CS122A: Intermediate Embedded and Real Time Operating Systems

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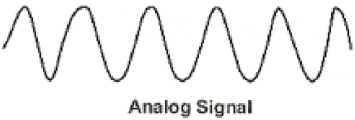
University of California, Riverside

Analog to Digital Conversion



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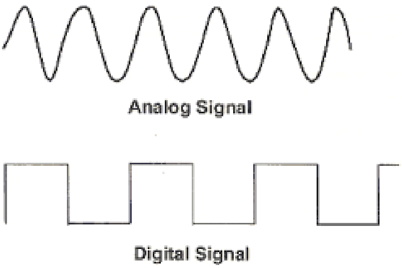

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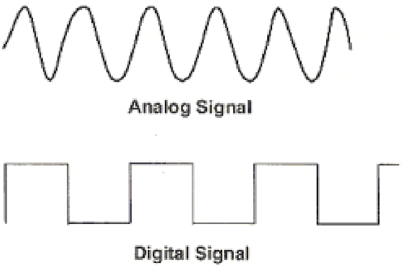

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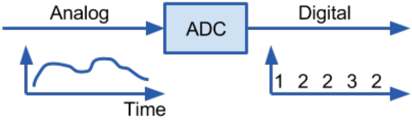
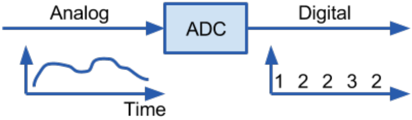


Required parameters:

Analog to Digital Conversion



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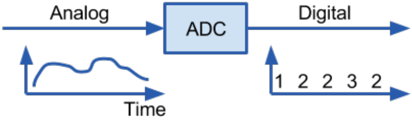

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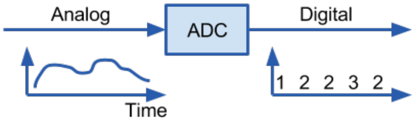

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- The **sampling rate** the ADC processes signals at

Analog to Digital Conversion

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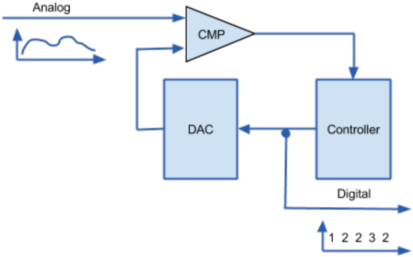
- Example:
  - Range: -2.0 V to +2.0 V
  - ADC Precision: 8 bits (256)
  - Interval $= 4V/256 = 0.015625$V
- Discretizing the analog signal leads to loss in precision, or **quantization error**

How is an ADC made?



Successive approximation circuit

- **Successive approximation** is commonly used

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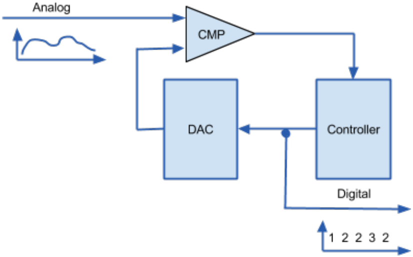

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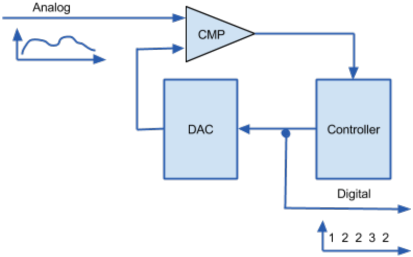

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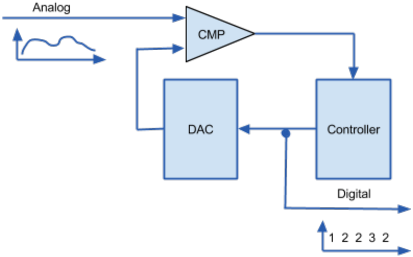

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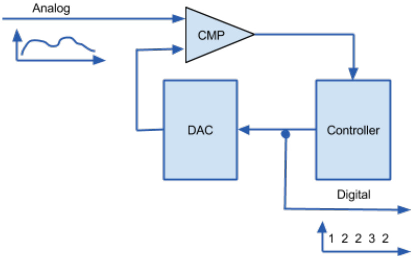

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  - outputs $In_{top} < In_{bottom}$

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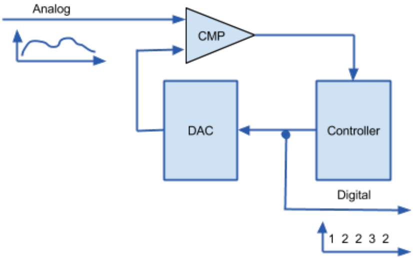

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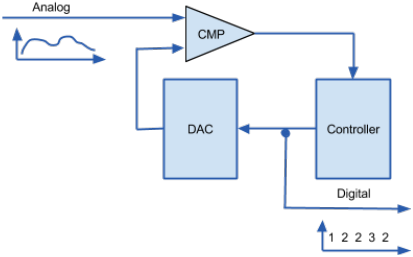

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- The controller
  - Controls execution of the algorithm

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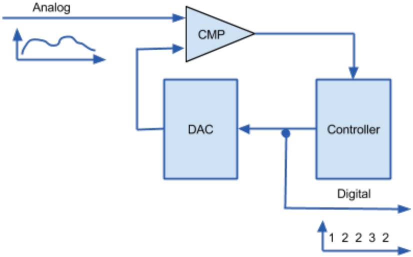

