

Lab 4

*School of Architecture, Civil and
Environmental Engineering*

EPFL, WS 2023-2024

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

Lab 4 Outline

- Concepts:
 - FIR and IIR filter
 - Z-Transform
 - Fast Fourier Transforms (FFT)
 - Frequency Response (Bode Plots)
 - Filtering
- Tools:
 - Matlab

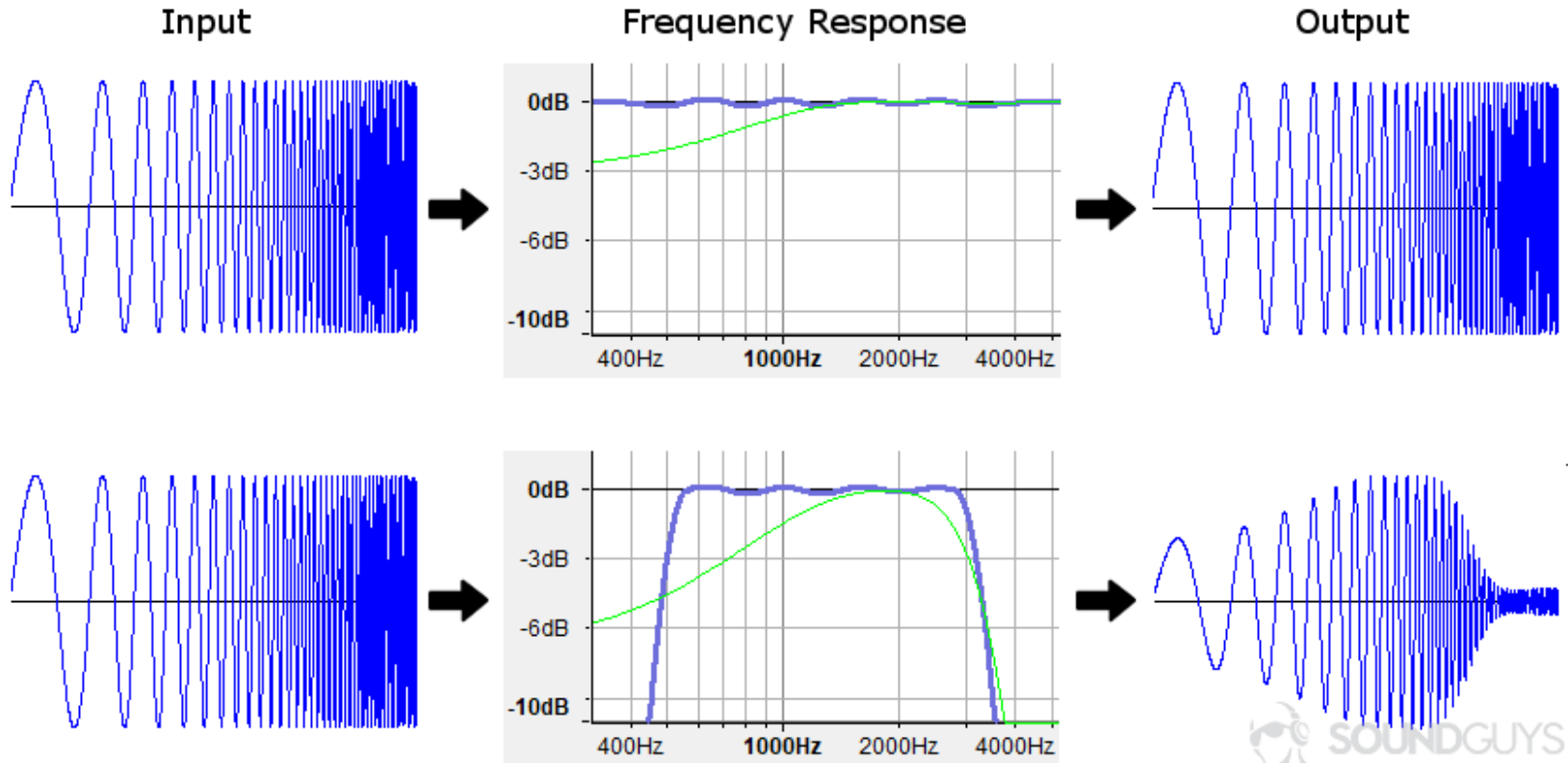
After logging into your session, perform the following steps:

- Start Matlab.
- Run `userpath('/usr/local/MATLAB/R2023a/matlab')` from the Command Window.
- Restart Matlab.

