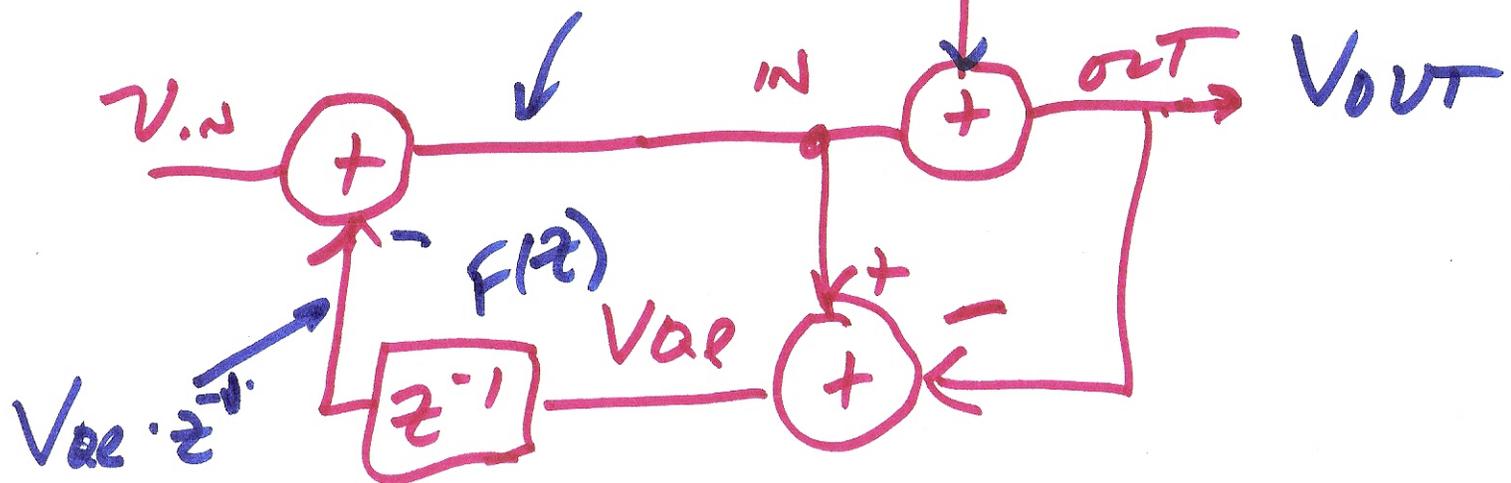


DEC. 6, 2010

Lecture 27

ERROR

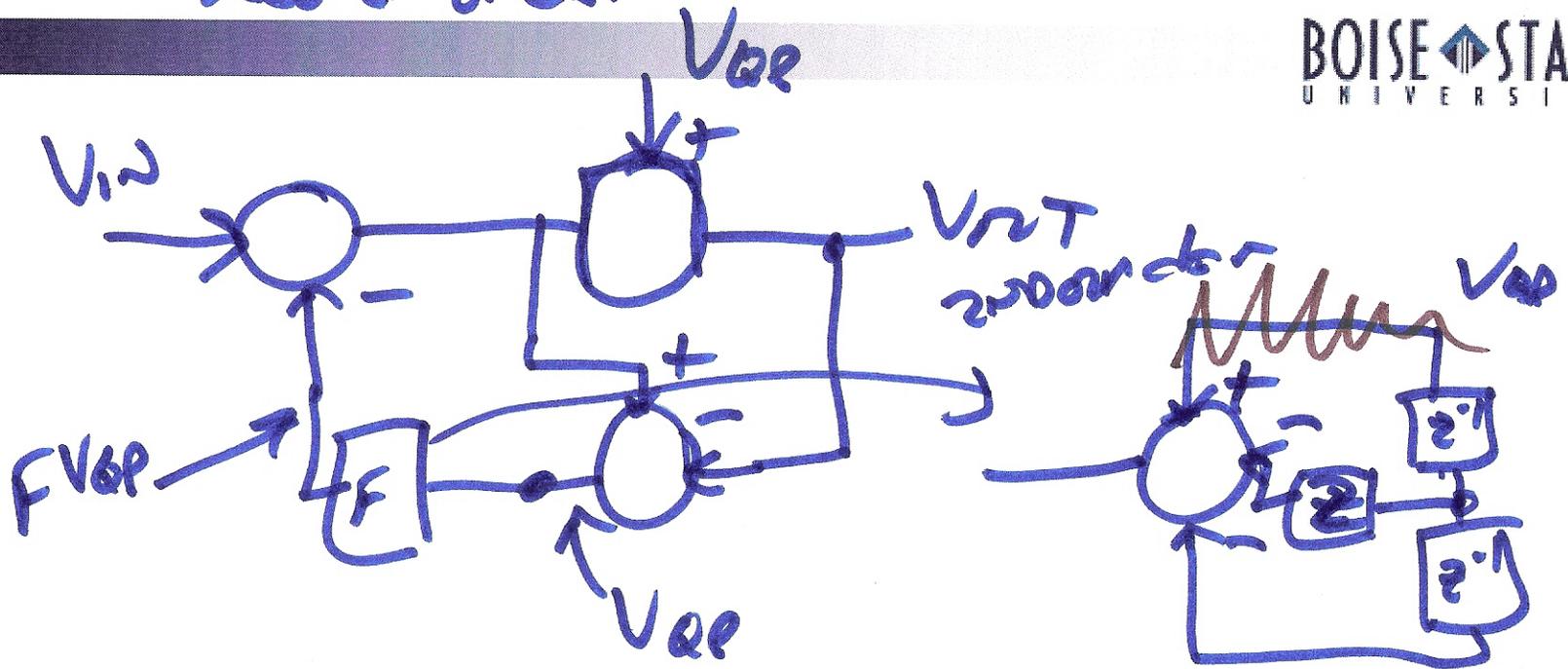
p. 272
 $V_{oe}(z)$ 

$$V_{IN} - V_{OE} \cdot z^{-1} + V_{OE} = V_{OUT}$$

$$V_{OUT} = V_{IN} + V_{OE}(1 - z^{-1})$$

1)