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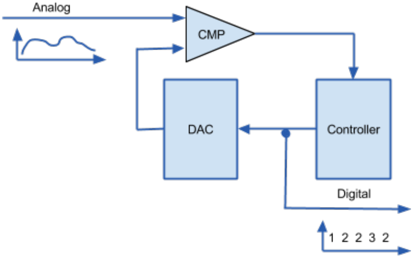

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- A comparator (CMP)
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- Digital to analog converter
    - Opposite of the ADC

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   - 0000 0011 to 0000 0100

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   - process continues until the window is 1

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- A radio that receives waves and extracts the audio broadcast

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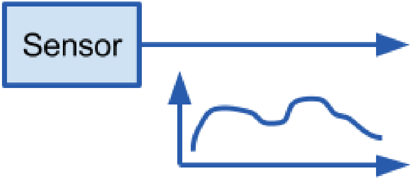

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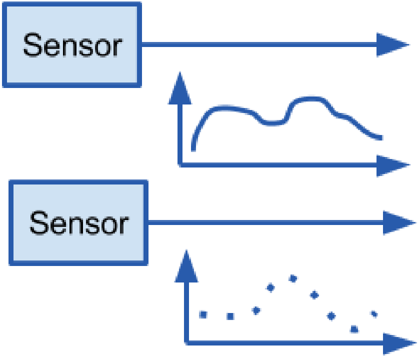

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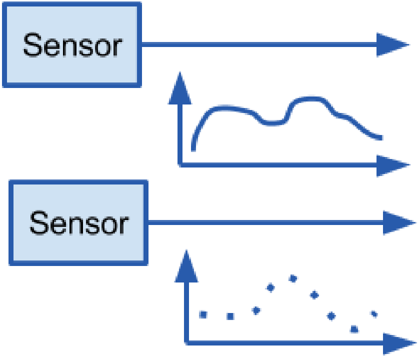

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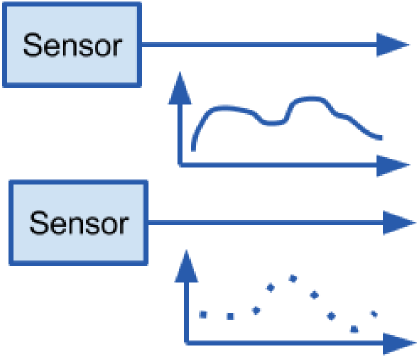

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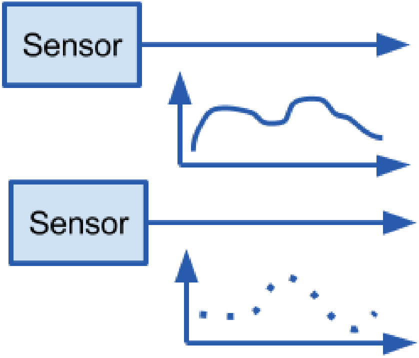

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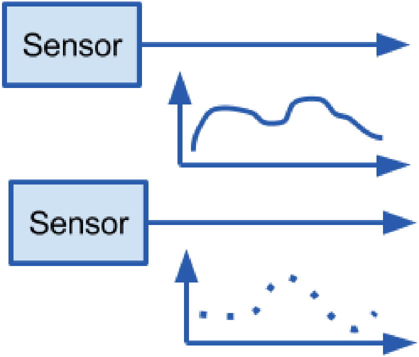

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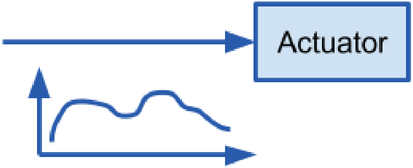
  - Output is **raw** and require further processing

Digital Signal Processing (DSP) - Actuators



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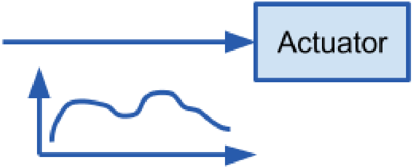

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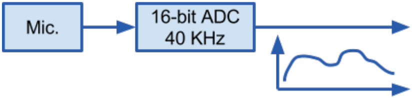
- Actuators have range and accuracy limitations as well
- Sensors need processing added before sending the signal to actuators

ADC and amplification



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  - Range: -1V to +1V
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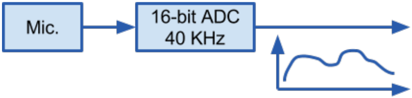

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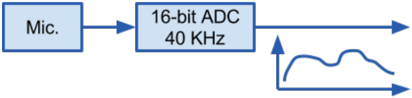

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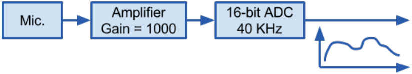

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- An **amplifier** must be added to the circuit

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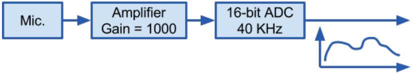

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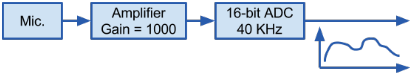

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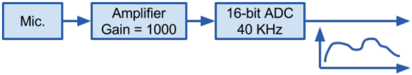

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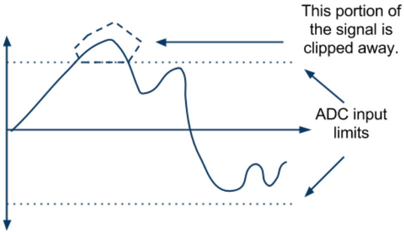

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- Results in **clipping**