Review – Frequency Response

- **Frequency response:** Quantitative measure of output spectrum of a system in response to stimulus (usually sine waves)
- **Magnitude** and **phase** of the output as a function of frequency
- For **linear systems**, if a **sine wave** injected to system at a **given frequency**, it responds at the **same frequency** with a **certain magnitude and phase**.

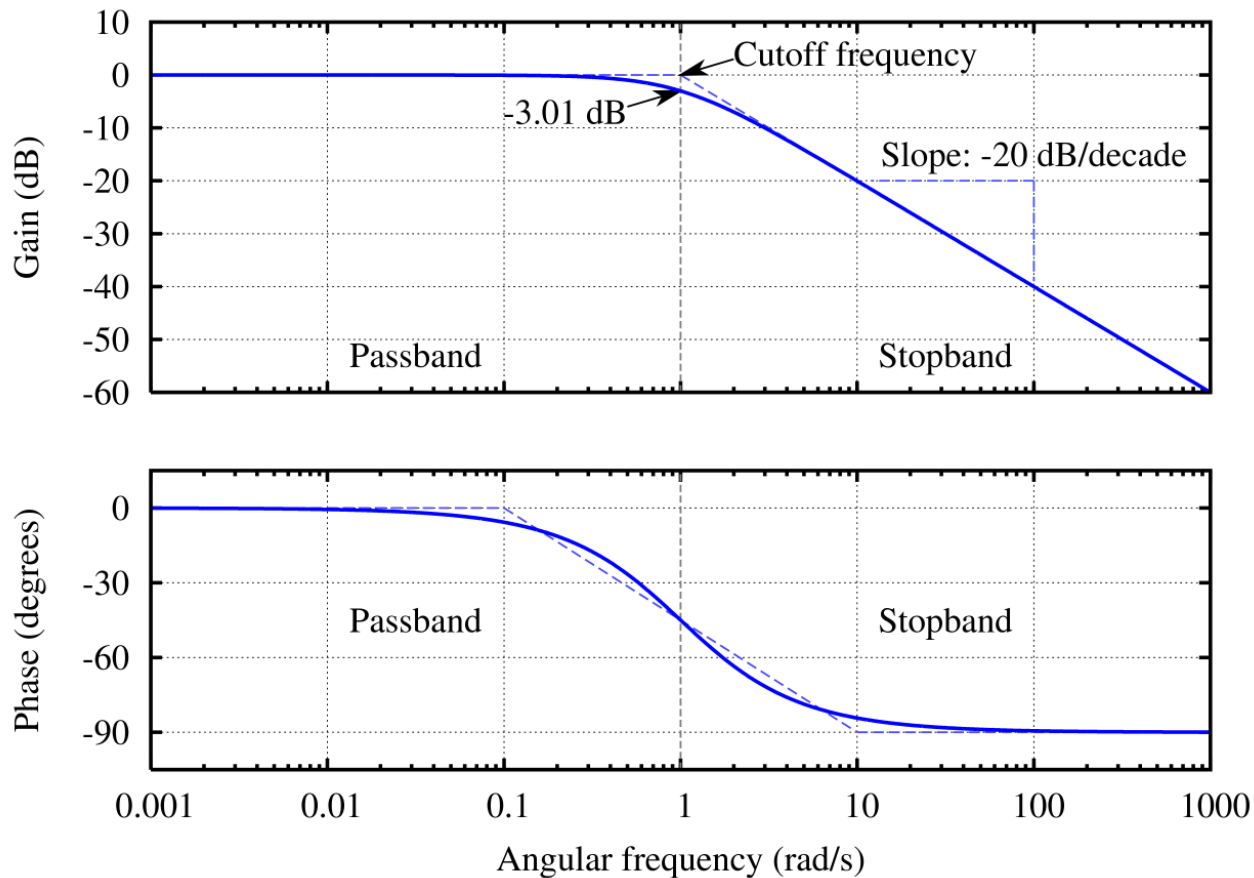
Review – Frequency Response



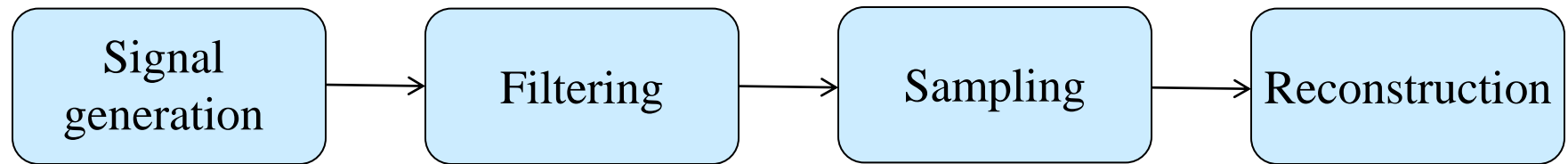
This shows only magnitude response, phase might also be affected