Second order



$$V_{in} - F V_{QEP} + V_{QEP} = V_{OUT}$$

1st order
 $F = z^{-1}$

$$V_{in} + V_{QEP} (1 - z^{-1}) = V_{OUT}$$

2nd order

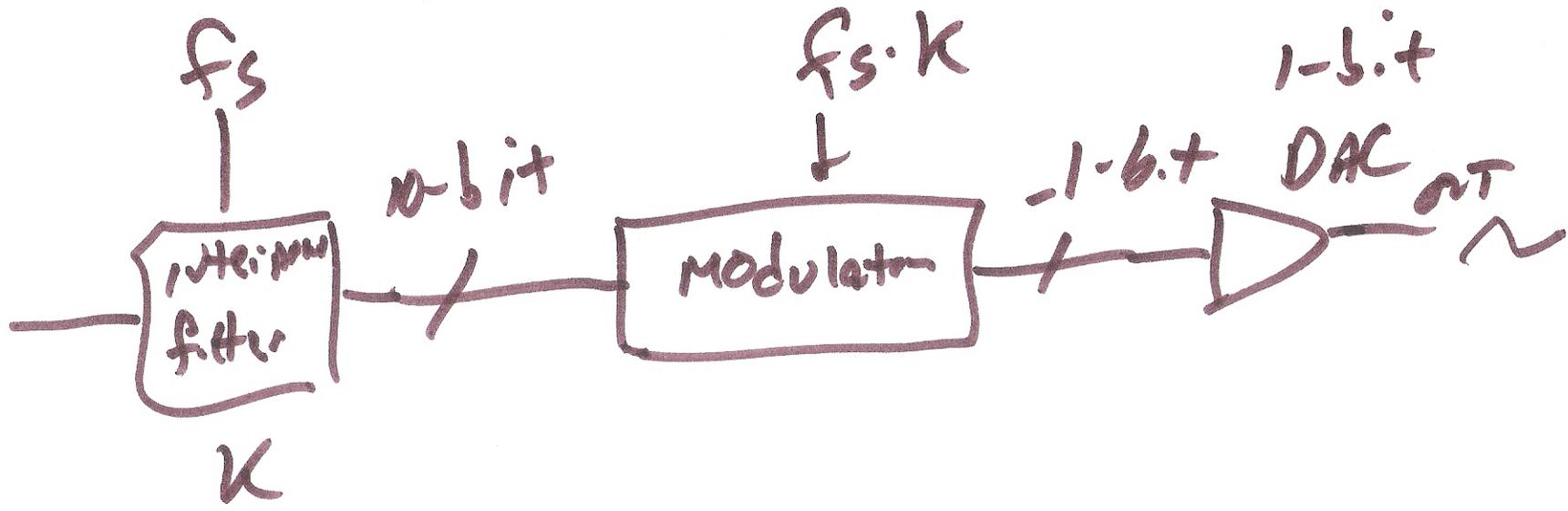
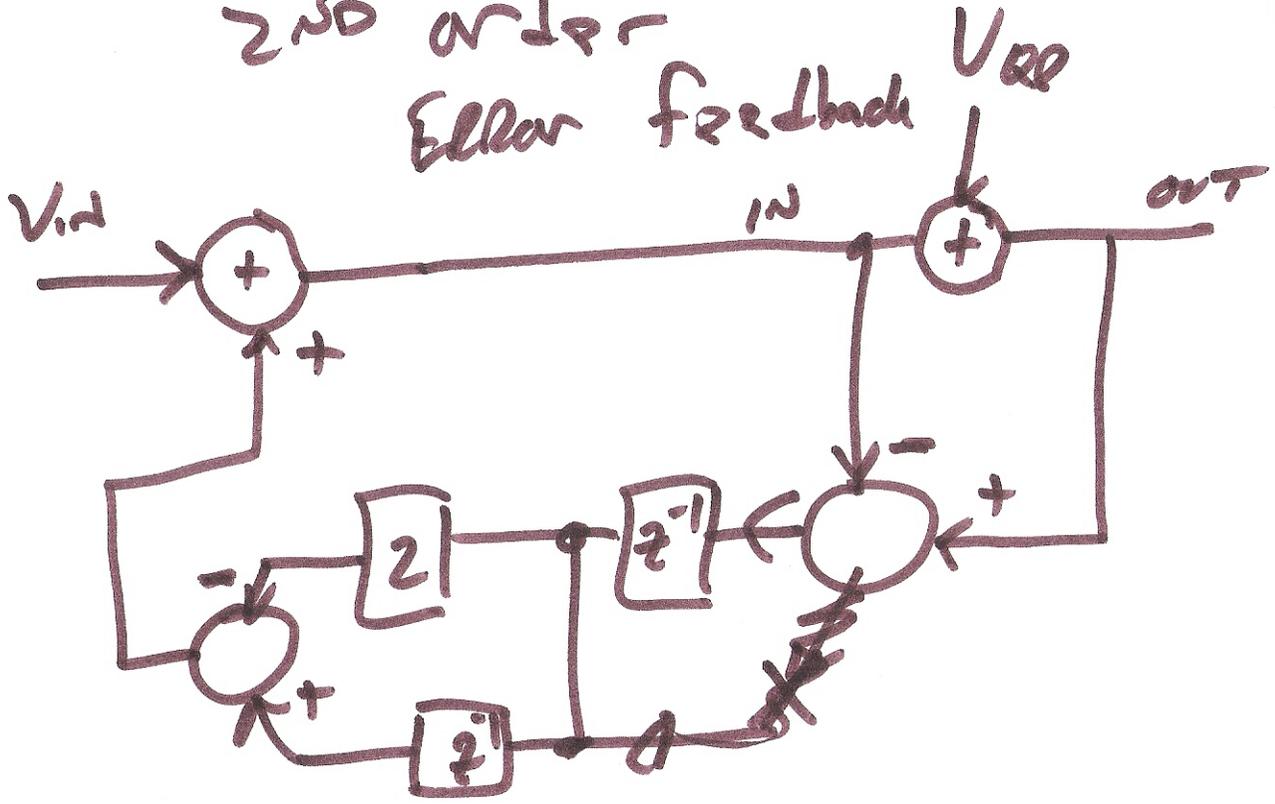
$$V_{in} + V_{QEP} (1 - z^{-1})^2 = V_{OUT}$$

