MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Stuff

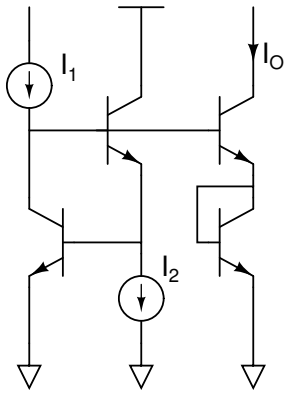
6.301 Solid State Circuits

Fall Term 2010 — Issued : Nov. 15, 2010
Problem Set 8 — Due : Tuesday, Nov. 23, 2010

Suggested Reading: Read as many of the following as you can. All of the recommended references are on reserve at Barker Library.

1. Lundberg sections 33-37.
2. Gray and Meyer section 4.4.

Problem 1: In the following circuit, assume I_2=1mA and β=100.



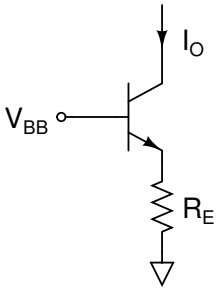
(a) Express I_O in terms of I_1 and I_2.

(b) Assume we can tolerate a maximum I_O error due to β of 50 percent. For what range of I_1 is this circuit valid?

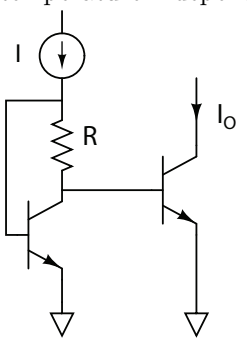
Problem 2: Circuit Dependencies.

When we design a circuit, we prefer that it operate over a wide range of temperature. In the following circuits, assume that $\frac{1}{R}\frac{dR}{dT}$=600$ppm/°C$ and $\frac{dV_{BE}}{dT} = -2mV/°C$. For each of the following circuits, find $\frac{dI_O}{dT}$ (Assume V_{BE} = 600 mV).

(a) Assume V_{BB} is temperature independent.

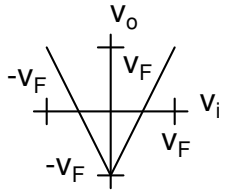


(b) Assume the current source, I, is temperature independent.

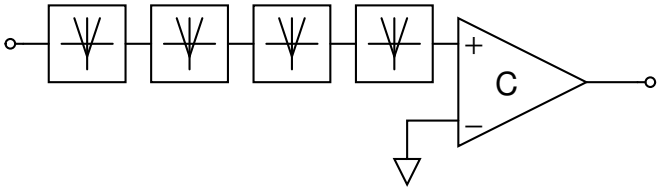


Problem 3: Wiggler ADCs.

Given a folding amplifier that implements the following function



where V_F is $5V$, indicate the succession of grey codes at the output of a comparator when the input ramps from $-5V$ to $5V$ when the folding amplifier is used in the following configuration.



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