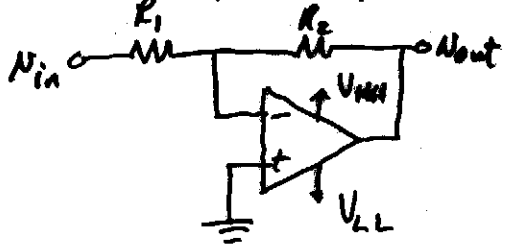
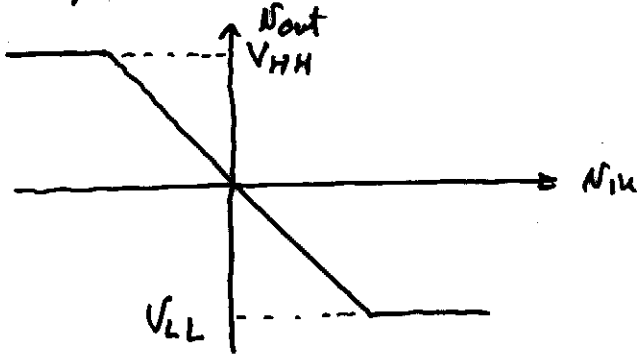
LIMITING AMPLIFIERS

How do you introduce an output saturation/limit in an amplifier?



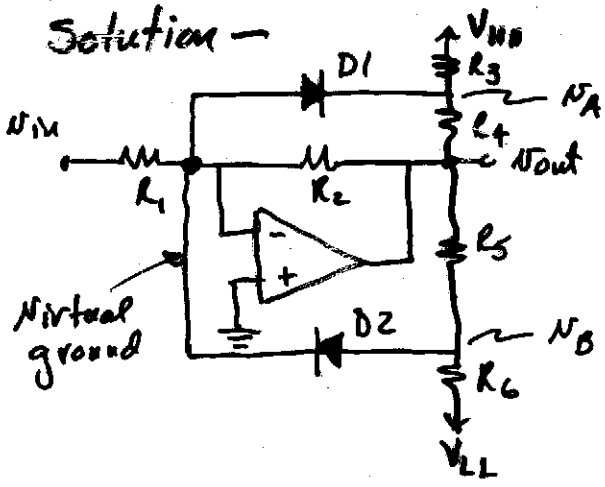


Problem:

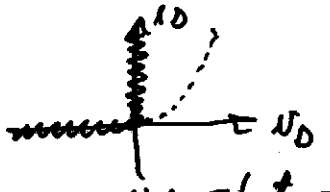
1.) Limits not well controlled

2.) Saturation too "hard".

Solution —



Assume Ideal diodes



Three possible states

1.) Both diodes off.

2.) D1 ON, D2 OFF

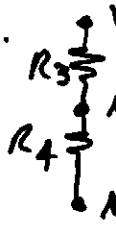
3.) D1 OFF, D2 ON

1.) D1 and D2 off

$$V_{out} = -\frac{R_2}{R_1} V_{in}$$

2.) $V_A \leq 0 \rightarrow$ D1 on and D2 off

To find where D1 turns on, assume D1 is off and solve for V_A.

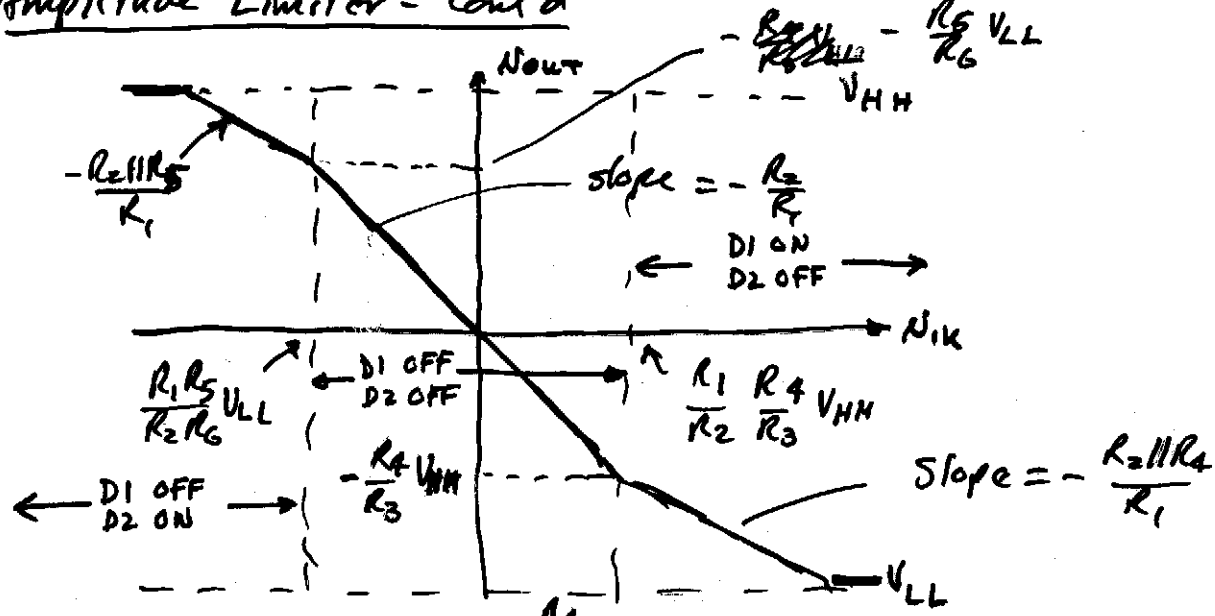


$$V_A = \frac{R_4}{R_3+R_4} V_{HH} + \frac{R_3}{R_3+R_4} V_{out} = 0$$

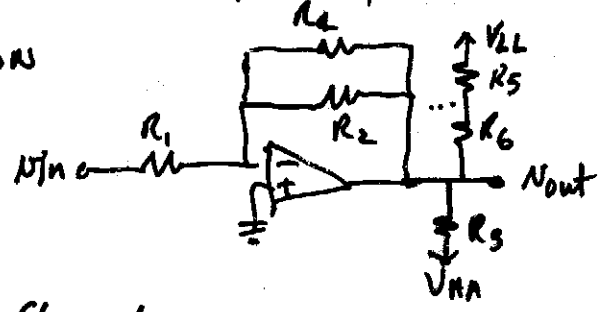
$$V_{out} = -\frac{R_4}{R_3} V_{HH}$$

Setting $V_A > 0 \rightarrow V_{out}$ where D1 turns on

Amplitude Limiter - Cont'd



D1 is ON



Added after class –

3.) $N_B \geq 0 \rightarrow$ D2 ON and D1 OFF

To find where D2 turns ON, assume D2 is off and find N_B.

$$N_B = \frac{R_5}{R_5+R_6}V_{LL} + \frac{R_6}{R_5+R_6}N_{OUT} = 0 \rightarrow N_{OUT} = -\frac{R_5}{R_6}V_{LL}$$

Corresponding input voltage is $N_{IN} = \frac{R_1}{R_2}\frac{R_5}{R_6}V_{LL}$

∴ D2 is ON