

# Feedback (Negative)

VCVS



Sense V, feedback V

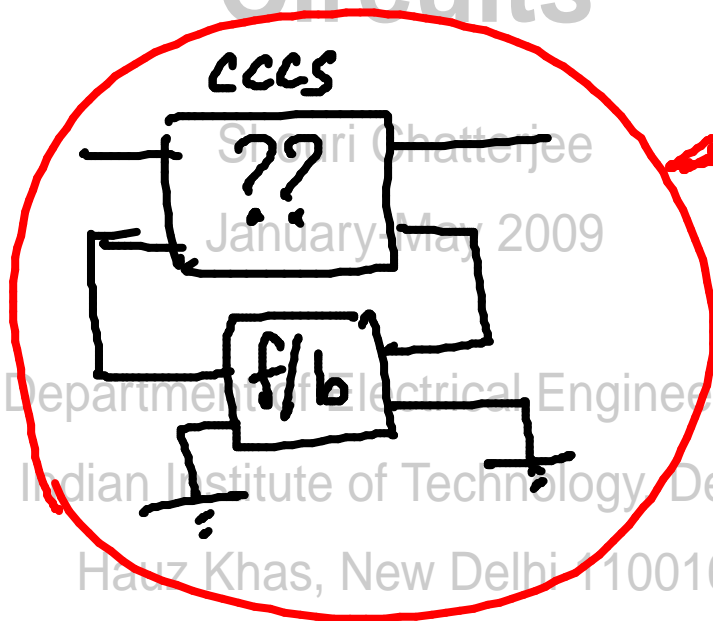
VCCS

CCCS

CCVS



Sense V, feedback I



better  
VCCS

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# EEL782: Analog Integrated Circuits

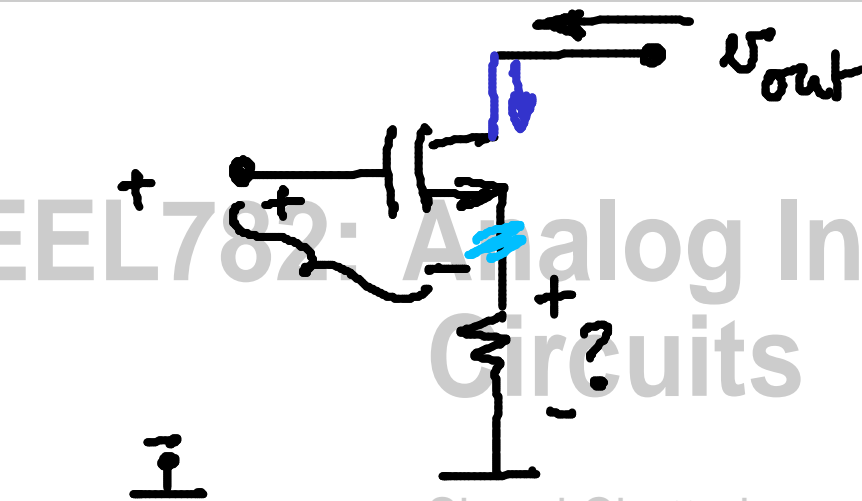
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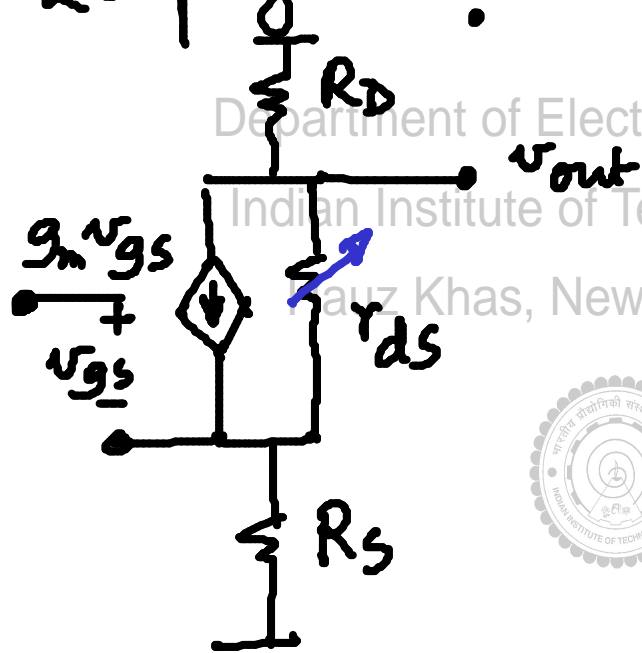
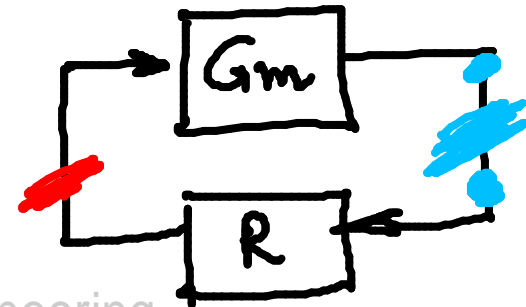
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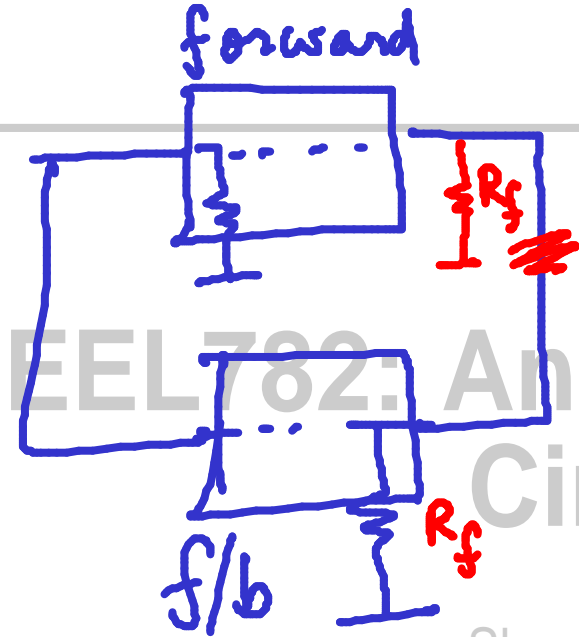
Better VCCS

$\checkmark R_{out} \uparrow$   
 $G_{m1} \downarrow$   
 $r_{ds}(1+g_m R_s)$   
 $\frac{g_m}{1+g_m R_s}$

Loop gain?



