Questions

1. A voltage amplifier operating from ±10V power supplies has a linear transfer characteristic passing through (0,0), but with output saturation at +7V and –9V. The amplifier gain is 50V/V. What DC operating point will result in the largest possible output signal magnitude? What is that magnitude?

2. A voltage amplifier connected to a particular source v_s has a no-load voltage gain of 100V/V and a gain of 70V/V with a 1kΩ load. What is its output resistance?

3. A voltage amplifier, when connected to a 10kΩ source has an overall gain (v_o/v_s)of 1667V/V. When a second, identical amplifier is connected in parallel with the first amplifier and connected to the same source, the corresponding overall gain is 909V/V. Estimate the input resistance of the amplifiers.

4. A design is required of a voltage amplifier to operate between a 1MΩ source and a 100Ω load. There are two amplifiers available each with 10V/V of open-circuit voltage gain. The first amplifier has input and output resistances of 1MΩ and 10kΩ, respectively. The second amplifier has input and output resistances of 10kΩ and 100Ω, respectively. What is the best way to connect the two amplifiers together to achieve the highest overall gain from source to load?

5. An amplifier saturates 1.5V from the upper supply rail (5V) and 0,5V from the lower supply rail (0V). It has a relatively constant gain of –10V/V in the transition region which is centered at v_{in} = 2.5V. Using the three-segment transfer characteristic inverter model of figure 1.29 of Sedra & Smith, find V_{OH}, V_{OL}, V_{IL}, V_{IH}, NM_L, NM_H. How wide is the transition region? If the slope of the transition region was lowered such that the width of the transition region was doubled, what would the noise margins become?

6. Following the analysis on slides 1.12 and 1.13, explain the ideal input and output resistance properties of transconductance and transresistance amplifiers as summarized on slide 1.15.

7. Show that method #1 for finding the output resistance of an amplifier (slide 1.19) is valid for any type of ideal amplifier. (voltage, current, transconductance, and transresistance)

8. Show that method #1 for finding the output resistance of an amplifier (slide 1.19) is not completely accurate for an amplifier unless reverse transmission is negligible. (slide 1.16)

9. A voltage amplifier with near-ideal characteristics (large input resistance, small output resistance) has its output connected back to its input as indicated in the figure below. Show that the output resistance of the amplifier with feedback (R_{OUT}') can be approximately written, independent of the source resistance R_S, as:

$$R_{OUT}' \approx -\frac{R_{OUT}}{A_{VO}}$$