# ECE 310 – MICROELECTRONICS I

#### CADENCE TUTORIAL: I-V AND PARAMETRIC SWEEPS

#### VISHAL SAXENA



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- Launch Cadence Virtuoso
  - cadsetup ams035
  - virtuoso
- Click on library Manager

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 $I_D VS V_{GS}$  (0.18 UM PROCESS)

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• Attach it to an existing technology library





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• In our case it is: "cdsDefTechLib"

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• Give it an appropriate name. Click OK.

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• The schematic window will pop up.



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 Press "I" or click on 'add instance' button to add circuit components to the schematic.

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# $I_D VS V_{GS}$ (0.18 UM PROCESS)

- From analoglib, select the MOSFET & press "Q" to edit its properties.
- Enter the parameters as shown in the screenshot.
- Don't forget to put the model name "cmosn" for NMOS and "cmosp" for PMOS.
- Also, always use absolute size of the MOSFET (0.18u NOT 0.18)

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- Complete the schematic
- Click on the "check and Save" Button to check if there is any error present in this schematic.
- Debug and fix any errors in the schematic.



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- Launch ADE L to simulate the circuit.
- Add variables for simulation.

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 Click "add" and "OK" (both VDS & VGS; select appropriate values for them)

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# $I_D VS V_{GS}$ (0.18 UM PROCESS)

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- Now, we have to link the model parameters to our device. Therefore, click: Setup->Model Libraries
- Browse for the model file and add to the list





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 For ECE310, models are located at: /home/alve8438/ece310\_examples/ ece310.lib





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• Setup DC analysis to sweep the required voltages

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- Select the outputs to be plotted from the schematic
- Outputs->To be Plotted->Select On Schematic



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• Save the state

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#### $I_D VS V_{GS}$ (0.18 UM PROCESS)

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# $I_D VS V_{GS}$ (0.18 UM PROCESS)

- Now, for this particular analysis, we have to select a value for VDS. Here, we have set it as 1V.
- Click "Netlist and Run"



• I<sub>D</sub> vs V<sub>GS</sub> Plot



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#### PLOTTING GM

- To plot g<sub>m</sub>, use calculator from Tools menu
- deriv() operator provides the derivative



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#### PLOTTING GM



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### $I_D VS V_{DS}$ FOR DIFFERENT $V_{GS}$ (0.18 UM PROCESS)

 Like before, you may create another cellview for ID-VDS sweep or just use the previous one

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### $I_D VS V_{DS}$ FOR DIFFERENT $V_{GS}(0.18 \text{ UM PROCESS})$

- Create a DC sweep analysis for VDS
- This will provide one ID-VDS plot
- But we need a family of curves for varying VGS

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# $I_{\rm D} VS V_{\rm DS} \ \ \text{FOR DIFFERENT} V_{\rm GS}(0.18 \ \text{UM PROCESS})$

- For parametric analysis, click: Tools> Parametric Analysis
- Setup the parametric analysis to double sweep VGS along with VDS
  - Think of it as two nested for loops in a code
- Click on the green button to run the analysis

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#### $I_D VS V_{DS}$ FOR DIFFERENT $V_{GS}(0.18 \text{ UM PROCESS})$





#### **PMOS SIMULATIONS**

- Now, figure out how to obtain ID-VSG and ID-VSD plots for the PMOSFETs
- Note that the body of the PMOS should be tied to VDD



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