Loopgain  $\approx g_m R_s$



# EEL 782: Analog Integrated Circuits

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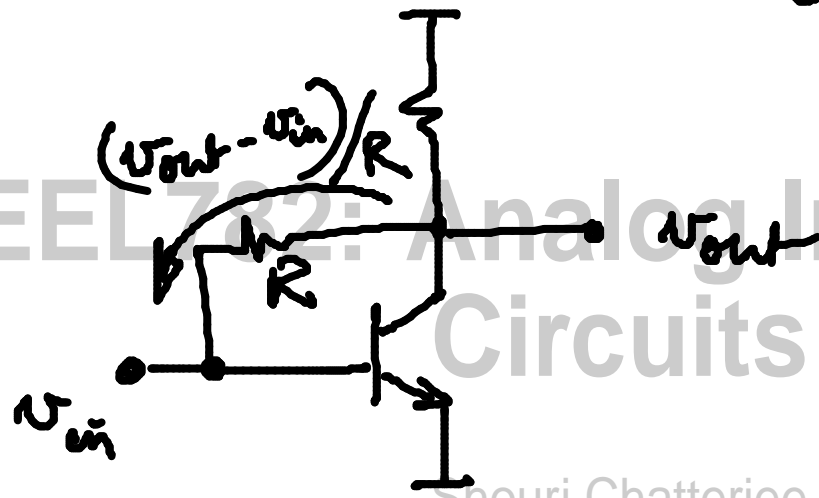
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better CCVS



$R_i \downarrow$

$R_o \downarrow$

$\frac{\Omega}{1 + \text{Loop gain}}$

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# Common-mode feedback

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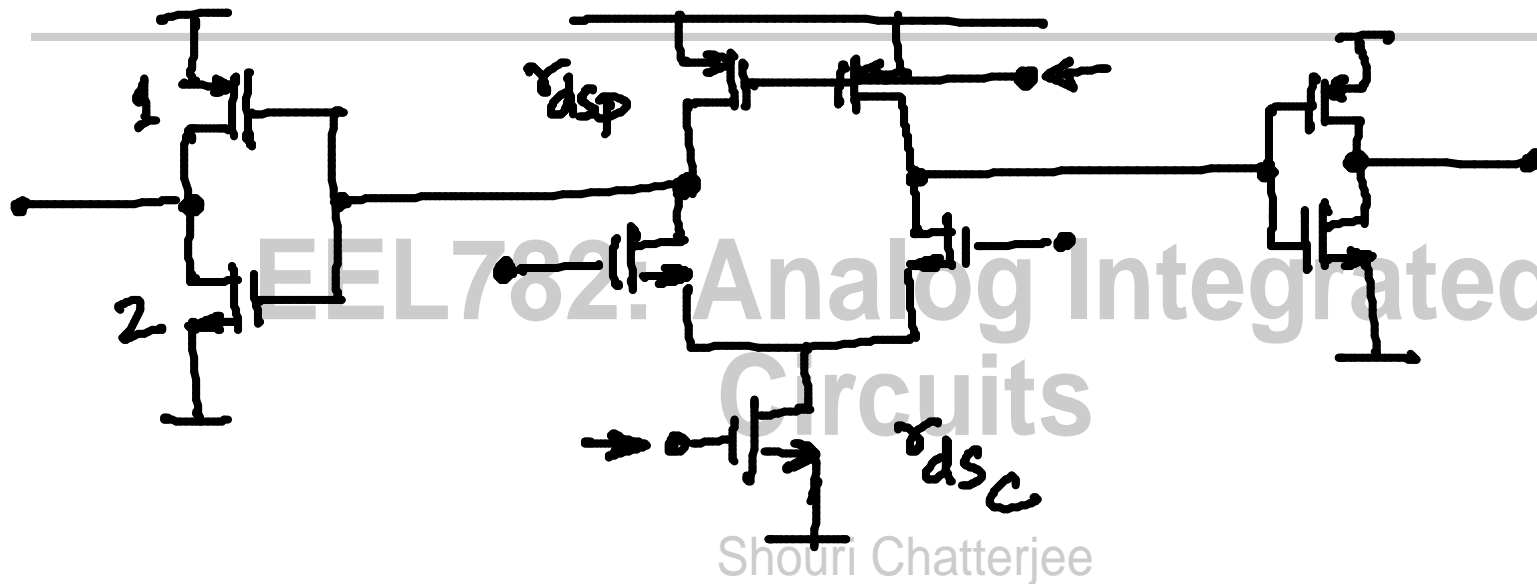
↳ To make CM gain  $< 1$

$\frac{\text{CM gain}}{1 + \text{Loop gain}}$  → Nothing should be disturbed  
→ in the diff mode  
→ To guarantee stability in the CM loop

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$$CM \text{ gain} = + \frac{r_{dsp}}{2r_{dsc}} \cdot (g_{m1} + g_{m2}) (r_{ds1} || r_{ds2})$$

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