$F =$

$$\frac{V_{QEP} (1 - 2z^{-1} - z^{-2})}{1 - F}$$

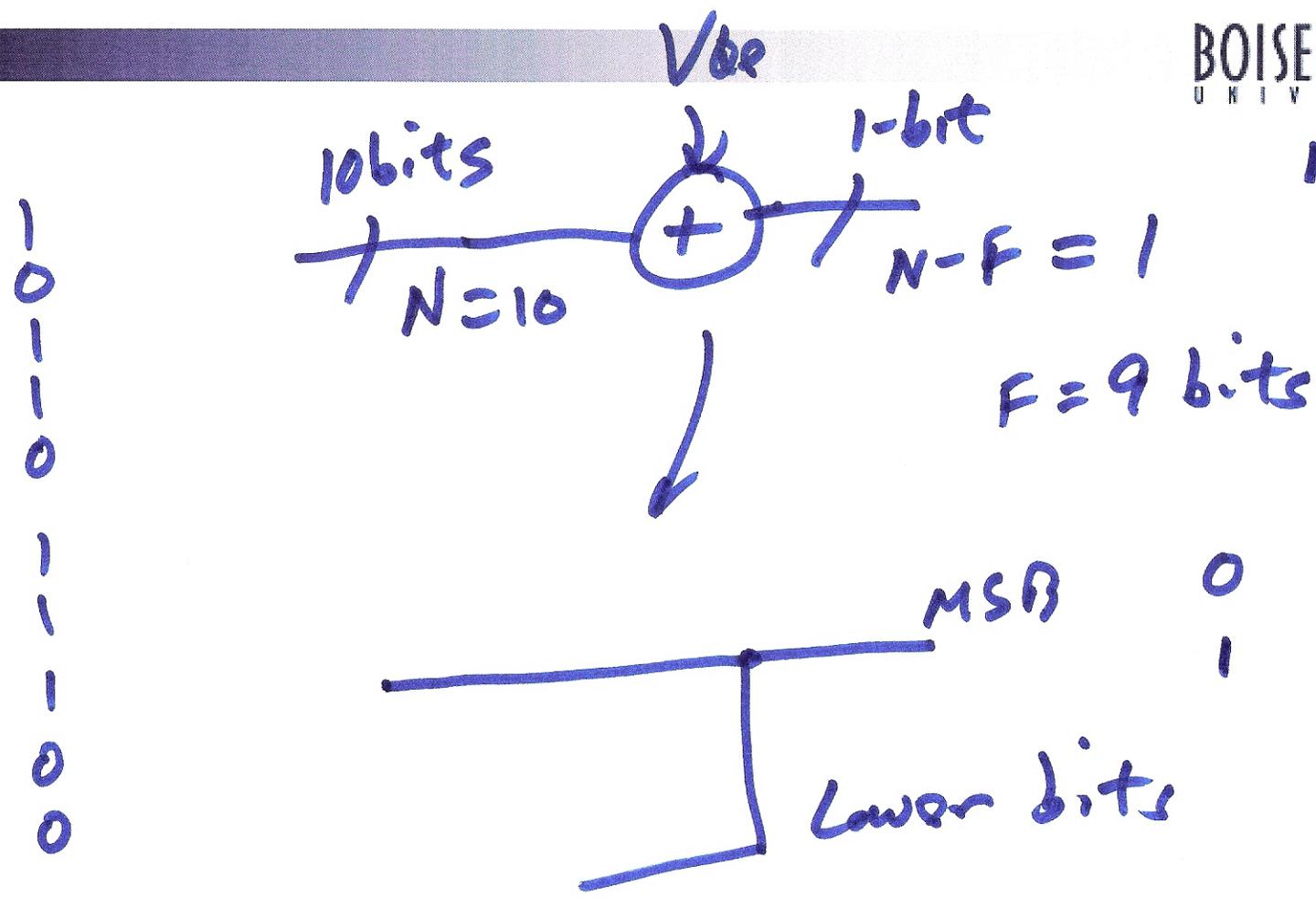
2)

2ND order
Error feedback



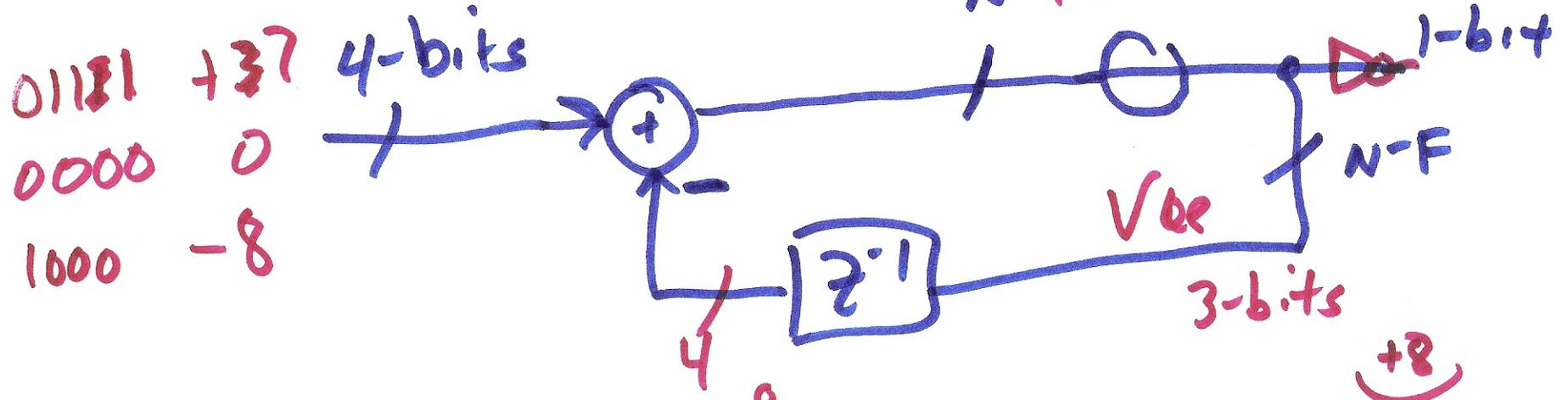
3)

1001111



4)

