VLSI Design

MOS Transistor

MOSFET

- Symbols – nmos
- All circuits are analog - basically
- nMOS majority charge carriers – e
- Graph I_{ds} vs v_t
- Depletion mode and enhancement mode
- Enhancement mode – used commonly

Enhancement transistor

- Moderately doped p type sub and heavily doped n+
- N+ regions acts as source and drain
- Working of an nMOS
  - Accumulation region
  - Depletion region
  - Inversion region
- Factors effecting I_{ds} when V_g and V_d are fixed
- Cut-off, linear and saturated regions
- PMOS Transistor

Threshold voltage

- Voltage applied between gate and source
- Below which I_{ds} falls to zero
- Is function of number of parameters
- Equations
- Example
- Body effect

Transistor Equations

- In Cut-off
- In Linear
- In Saturation
- β equation
- Example to calculate β

Second order effects

- Body effect on threshold voltage
- Sub-threshold region
- Channel-length modulation
- Variation in mobility
- Tunneling
- Punchthrough
- Impact ionization

Model

- Tabulate the values
- Small signal ac analysis
  - In linear and saturation
  - Equations of gds and gm