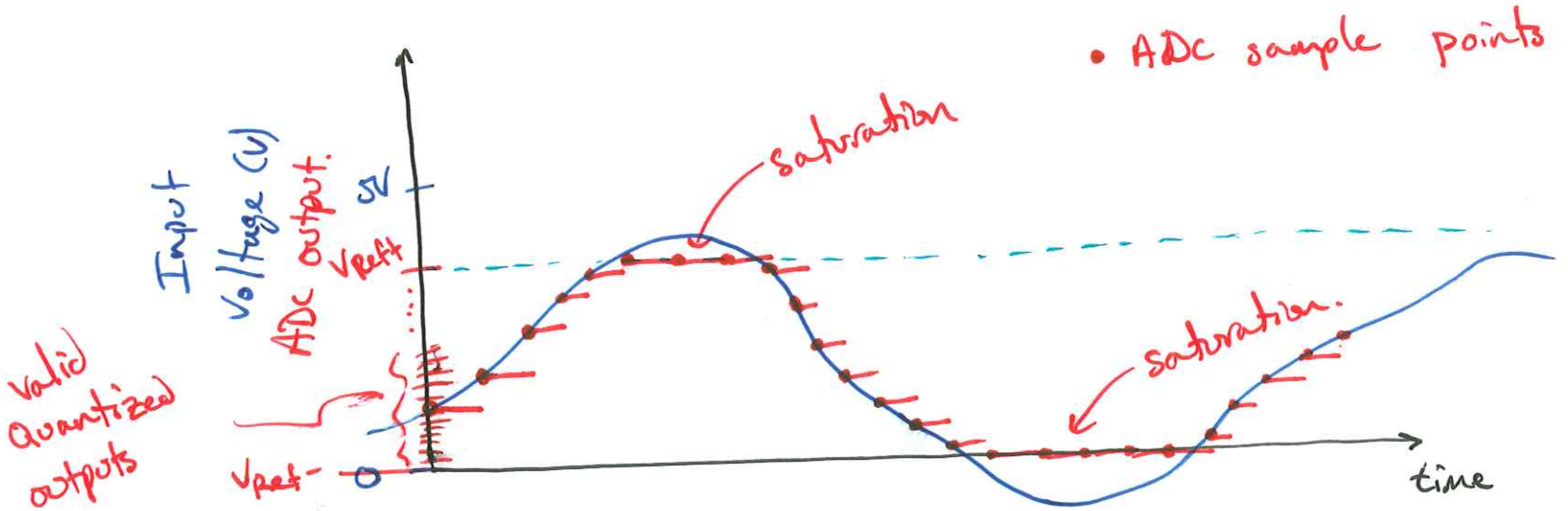
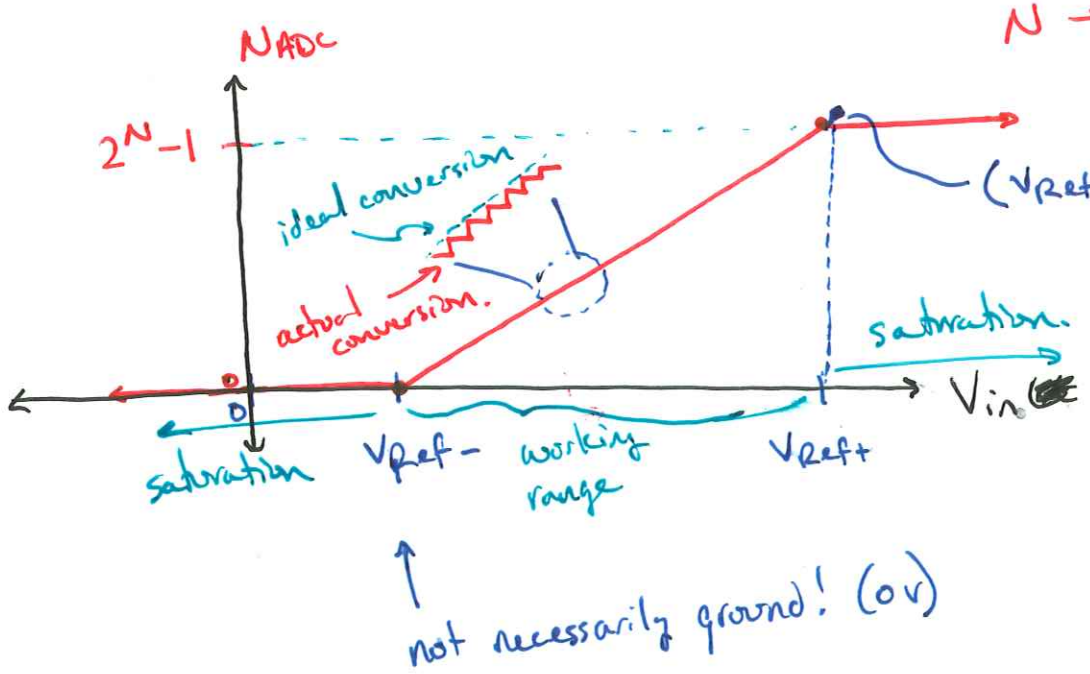
# Analog-to-Digital Converters (ADCs)




$V_{Ref+}$ & $V_{Ref-}$ are our reference voltages → limit the conversion range.

if input voltage outside this range: "saturation"

ADC output vs. Input Voltage ($V_{in}$)
($N_{ADC}$)




N → number of bits in conversion
(Not $N_{ADC}$)

ADC map:
in working range

$$N_{ADC} = \left\lfloor 2^N \frac{V_{in} - V_{Ref-}}{V_{Ref+} - V_{Ref-}} \right\rfloor$$

$\lfloor x \rfloor$ = floor function
(round down)
$\lfloor \rfloor$ will cause [quantization] error!

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full range:

$$N_{ADC} = \begin{cases} 0, & V_{in} < V_{Ref-} \\ \left\lfloor 2^N \frac{V_{in} - V_{Ref-}}{V_{Ref+} - V_{Ref-}} \right\rfloor, & V_{Ref-} \le V_{in} < V_{Ref+} \\ 2^N - 1, & V_{in} \ge V_{Ref+} \end{cases}$$