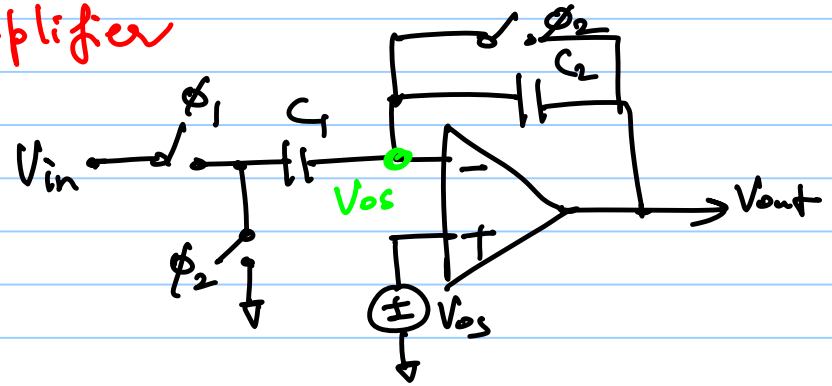
ECE 517 - Lecture 24

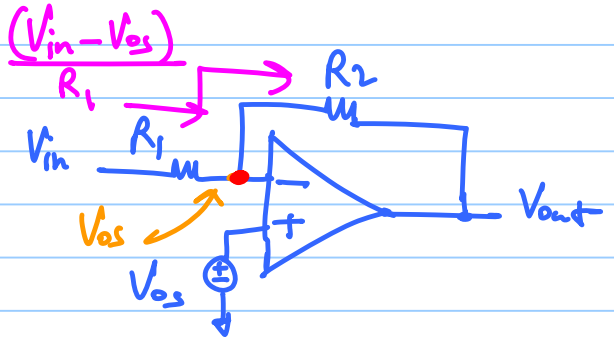
Note Title 4/13/2017

SC Amplifier



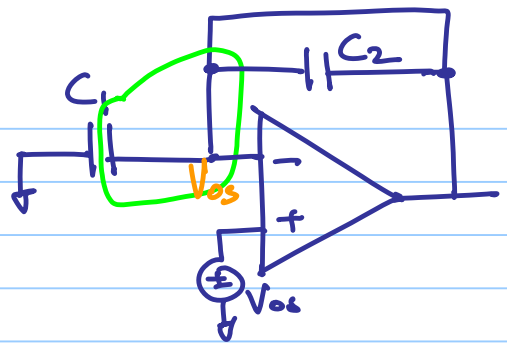
$$V_{out} = -\frac{C_1}{C_2} V_{in} + V_{os}$$

CT Amplifier



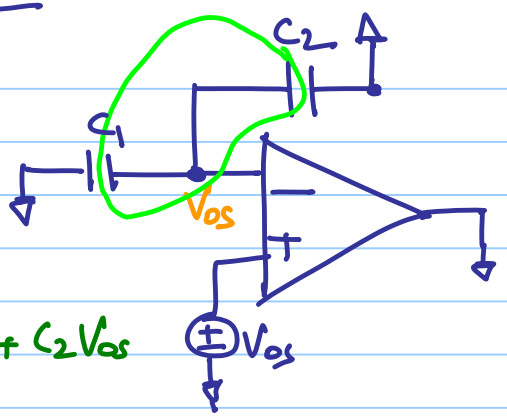
$$V_{out} = V_{os} - \frac{R_2}{R_1}(V_{in} - V_{os})$$

