Academy of Innovative Semiconductor and Sustainable Manufacturing

ANALOG INTEGRATED CIRCUIT DESIGN AND LAYOUT LAB

MOSFET CHARACTERISTIC CURVE

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LAB2-1-2u. NMOS INTRINSIC GAIN VS VDS.

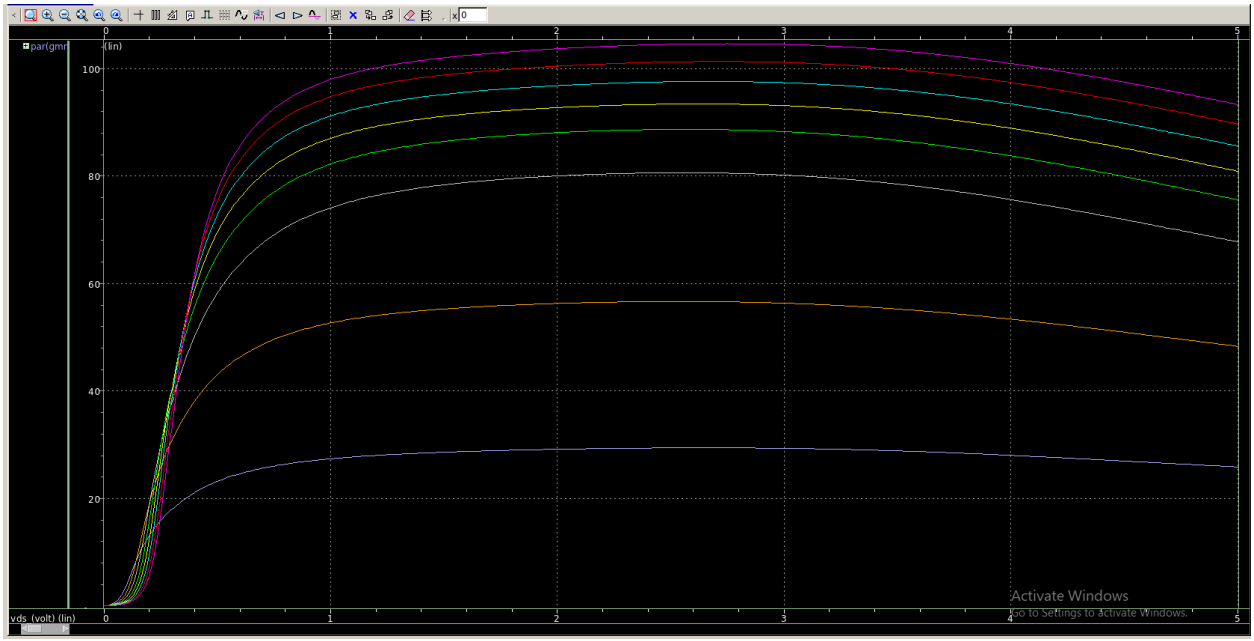

Figure 1. NMOS $g_m r_o$ vs V_{in} characteristic curve

Comment:

- From Figure 1, V_{in} increases, V_{DS} increases, NMOS operates from Triode to Saturation region, g_m increases. In saturation region, I_D is almost constant so g_m is also constant.

- When we sweep Length, with the length doubled, lambda decreases, g_m decreases by a factor of $\sqrt{2}$, and r_o increases by a factor of 2, resulting in an overall increase in $g_m r_o$ by a factor of $\sqrt{2}$.

LAB2-1-2v. PMOS INTRINSIC GAIN VS VSD.