<https://www.soundguys.com/frequency-response-explained-16507/>

Review - Bode Plots

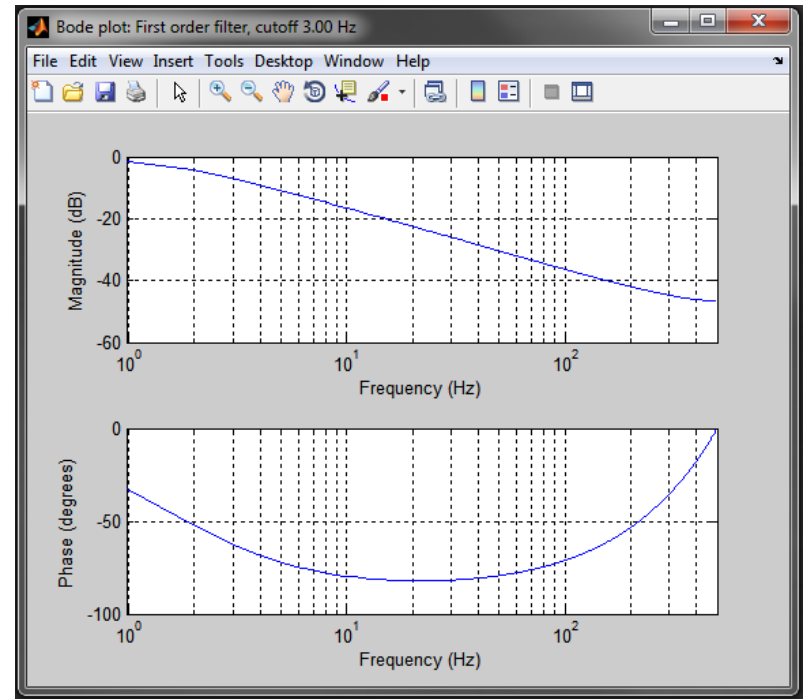
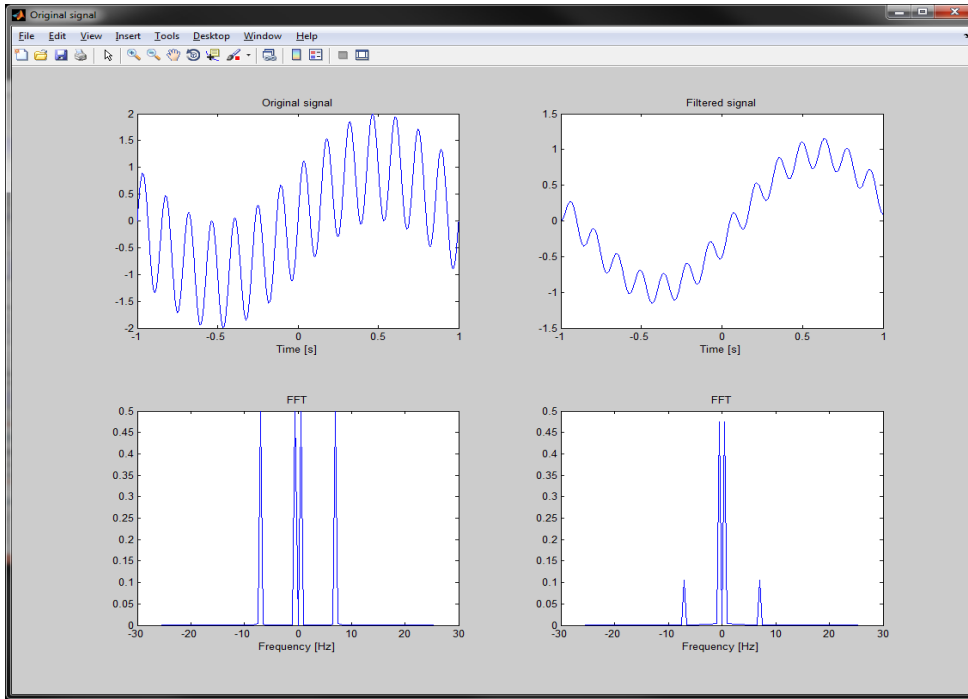
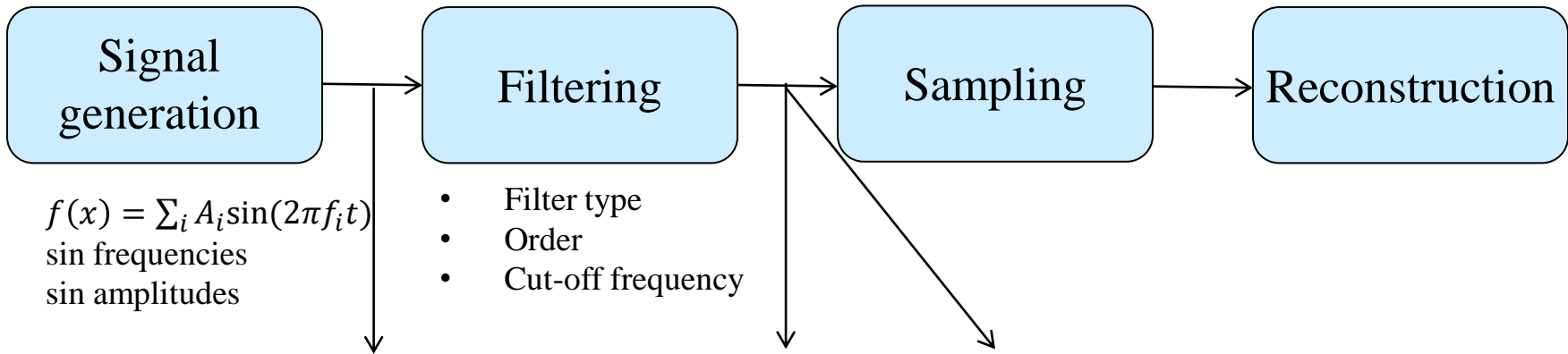


