EE 105 Discussion
Welcome!

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Today

- Linearize a non-linear device
- Selected homework problems
- Selected S&S exercises
If \( f(\gamma) = ax + b \) is a linear function, then \( \frac{d}{d\gamma} f(\gamma) = a, b \) const.

Linearize a non-linear Device

- **Resistor**: \( R = \frac{V}{I} \)
- **Diode**: \( SC = \frac{I}{V} \)
- **MOSFET**: \( SL = \frac{V}{I} \)
2-Port Device

MOSFET

3V+ac

Gate

Source

Drain

5V

\[ i_{ds} = f(V_{gs}) \cdot V_{ds} \]

\[ R_{os} = \frac{2}{3} \frac{V_{os}}{V_{os}} \]
A random 2-Port Device

\[ V_2 = V_2 - V_3 \]
\[ V_1 = V_1 - V_3 \]

\[ i_\alpha = f(v_2) = \frac{\partial I_4}{\partial V_2} \cdot v_{2,0} \cdot v_2 \]
\[ = G_m \cdot v_2 \]

Trans-conductance
HW2 Q5

5. Derive an expression for the current $I_L$ in terms of $I_S$, $R_1$, and $R_2$ for the circuit in Figure PS2.1. Calculate the input and output resistance of this circuit if the OpAmp is ideal.

\[ KCL \ @ \ Output \rightarrow \ \bar{i}_{test} = \bar{i}_1 + \bar{i}_2 = 0 \]

\[ \Rightarrow Z_{out} = \frac{\bar{v}_{test}}{\bar{i}_{test}} = \frac{0}{0} = \infty \]

\[ v^+ = v^- \leq \text{N.F.} \]
4.9 Assuming that the diodes in the circuits of Fig. P4.9 are ideal, find the values of the labeled voltages and currents.

- **Diagram (a)**
  - Diode with a voltage of 3 V and a current of 0.35 mA.
  - Voltage across the diode is 0 V.
  - Current through the 12 kΩ resistor is $I = \frac{3}{12kΩ} = 0.25mA$.

- **Diagram (b)**
  - Diode with a voltage of 3 V and a current of 0.35 mA.
  - Voltage across the diode is 0 V.
  - Current through the 12 kΩ resistor is $I = \frac{3}{12kΩ} = 0.25mA$.

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**S&S 4.9**

**Ideal Diode**

1) Assumption $V = 0$ $\Rightarrow$ $I = 0$

2) Solve with assumptions

3) Only 1 will work.