Háskóli Íslands
Raunvísindadeild
Eðlisfræðiskor

26. apríl 2008

09.21.23 Eðlisfræði 2a

How to deal with BJT circuits?

Note: V_γ is the voltage drop over a forward biased diode. V_{sat} is the saturation voltage.

1. Apply Kirchoff's 2. law ("loop rule") to a closed loop containing the BE junction.
2. Do the same for a loop containing the CE junction.
3. Assume we are in cutoff and set $I_{\text{B}} = 0$ and find V_{BE} based on item 1.
   (a) If $V_{\text{BE}} < V_\gamma$ then the transistor is in the cutoff region. $I_{\text{B}} = 0$ and V_{BE} remains unchanged. Set $I_{\text{C}} = I_{\text{E}} = 0$ and calculate V_{CE} based on item 2. *Done.*
   (b) If $V_{\text{BE}} > V_\gamma$ then the transistion is not in cutoff. Set $V_{\text{BE}} = V_\gamma$.
4. Assume the transistor is in the linear region. Set $I_{\text{E}} \simeq I_{\text{C}} \simeq \beta I_{\text{B}}$. Calculate V_{CE} based on item 2.
   (a) If $V_{\text{CE}} > V_{\text{sat}}$ then the transistor is in the linear region—problem solved.
   (b) If $V_{\text{CE}} < V_{\text{sat}}$ then the transistor is in saturation. Set $V_{\text{CE}} = V_{\text{sat}}$ and calculate I_{C} from item 2. Then you should have $I_{\text{C}} < \beta I_{\text{B}}$. Problem solved.