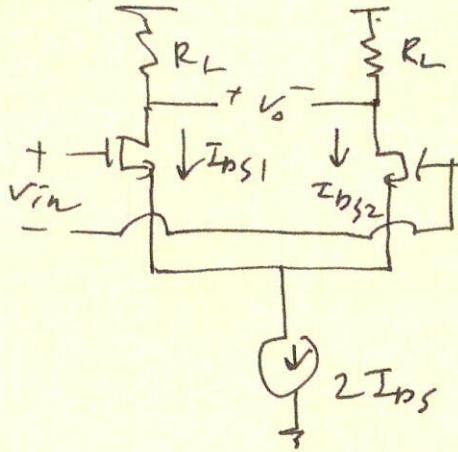


problem-2



$$i_o = I_{DS1} - I_{DS2}$$

$$= \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS1} - V_{th})^2 - \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS2} - V_{th})^2$$

$$= \frac{1}{2} \mu_n C_{ox} \frac{W}{L} \left\{ \underbrace{(V_{GS1} - V_{GS2})}_{\text{AC-component} = v_{in}} \underbrace{(V_{GS1} + V_{GS2} - 2V_{th})}_{\text{DC-component}} \right\}$$

$$= \cancel{\frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS1} - V_{GS2})^2}$$

$$= \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS1} - V_{GS2}) \left(\sqrt{\frac{2I_{DS1}}{\mu_n C_{ox} \frac{W}{L}}} + \sqrt{\frac{2I_{DS2}}{\mu_n C_{ox} \frac{W}{L}}} \right)$$

$$= \sqrt{\frac{1}{2} \mu_n C_{ox} \frac{W}{L}} (V_{GS1} - V_{GS2}) (\sqrt{I_{DS1}} + \sqrt{I_{DS2}}) \quad \text{--- (1)}$$

$$= I_{DS1} - I_{DS2} = (\sqrt{I_{DS1}} + \sqrt{I_{DS2}}) (\sqrt{I_{DS1}} - \sqrt{I_{DS2}})$$

$$\therefore \sqrt{I_{DS1}} - \sqrt{I_{DS2}} = \sqrt{\frac{1}{2} \mu_n C_{ox} \frac{W}{L}} (V_{GS1} - V_{GS2}) \quad \text{--- (2)}$$