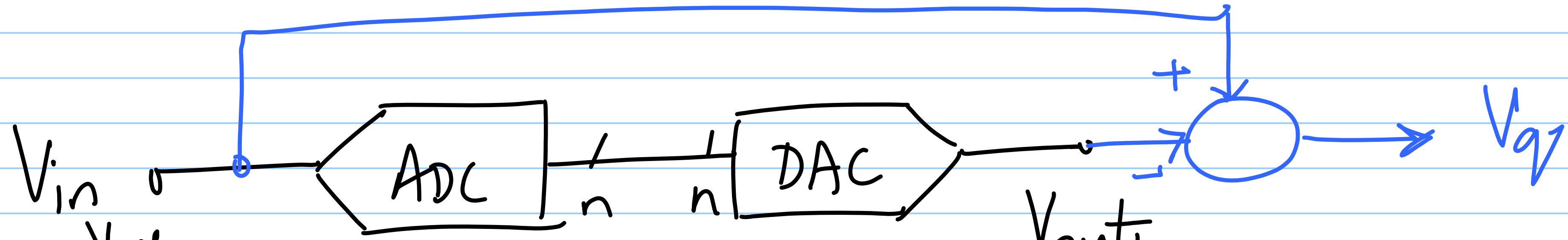
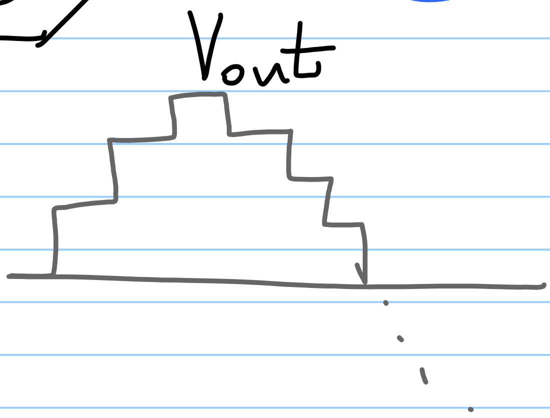
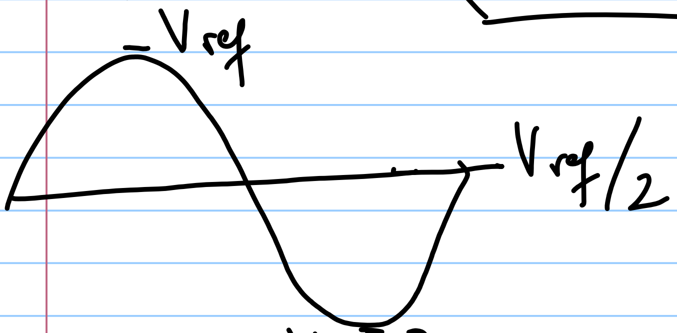
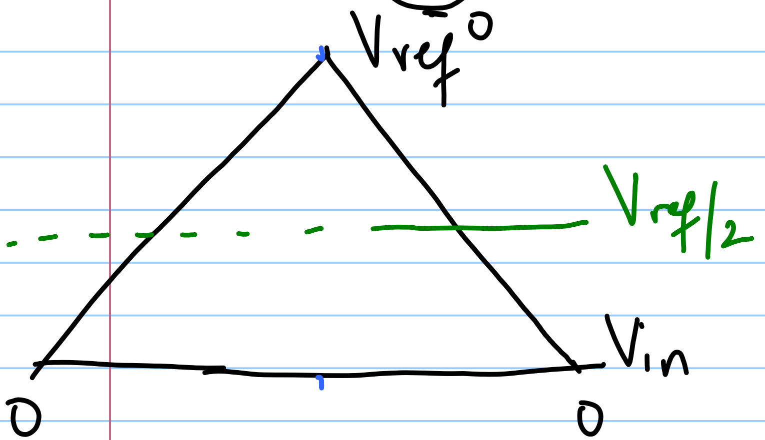
23/04/2019

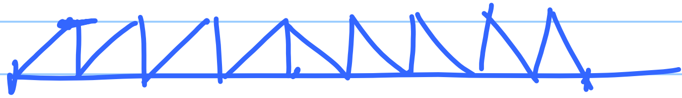
Lecture 41











$$av.(V_q) = \frac{1}{2} V_{LSB}$$

rms Value of $V_{in} = \dfrac{V_{ref}}{2\sqrt{3}}$

rms Value of $V_q = \dfrac{V_{LSB}}{2\sqrt{3}}$

$$SNR_{\Delta} = 20\log_{10}\left(\frac{\text{Signal}}{\text{Noise}}\right) = 20\log_{10}\left(2^n\right)$$

$$= 6.02n \text{ dB}$$

For a sine wave:

$$SNR = 20\log_{10}\left(\frac{V_{ref}/2\sqrt{2}}{V_{LSB}/2\sqrt{3}}\right)$$

$$= 20\log_{10}\left(2^n \cdot \sqrt{\frac{3}{2}}\right)$$

$$= 6.02n + 1.76 \quad dB$$

e.g. 10-bit ADC : $SNR_{ideal} \approx 62\,dB$

Say, Measured SNR @ ADC output $= 56\,dB$

effective # of bits n_{eff}

$$SNR_{meas.} = 6.02\,n_{eff} + 1.76\,dB$$

$$n_{eff} = \frac{SNR_{meas.} - 1.76}{6.02}$$

e.g. $n_{eff} \approx 9$

Metrics of ADC : INL, DNL, offset, gain, SNR, ENOB / n_{eff}