Fig. 7.50



0111 +37
 0000 0
 1000 -8

+8
 -7

 +1

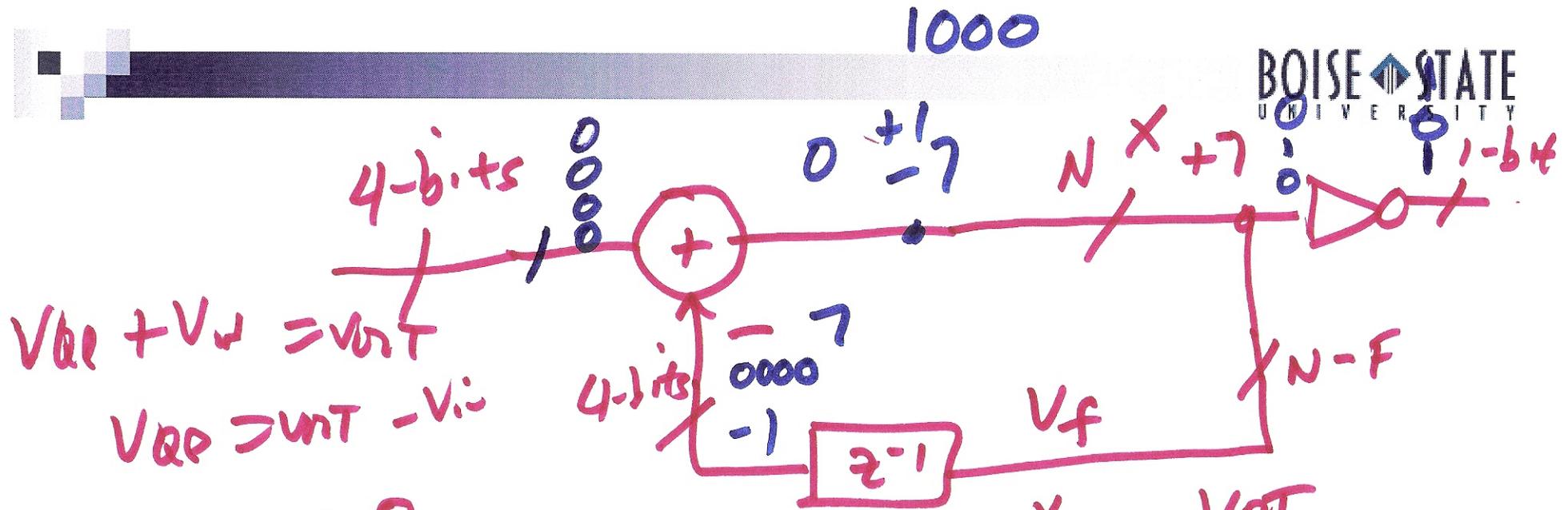
+8
 -0

 8

0111 +7
 0110 +6
 0101 +5
 ⋮
 0000 0
 1111 -1
 1110 -2

-8

5)



$$V_{QR} + V_d = V_{OUT}$$

$$V_{QR} = V_{INT} - V_{in}$$

$$\begin{array}{r} +8 \\ -7 \\ \hline +1 \end{array}$$

$$V_{QR} = -8 - (-1) = -7$$

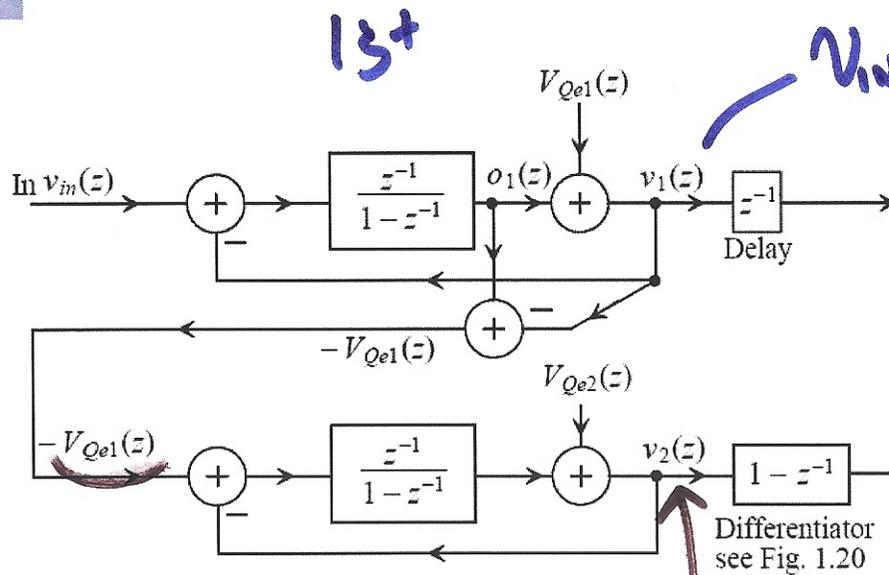
$$8 - 0 = 8$$

$$-8 + 7 = -1$$

6)