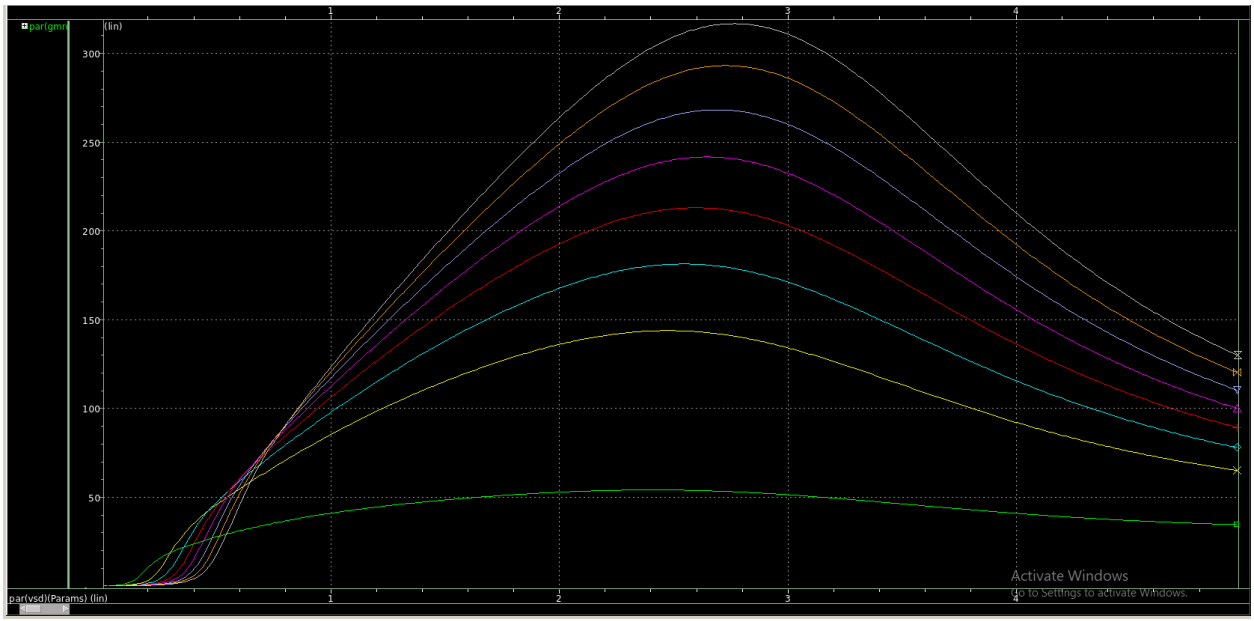

Figure 2. PMOS $g_m r_o$ vs V_{in} characteristic curve

Comment:

- In the triode region the gain is small and in saturation region the gain is bigger.

- From Figure 2, V_{in} increases, V_{SD} increases, PMOS operates from Triode to Saturation region, g_m increases. In saturation region, I_D is almost constant so g_m is also constant.

- When we sweep Length, with the length doubled, lambda decreases, g_m decreases by a factor of $\sqrt{2}$, and r_o increases by a factor of 2, resulting in an overall increase in $g_m r_o$ by a factor of $\sqrt{2}$.

- In Substrate current – Incluced body effect, the $g_m r_o$ of PMOS decreases faster then NMOS.

LAB2-1-2w&x. NMOS & PMOS INTRINSIC GAIN VS VOV.