ϕ_1



Modify

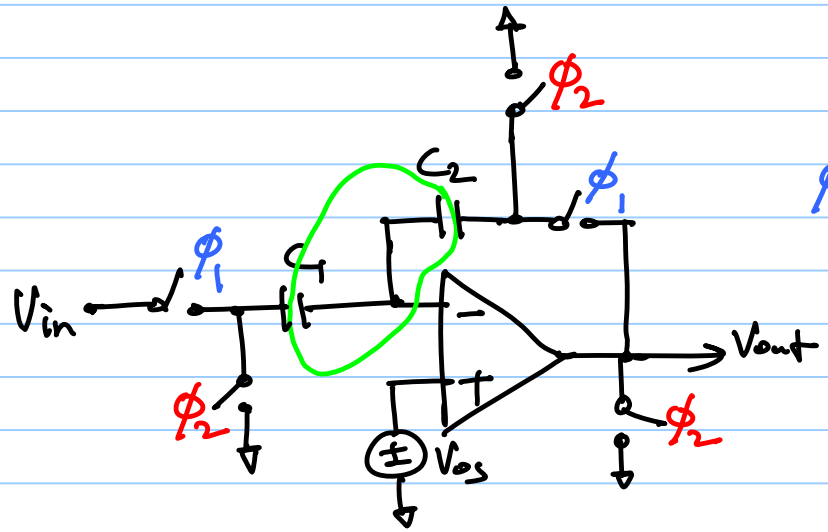
ϕ_2



$Q = +C_1 V_{os}$

$Q = C_1 V_{os} + C_2 V_{os}$

Different way of resetting



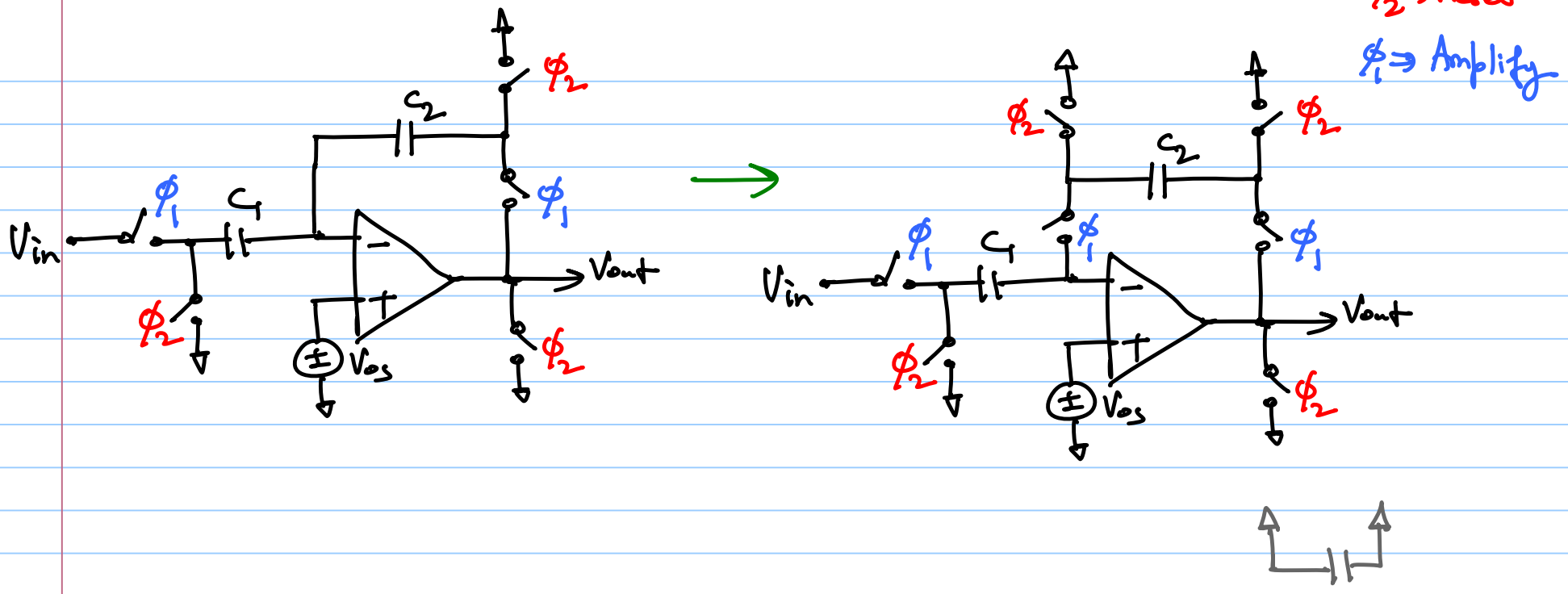
ϕ_2:

