Sampling, Analog-to-Digital, and Digital Filters

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- Sampling

  - To be able to process the analog signal with digital computers, we need to digitize the analog signal
  - It introduces noise due to quantization
  - Sampling rate is the rate at which samples are taken (in Hertz)

- The Nyquist Theorem

  - States that in order to adequately reproduce a signal, it should be periodically sampled at a rate that is two times the highest frequency you wish to record

- Analog Filtering

  - Typically designed for frequency selectivity
  - Typically using circuits and circuit devices
  - "Real-time" and fast
  - Filter settings can be hard to change
  - Filtering necessary before A/D

- Digital Filter Design

  - Two Common Approaches
    * Approximate analog filters directly

- Trade-offs

  - Design from analog generally much lower order for same specifications
  - Design from digital allows control over phase behavior, greater flexibility in frequency response, and tolerance specifications
  - Design from digital can be more stable in finite precision