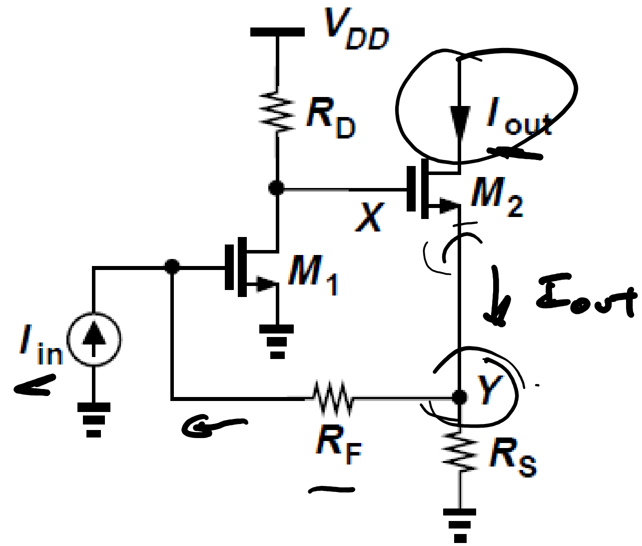
Lecture #23, March 4^{th}, 2022

- Will focus on 10 (Stability and Compensation).
- Homework #4 due next Monday – don’t wait until the day before to start the homework.
- Project 2 due this Saturday March 5^{th}, at 11:59pm
- Today
  - Finish Feedback Basics
  - Begin Stability and Compensation

Current-Current Feedback: Example



- **Above figure shows an example of current-current feedback**
- **Since the source and drain currents of M_1 are equal (at low frequencies), resistor R_S is inserted in the source network to monitor the output current**
- **Resistor R_F senses the output voltage and returns a current to the input**

8.7. The circuit of Fig. 8.42 can operate as a transimpedance amplifier if I_{out} flows through a resistor, R_{D2}, connected to V_{DD}, producing an output voltage. Replacing R_S with an ideal current source and assuming that $\lambda = \gamma = 0$, calculate the transimpedance of the resulting circuit. Also, calculate the input-referred noise current per unit bandwidth.