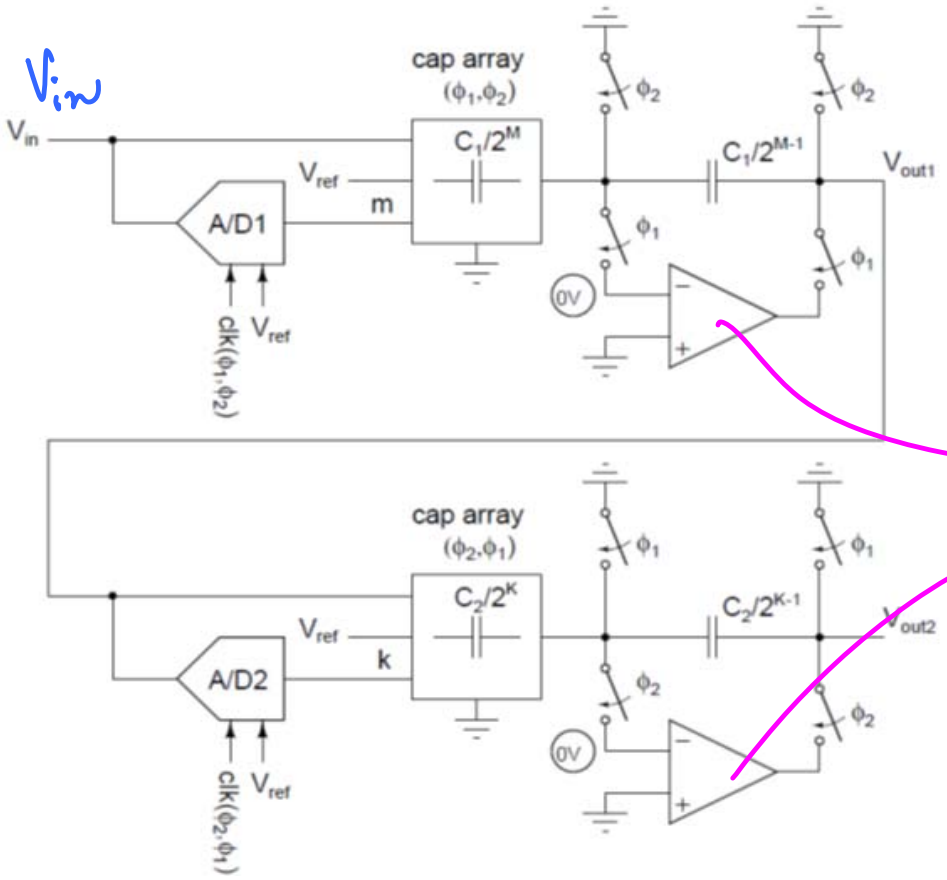
$Q = C_1 V_{os} + C_2 V_{os}$

ϕ_1: $-C_1(V_{in} - V_{os}) - C_2(V_{out} - V_{os})$

$C_1 V_{os} + C_2 V_{os} = -C_1 V_{in} + C_1 V_{os} - C_2 V_{out} + C_2 V_{os}$

$V_{out} = -\frac{C_1}{C_2} V_{in}$


$\phi_2 \Rightarrow$ Reset
$\phi_1 \Rightarrow$ Amplify
ϕ_2
C_2
ϕ_1
ϕ_1
C_1
V_{in}
V_{out}
ϕ_2
$\pm$
V_{os}
ϕ_2
ϕ_2
C_2
ϕ_2
ϕ_1
ϕ_1
ϕ_1
C_1
V_{in}
V_{out}
ϕ_2
$\pm$
V_{os}
ϕ_2