V_f	X	V_{OUT}
0001	0111 (7)	+1 (+8)
0010	0110 (6)	+1 (+8)
1001	1111 (-1)	0 (-8)
	0000 (0)	+1 (+8)

$$+8 - 1 = +7$$



$$v_{in}z^{-1} + V_{Qe1} \cdot (1-z^{-1})$$

$$\leftarrow v_{in}z^{-2} + V_{Qe1}z^{-1}(1-z^{-1})$$

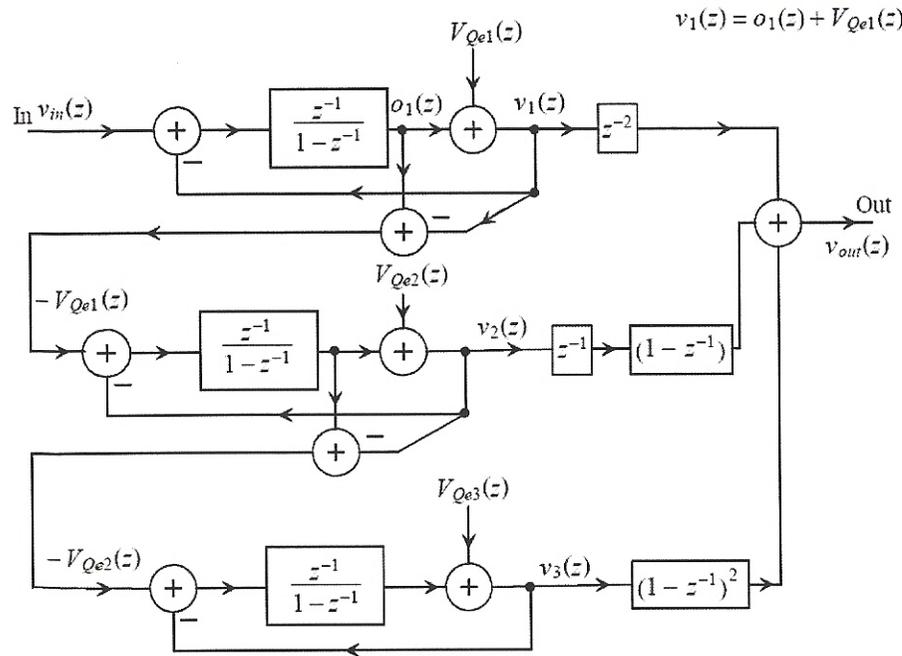
$$= v_{in} \cdot z^{-2} + V_{Qe1}(1-z^{-1})^2$$

MASH

$$-V_{Qe1} \cdot z^{-1} + V_{Qe2}(1-z^{-1})^2$$

$$(1-z^{-1})$$

7)



$= v_{in}(z^{-3}) + V_{Qe3}(1-z^{-1})^3$
 doubling \Rightarrow fs
 Neff 3.5 b.ts!

Figure 7.54 Third-order (1-1-1) cascaded modulator.

8)

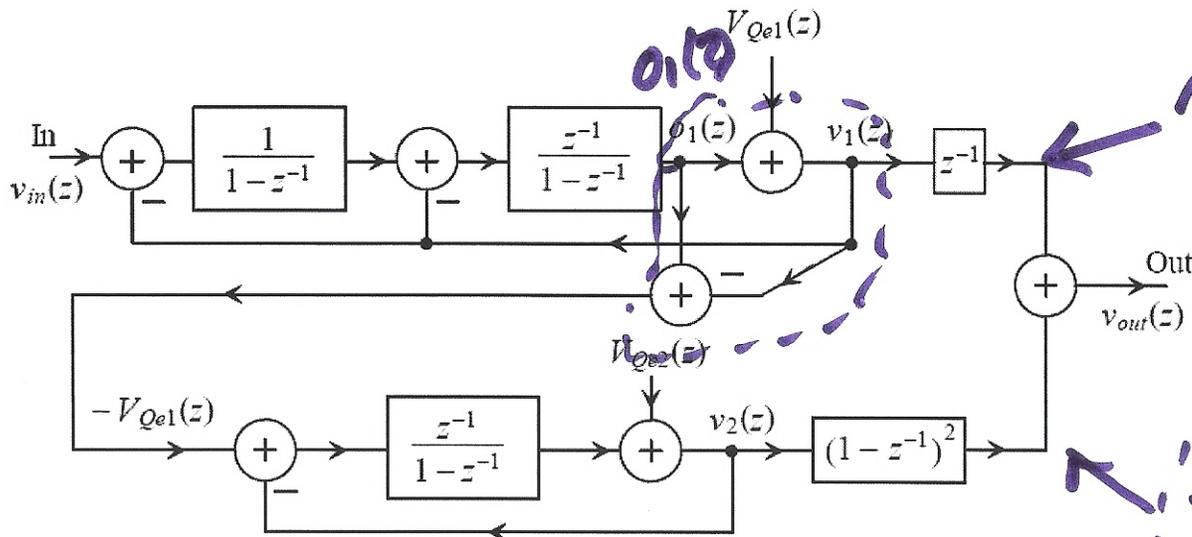


Figure 7.55 Third-order (2-1) cascaded modulator.

