance (C_L) is 5 pF for dc and ac simulations, and 100 fF for transient simulation. Your simulation results on dc operating point should show most of the transistors are in saturation region except a few transistors.

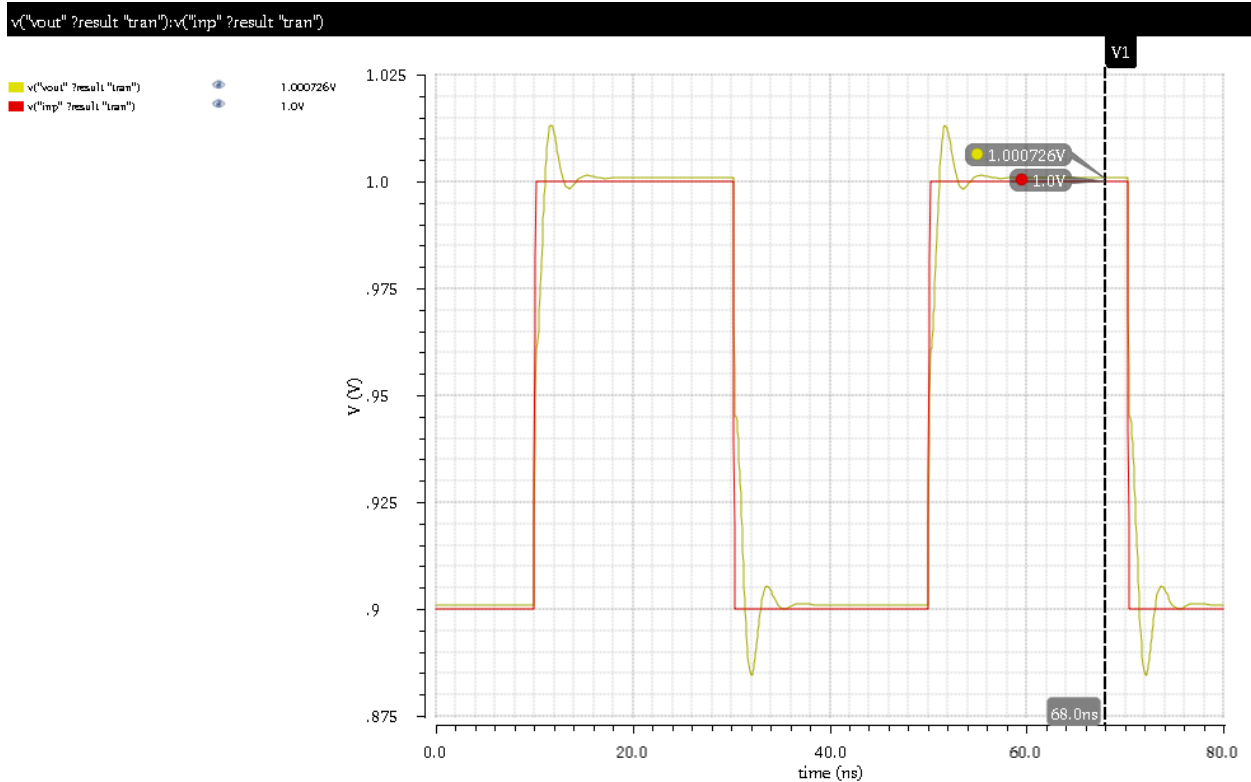


1. Draw a schematic shown above. Refer to zoomed version of the schematic in the last page. Add a startup circuit and run a dc simulation with $V_{DD}=1.8V$, Temperature=27C in Typical corner. Provide the dc operating point information as well as the node voltage information in the schematic you have designed. Specify which transistors are not in saturation region in your design. Create a screenshot with white background in monochrome. The screenshot should show transistor sizes as well as operating point information (drain current and operating region). Report the total power dissipation of the circuit as well. (20 points)
2. Run an ac simulation from 10 Hz to 1 GHz using the ac simulation test bench shown below. Create an ac plot like below. From the ac plot, report the DC gain (A_0), -3dB bandwidth (ω_{-3db}), and the unity gain bandwidth (ω_u). Calculate the gain bandwidth product ($A_0 \times \omega_{-3db}$) and compare it with the unity gain bandwidth (ω_u). Explain if there is any difference. (20 points)





3. Assuming the loading capacitance is 100 fF, run a transient simulation in unity gain configuration to get a plot like below. Input signal should be 25MHz with 100mV step from 0.9V bias voltage. Create a plot of this! (10 points)



Zoomed version of the schematics to be used in this homework.