Stage 1

$\phi_1 \Rightarrow$ Amplify

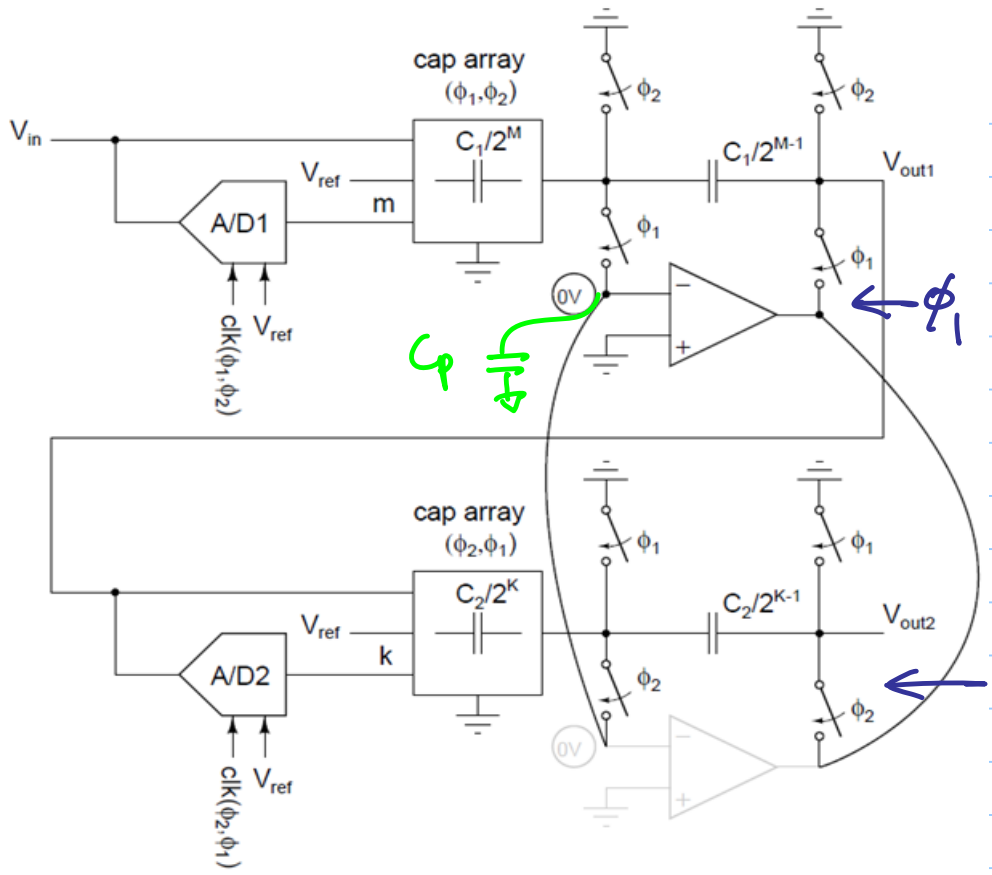
$\phi_2 \Rightarrow$ Reset

Idle during Reset phase

Stage 2

$\phi_1 \Rightarrow$ Reset

$\phi_2 \Rightarrow$ Amplify



opamp sharing

(+) Reduce Power Consumption

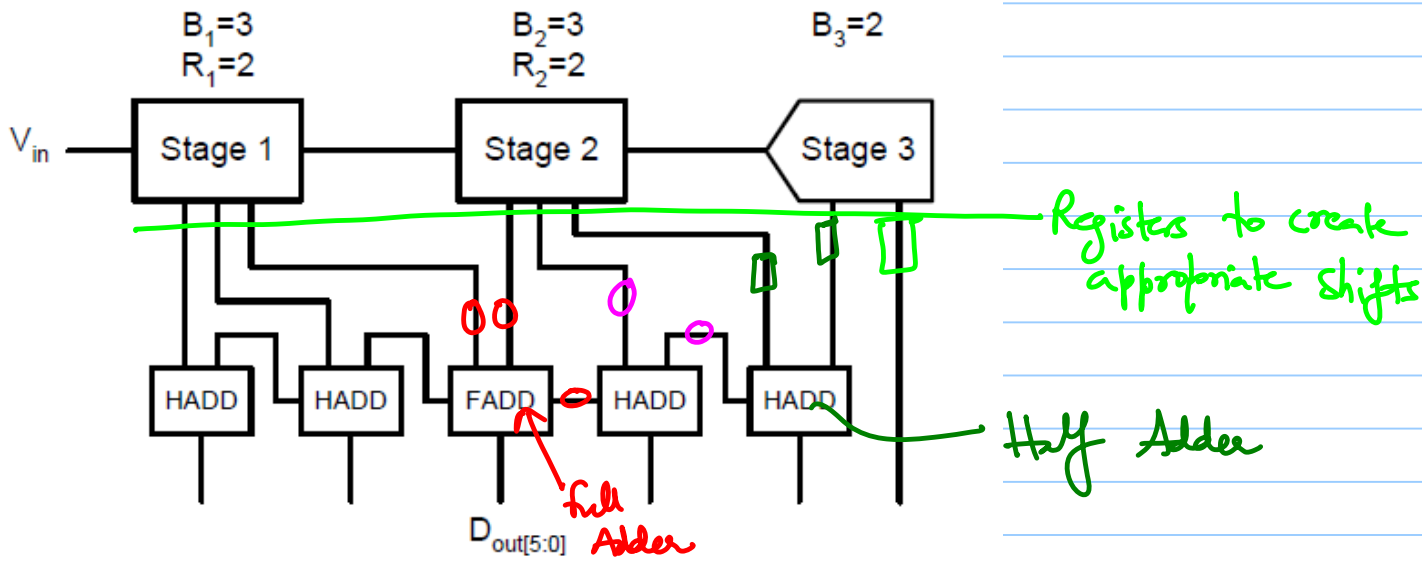
(−) Cannot correct for opamp offsets

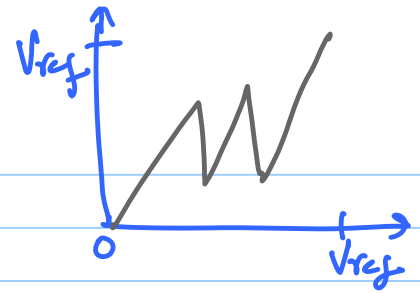
(−) Memory effect due to charge storage at −ve input of the opamp.

$$D_{out} = D_1 + \frac{1}{4}D_2 + \frac{1}{16}D_3$$

```
D1     XXX
D2      XXX
D3       XX
-----------
Dout   DDDDDD
```