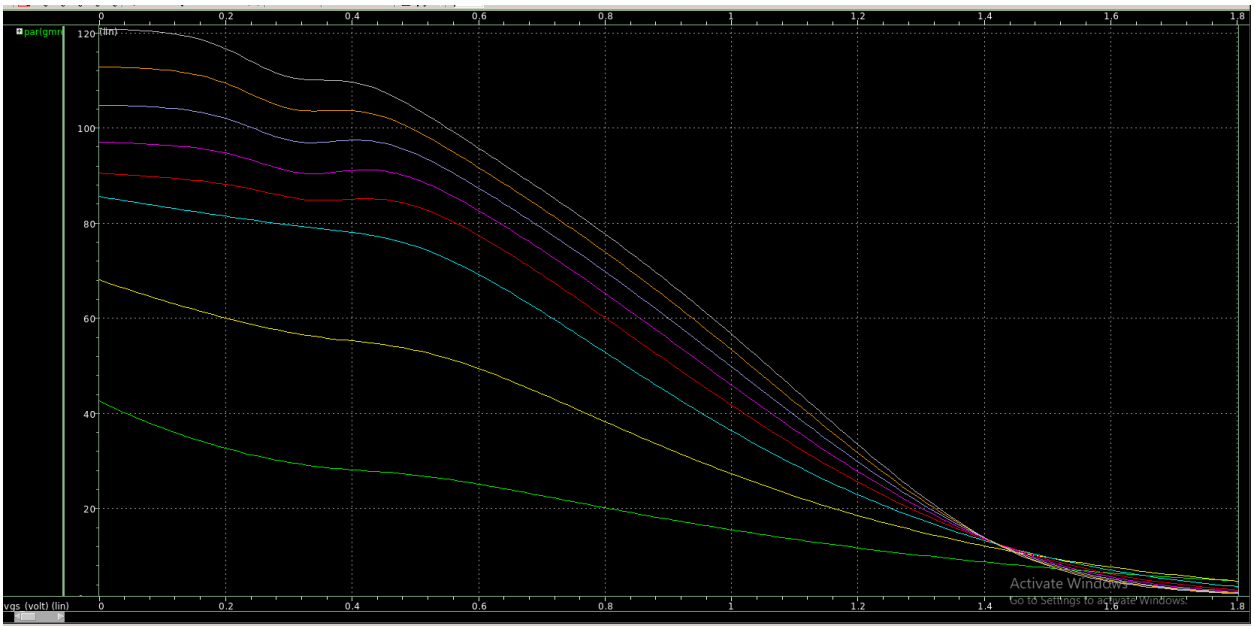

Figure 3. NMOS $g_m r_o$ vs V_{OV} characteristic curve

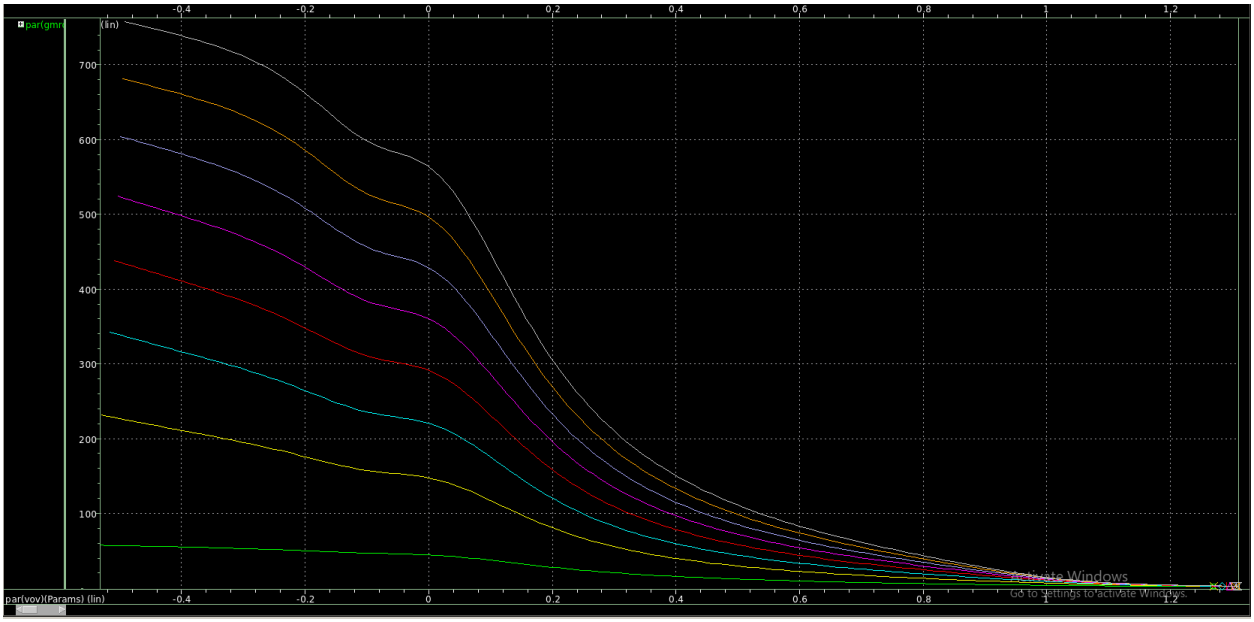

Figure 4. PMOS $g_m r_o$ vs V_{OV} characteristic curve

Comment:

$$g_m r_o \approx \frac{2}{V_{OV}\lambda}$$

So when the V_{OV} increases then $g_m r_o$ decrease.