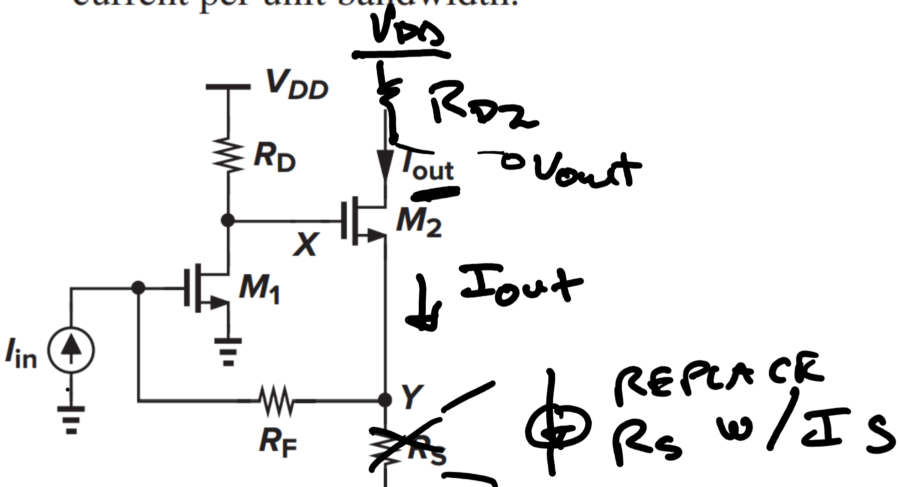
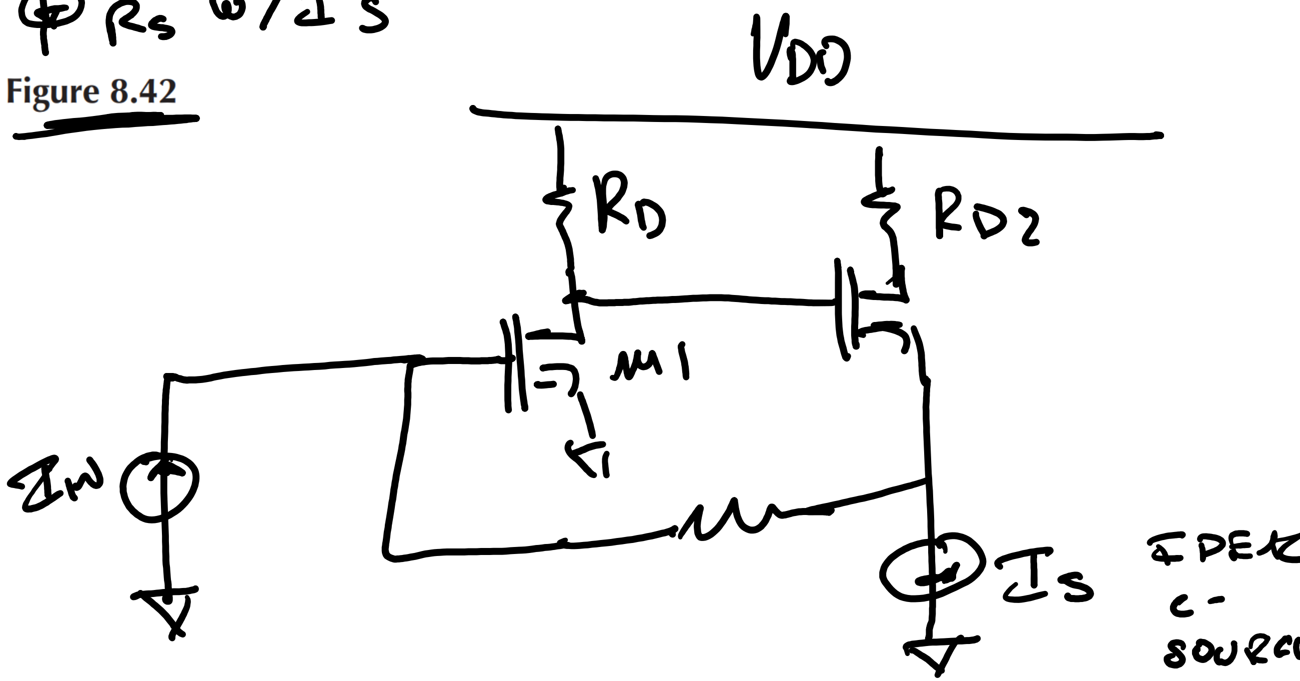
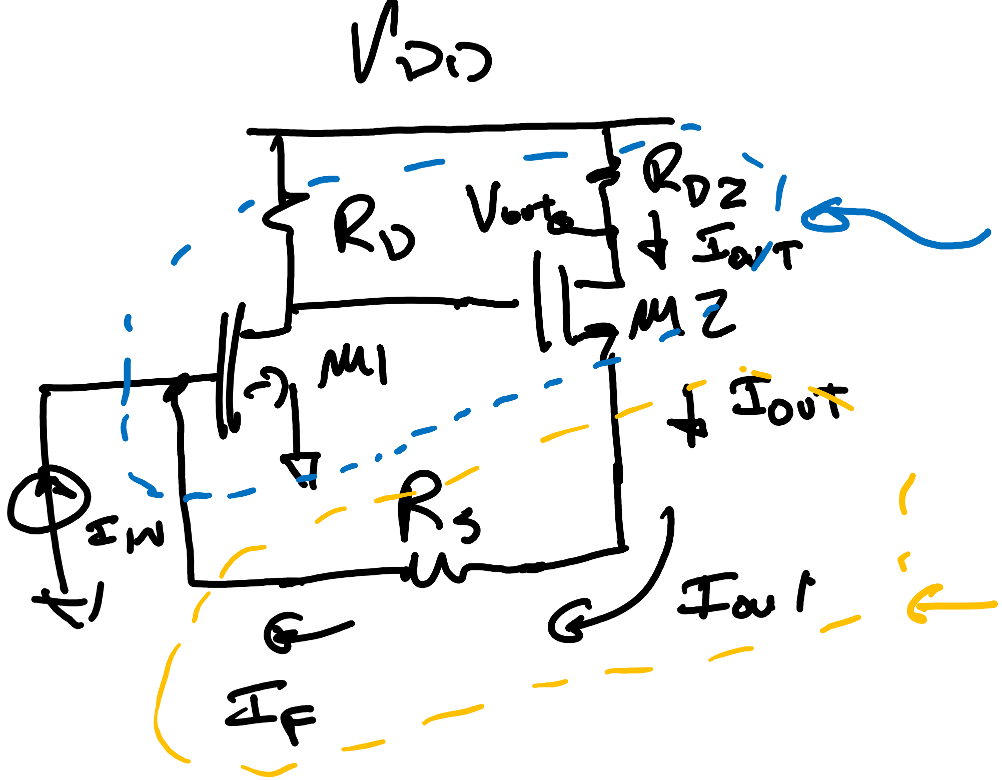


Figure 8.42





FORWARD AMP A_I (CURRENT AMP)