Overlap by 1-bit and add

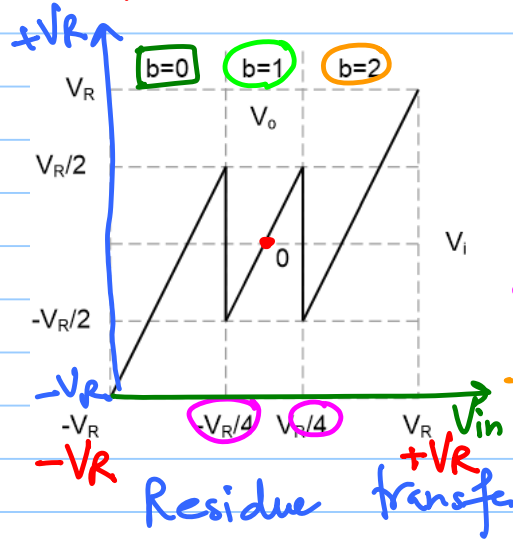


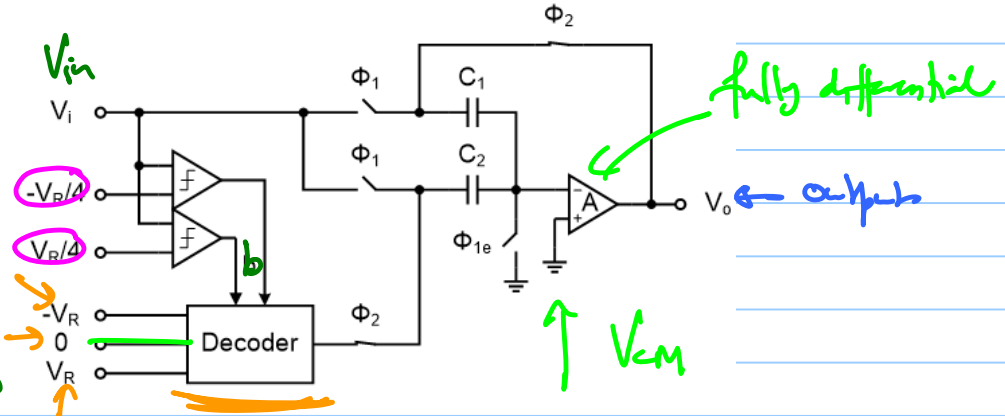


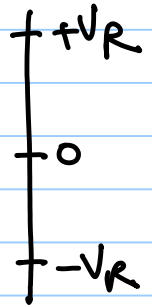
Single ended inputs

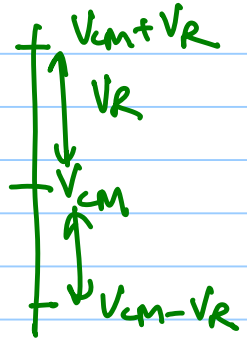
Differential inputs

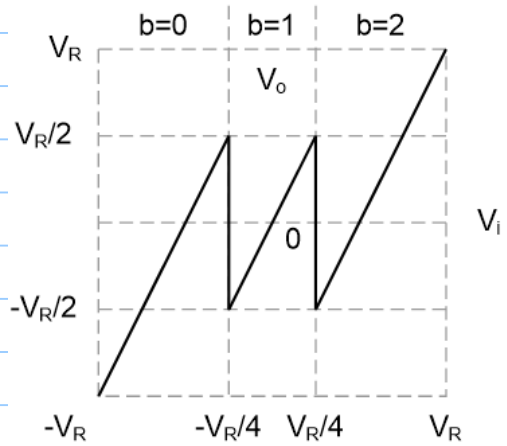
* 1.5bit/stage design





