EECS 42 – Introduction to Electronics for Computer Science

Spring 2003, Prof. A. R. Neureuther
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Problem Set # 8 Due 2:30 PM April 2nd, 240 Cory

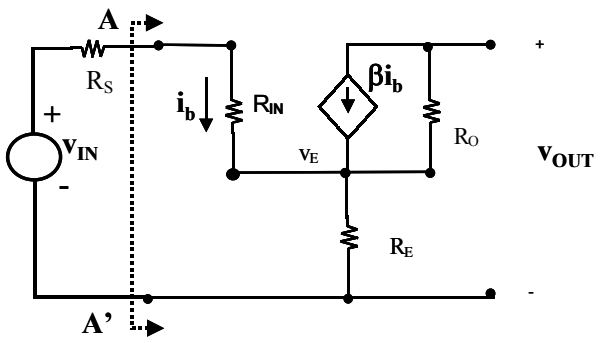
Reading:. **Week 10# Logic with State Dependent Devices S&O 593-595, 604-611 (read for graphs and not device equations).**

8.1 Input/out impedances. Consider the circuit in Fig. P8.1.

a) Find the small signal gain v_{OUT}/v_{IN}.
b) Find the input resistance looking from AA' to the right when the output is **short** circuited.
c) Find the output resistance seen looking into the output terminal when a short is applied across AA'.

8.2 A to D Comparator. Consider the circuit in Fig. P8.2.

a) Sketch $V_{IN}(t) = 1 + 0.01\sin(2\pi ft)$ where $f = 10^6$ Hz from t = 0 for two complete cycles using a voltage scale from 0.98 to 1.02.
b) Choose V_{REF} such that V_{OUT} is 0 or smaller when V_{IN} is less than or equal to 1V. **{Note resistors R_3 and R_4 have been added and are 10 kΩ each. They allow a reference voltage V_{REF} to be added. However, the voltage V- is $(V_{REF} + V_{IN})/2$. That is they divide both V_{REF} and V_{IN} by a factor of two.}**
c) Set V_{RAIL+} and V_{RAIL-} such that V_{OUT} ranges from 0 to 2 V.
d) Assume R_1 = 1 kΩ and choose R_2 such that the small signal change in V_{OUT}/V_{IN} is 1000.
e) Sketch V_{OUT} on the vertical axis vs. V_{IN} on then horizontal axis where both axes go from 0 to 2V.
f) Sketch $V_{OUT}(t)$ from t = 0 for two complete cycles using a voltage scale from 0 to 2V.



R_S = 1kΩ, R_{IN} = 10 kΩ, R_E = 100Ω, r_o = 100kΩ, β = 100

Fig. P8.1

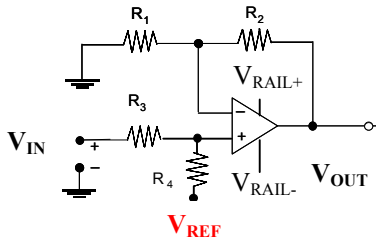


Fig. P8.2