

Lab 2

Signals, Instruments and Systems

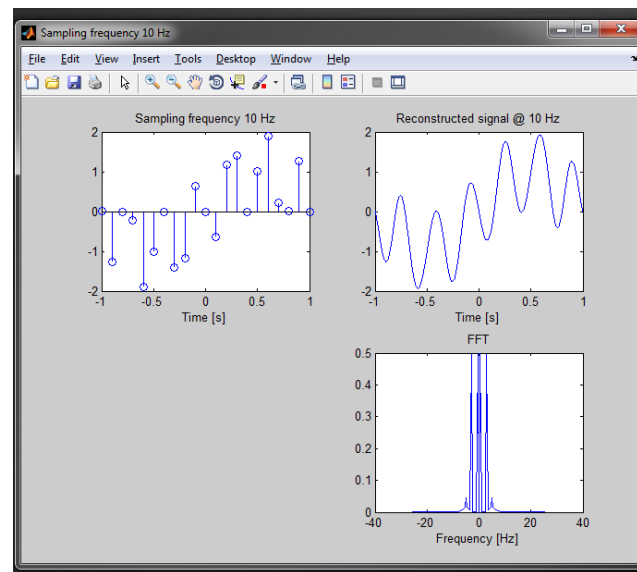
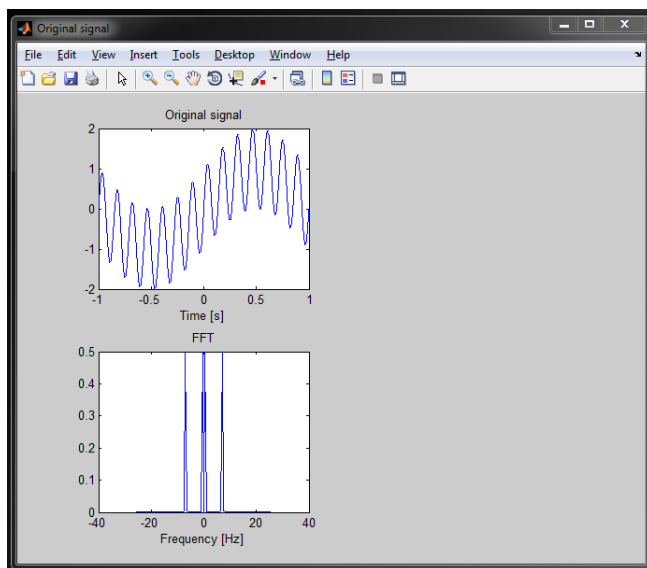
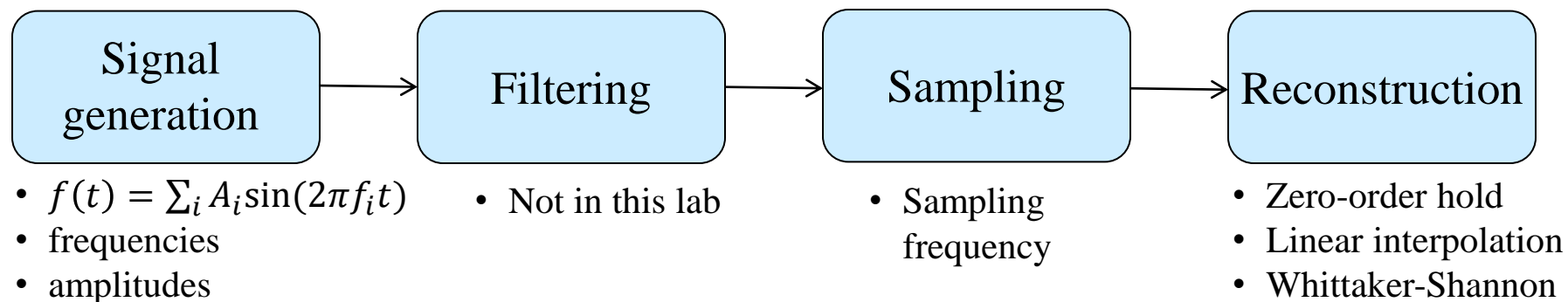
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Environmental Engineering*

http://disal.epfl.ch/teaching/signals_instruments_systems/

Lab 2 Outline

- Concepts:
 - Sampling
 - Aliasing
 - Reconstruction
- Tools:
 - Matlab
 - After logging into your session, follow these steps:
 - Start Matlab
 - Run `userpath('usr/local/MATLAB/2023a/matlab')` from the Command Window.
 - Restart Matlab.

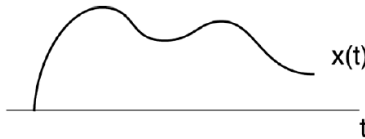
Part 1: Sampling and reconstruction



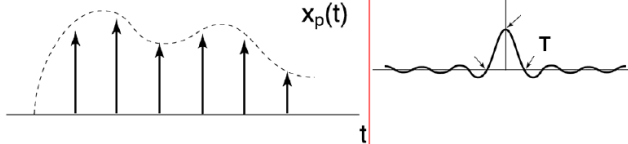
Part 1: Reconstruction: Wittaker-Shannon vs. Linear

Graphic Illustration of Time-Domain Interpolation

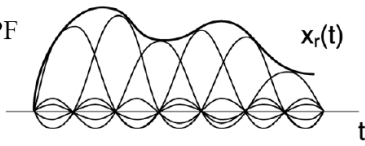
Original
CT signal



After sampling

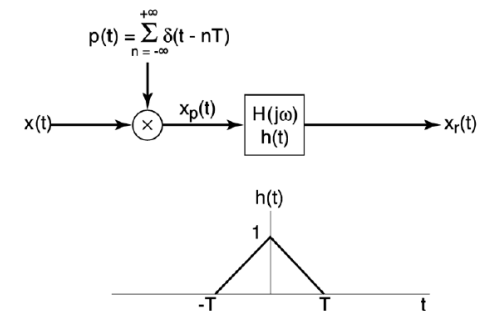
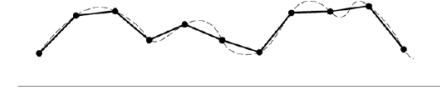


After passing the LPF



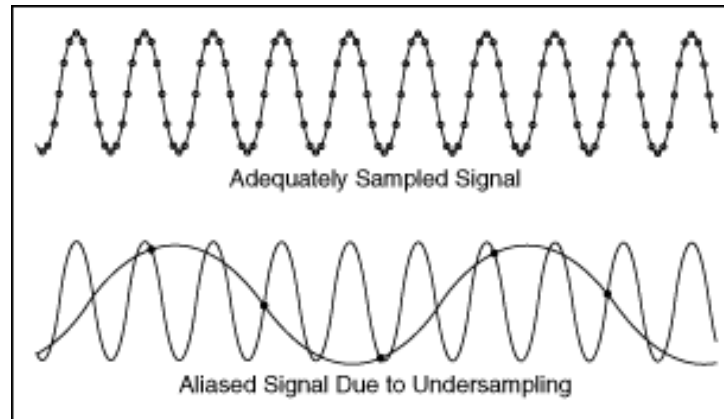
Interpolation Methods

- Bandlimited Interpolation
- Zero-Order Hold
- First-Order Hold — Linear interpolation



Part 2: Aliasing

- An effect that causes different signals to become indistinguishable when sampled



- Nyquist rate: $f_s > 2B$

Sampling frequency f_s must be at least two times greater than the maximal signal frequency B

Part 3: Applications

- You will work with real data.
- Use DFT to extract the presence of lighthouses
- Separate the signals in the frequency domain