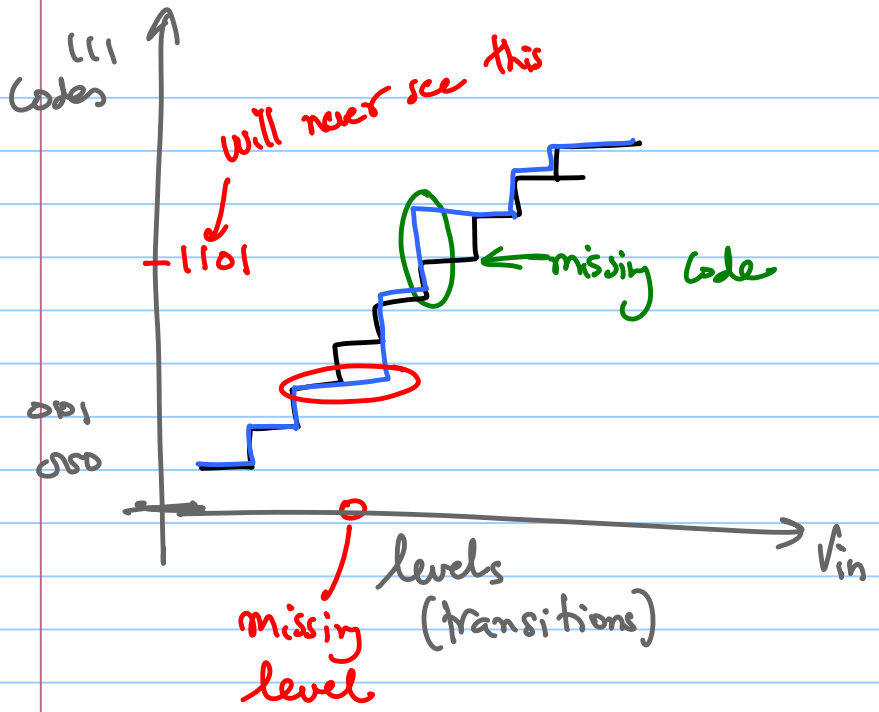


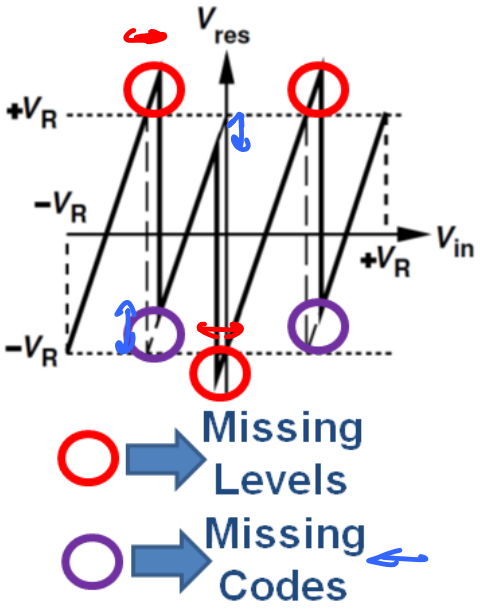




flash A/D output

b	0	1	2
b-1	-1	0	+1
C_2	$+V_R$	0	$-V_R$


111
Codes
will never see this
1101
missing code
000
000
missing level
levels (transitions)
Vin


Vres
+VR
−VR
Vin
+VR
−VR
Missing Levels
Missing Codes