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303 Spring 2011– Homework 1 Due ~~W 02/02/11~~ M 02/07/11

For the following it will be helpful if you change the Probe background from black to white so that the curves can be well distinguished.

1. Run curves for the CMOS 4007 to reproduce those on the course web page under the title "4007 NMOS and PMOS curves." Devise a means to plot the PMOS curves as ID versus VDS (rather than VSD).
   For this problem use breakout transistors and copy the 4007 models. You can follow the instructions on the course web page under "technique for customizing breakout device models" [which is for PSpice version 8 so there will be slight differences for later PSpice versions] and with the models given in "library file for breakout 4007 transistors."
   Submit these curves for 0≤VDS≤5 in 0.1V steps nested with 0≤VGS≤5 in 1 V steps for NMOS (and the negatives for PMOS).

2. Repeat the above using the mnmosis and mpmosis transistors from the bicmos12 set. [These can be found by downloading from the course web page the transistor files bicmosis12.olb and bicmosis12.lib (or for PSpice 8 the two equivalent files bicmosis12.slb & bicmosis12.lib). These files may already be installed but if not install them on the computers or folders from which you will run Spice]

3. For just the mnmosis transistor run the same set of curves but with another voltage source, V_{SB}, inserted between the bulk and source. Set that voltage as a parameter with values between 0V and 5V in 1V steps and obtain a new set of curves through a parametric run.
   Submit both your circuit and the resulting curves.

4 Repeat part 2 with the bulk forward biased, that is for negative V_{SB} now between -0.5V and 0V in +0.25V steps.

5. Set up in PSpice a circuit, using a capacitor and a Gvalue component, for the differential equation (where y=v on capacitor and x=time)

$$\frac{dy}{dx} = -(y+1)^2; \quad y(0) = 4 \text{ for } 0 \le x \le 2$$

   Submit your schematic and the plot of the solution (with a white background).
   NOTE of 02/02/11: This is a Riccati equation which has finite escape time so change the end time to 0.1; then see how long it will run before crashing (escaping).
   You can change y(0) to –4 and it will run for 2 seconds.