ECE 3050 Analog Electronics Quiz 7  
February 25, 2009

Professor Leach  

Name______________________________

Instructions. Print your name in the space above. Honor Code: I have neither given nor received help on this quiz. Initials ____________

1. The figure shows a basic two-BJT current mirror.

(a) Assume the two transistors are identical and that the Early effect can be neglected, i.e., \( V_A = \infty \). Label the branch currents and derive the equation for the output current \( I_O \).

(b) If the Early effect is not neglected, what would be the output resistance \( r_0 \)?

\[ I_{REF} = I_O + \frac{I_O}{\beta} + \frac{I_O}{\alpha} \Rightarrow I_O = \frac{I_{REF}}{1 + 2/\beta} \quad r_{out} = r_{o2} \]

2. The figure shows a Wilson current mirror.

(a) Assume the two transistors are identical and that the early effect can be neglected, i.e., \( V_A = \infty \). Making use of the results of Problem 1, label the branch currents and derive the equation for the output current \( I_O \).

(b) Aside from the difference in the equation for \( I_O \), what is the major difference between the Wilson mirror and the two-BJT current mirror?

\[ I_{REF} = \frac{I_O}{\beta} + \frac{I_O/\alpha}{1 + 2/\beta} \Rightarrow I_O = \frac{I_{REF} \beta}{\beta + \frac{1}{\alpha} \frac{1}{1 + 2/\beta}} \]

The output resistance is much higher than for the two-BJT current mirror. This is caused by a positive feedback effect.