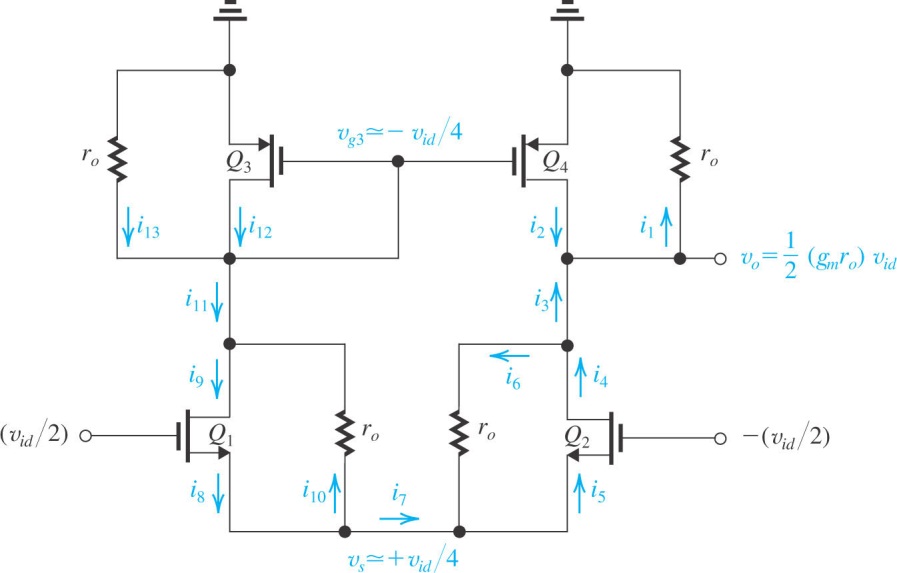
ELEG 312 - Example Problems Chapter 9-3

**Problem 9.91**

Figure P9.91 shows the active-loaded MOS differential amplifier prepared for small-signal analysis. To help the reader we have already indicated approximate values for some of the node voltages. For instance, the output voltage , which we have derived in the text. The voltage at the common sources has been found to be approximately , which is very far from the virtual ground one might assume. Also, the voltage at the gate of the mirror is approximately confirming our contention that the voltage there is vastly different from the output voltage, hence the lack of balance in the circuit and the unavailability of a differential half-circuit. Find the currents labeled *i*1 to *i*13. Determine their values in the sequence of their numbering and reflect on the results. You will find that there is some inconsistency, which is a result of the approximations we have made. Note that all transistors are assumed to be operating at the same .



**Problem 9.92**

A current-mirror-loaded NMOS differential amplifier operates with a bias current *I* of 200 μA. The NMOS transistors are operated at *VOV* = 0.2 V and the PMOS devices at |*VOV*| = 0.3 V. The Early voltages are 20 V for the NMOS and 12 V for the PMOS transistors. Find *Gm*, *Ro*, and *Ad*. For what value of load resistance is the gain reduced by a factor of 2?