Handwritten notes in purple ink:

$$v_{in} \cdot z^{-2} + V_{Qe1} (1-z^{-1})^2 z^{-1}$$

$$= v_{in} \cdot z^{-2} + V_{Qe2} (1-z^{-1})^3$$

$$- V_{Qe1} \cdot z^{-1} + V_{Qe2} \cdot z^{-3}$$

9)

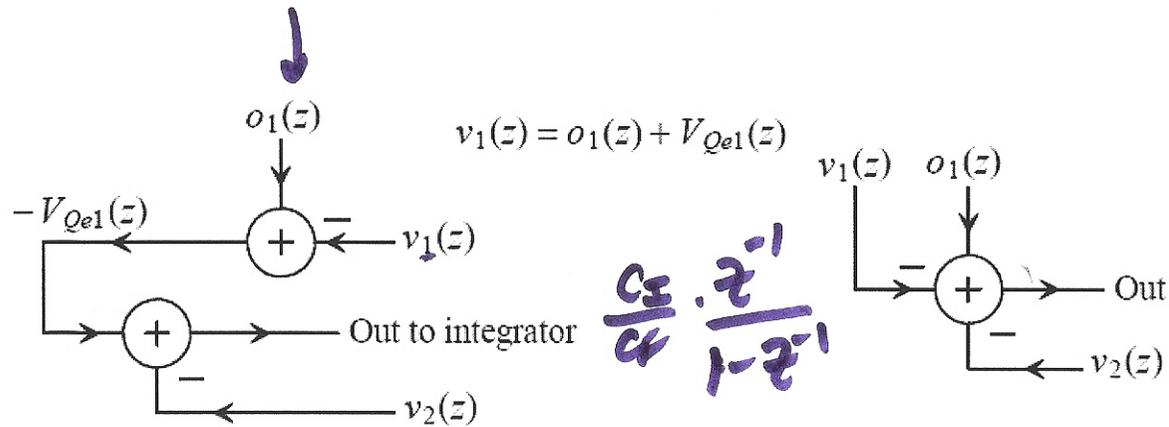


Figure 7.56 Showing implementation of the dual summing block as a single block.

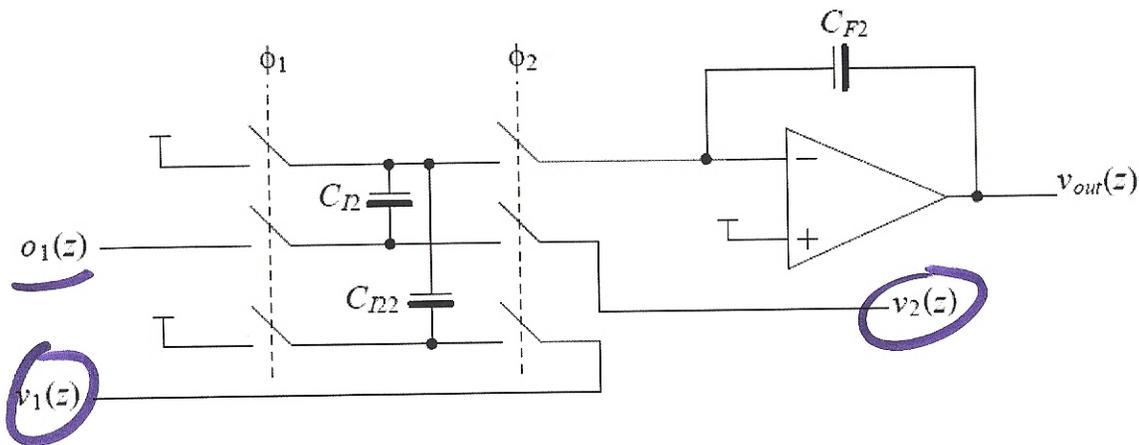
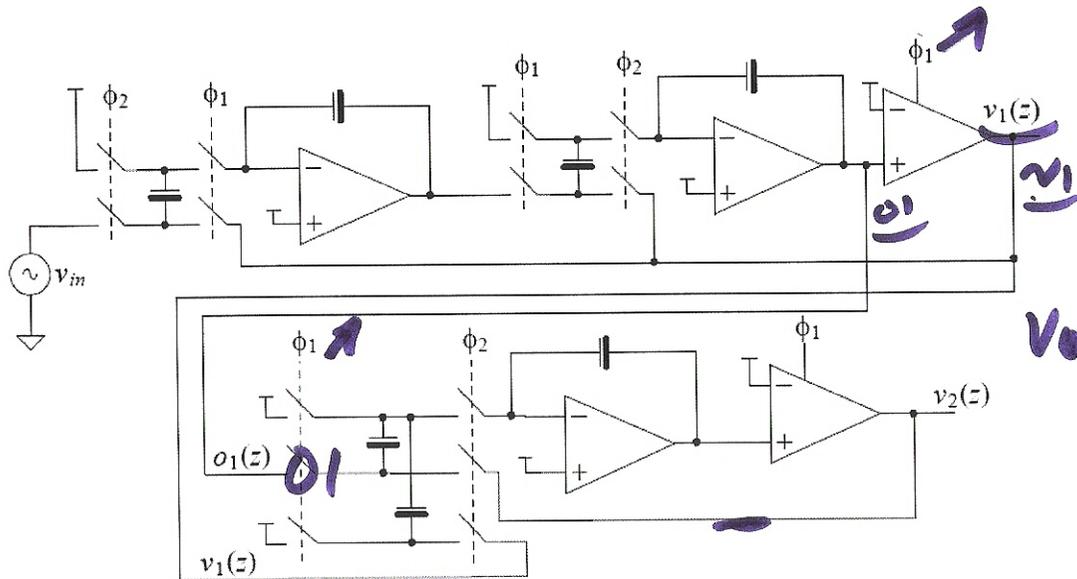


