EE4C10 Analog Circuit Design Fundamentals

Homework Assignment I

Tzong Lin Chua

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Problem 1

For $I_D = 40\mu A$:

$$I_D = \frac{1.8V - V_D}{R}$$
$$V_D = 1.8V - I_D R$$
$$V_D = 1.0V$$

Saturation region:

$$V_{GS} = 1.0V > V_{TH}$$
$$V_{GS} - V_{TH} = 0.4V < V_{DS}$$

1. $\lambda = 0V^{-1}$

$$I_D = \frac{\mu_n C_{OX}}{2} \frac{W}{L} (V_{GS} - V_{TH})^2$$
$$L = \frac{\mu_n C_{OX}}{2} \frac{W}{I_D} (V_{GS} - V_{TH})^2$$
$$L = 0.39\mu m$$

2. $\lambda = 0.06V^{-1}$

$$I_D = \frac{\mu_n C_{OX}}{2} \frac{W}{L} (V_{GS} - V_{TH})^2 (1 + \lambda V_{DS})$$
$$L = \frac{\mu_n C_{OX}}{2} \frac{W}{I_D} (V_{GS} - V_{TH})^2 (1 + \lambda V_{DS})$$
$$L = 0.41\mu m$$

Problem 2

Problem 3

Problem 4

Problem 5

Problem 6

Problem 7