FEEDBACK

$$\beta = \frac{I_F}{I_{OUT}}$$

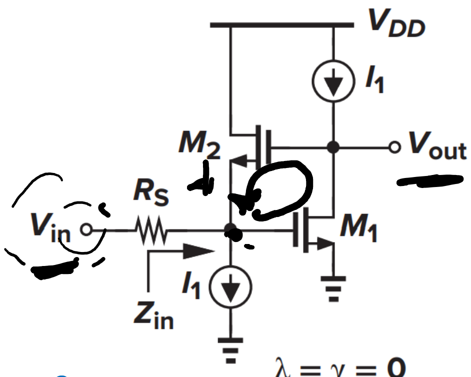
$$I_F = I_{OUT} \Rightarrow \beta = 1$$

CLOSED-LOOP GAIN $\dfrac{I_{out}}{I_{IN}} \simeq \dfrac{1}{\beta} \simeq 1$

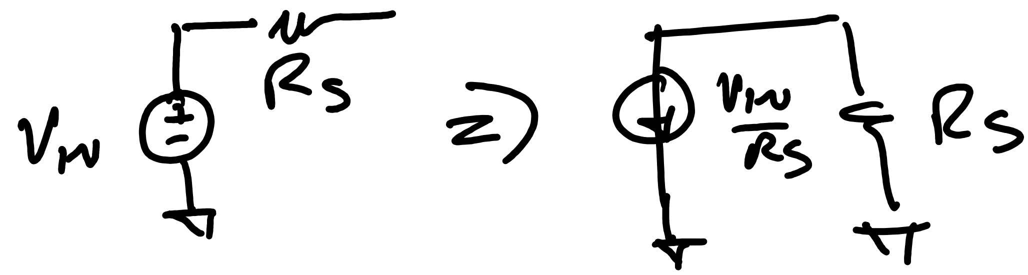
TRANSIMPEDANCE = $\dfrac{V_{out}}{I_{IN}} = -\underbrace{\dfrac{I_{OUT}}{I_{IN}}}_{1} \cdot R_{D2}$

$$\frac{V_{OUT}}{I_{IN}}(R) = -R_{D2}$$

8.10. Using feedback techniques, calculate the input and output impedance and voltage gain of each circuit in Fig. 8.95.



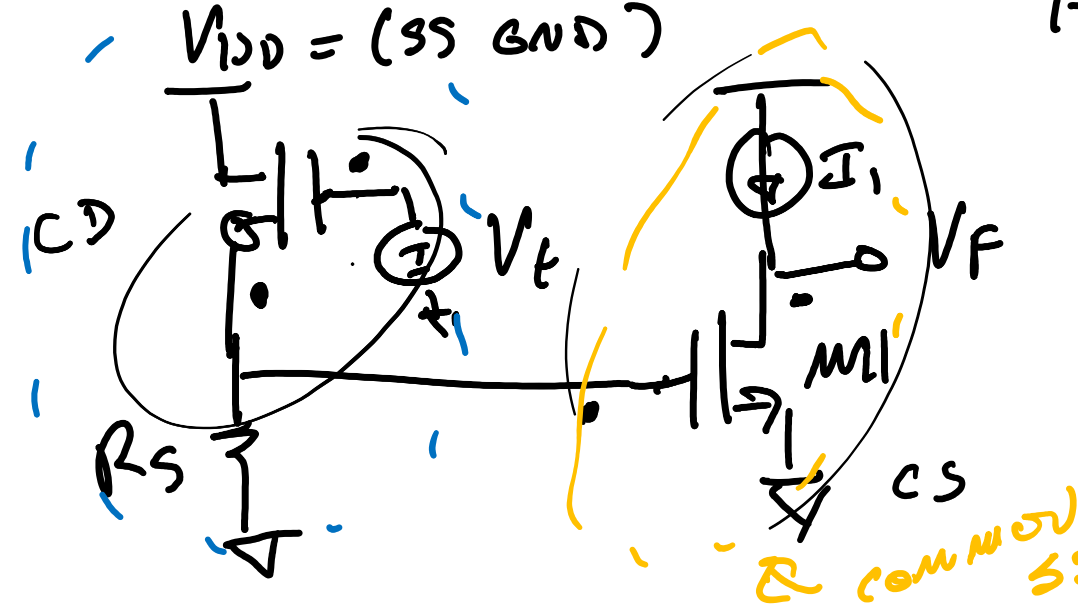
(a)



NORTON EQ.

COMMON DRAIN

$$A_{v,\text{CLOSED}} = \frac{A}{1 + A\beta}.$$



$$A \cdot \beta = A_{CD} \cdot A_{CS}$$
$$= (1) \cdot (-g_{m1} \cdot r_{o1})$$
$$= -g_{m1} \cdot r_{o1}$$