Figure 7.57 Implementing the dual summing block for a cascaded modulator.

11)



$$V_{op} = V_i - 01$$

$$V_{op1} = 01$$

$$V_1 - 01$$

Figure 7.58 Implementation of a 2-1 NS modulator.

12)

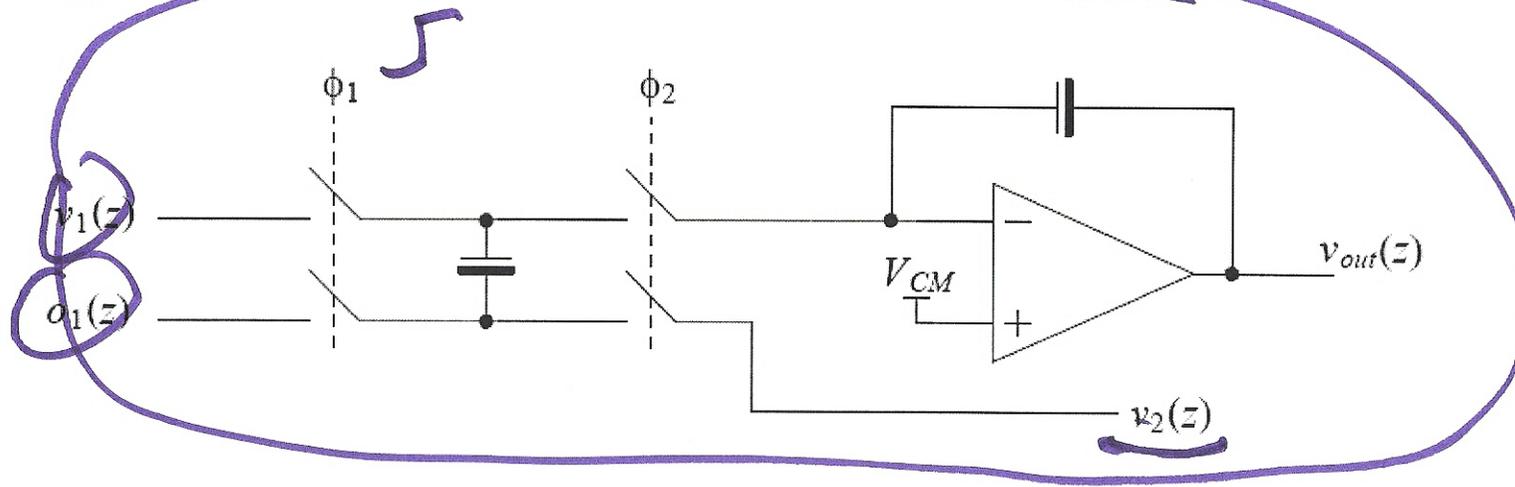


Figure 7.59 Implementing the dual summing block with a single capacitor results in sensitivity to the top plate parasitic capacitance.

13)