Part 1: Filters

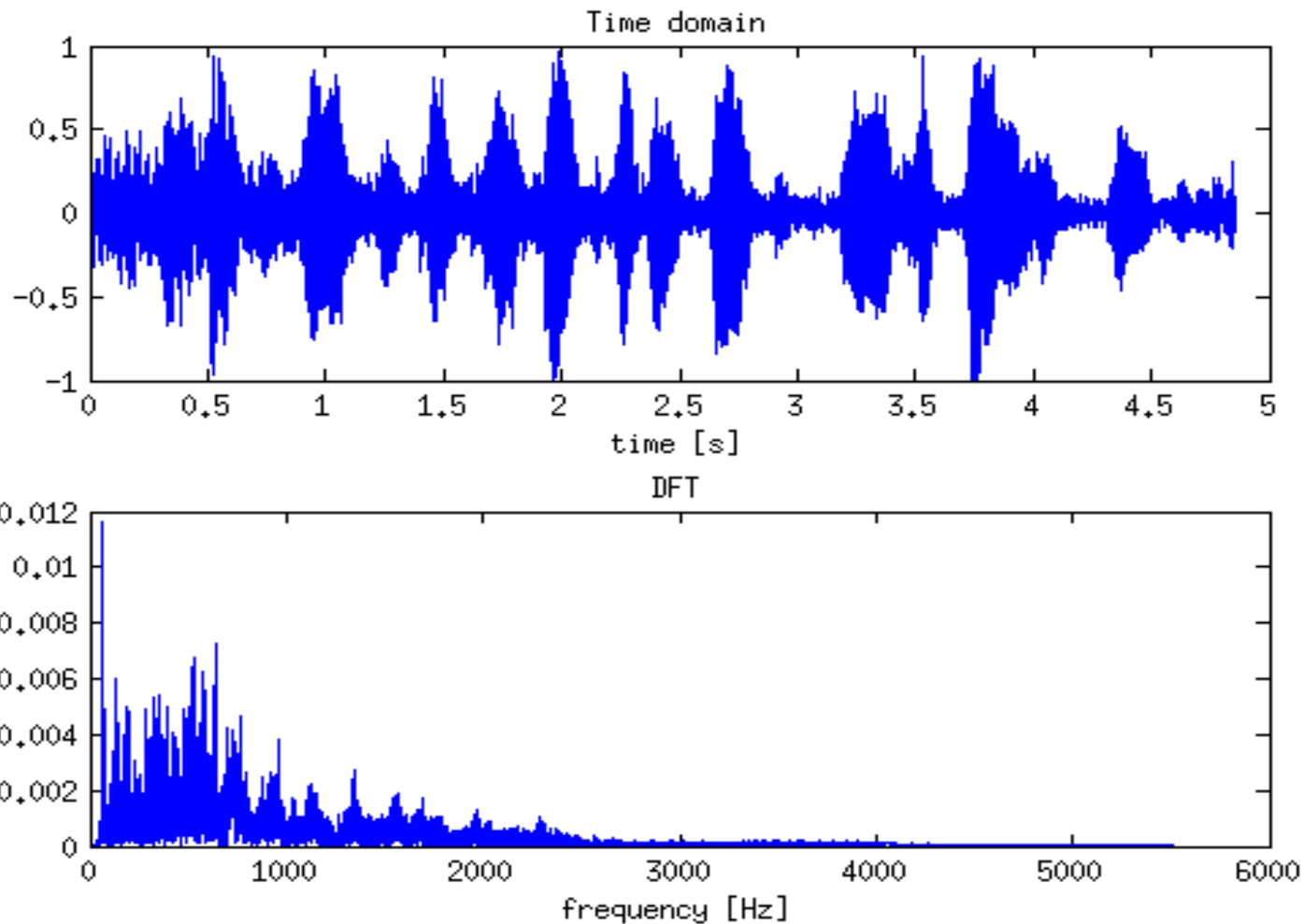


- $f(t) = \sum_i A_i \sin(2\pi f_i t)$
- sin frequencies
- sin amplitudes

- Filter type
- Order
- Cut-off frequency



Part 2: Sound / Voice Signal & Filters



Feedback

- Please fill the feedback form for Lab-4