

# Lab 4

*School of Architecture, Civil and  
Environmental Engineering*

*EPFL, SS 2020-2021*

[http://disal.epfl.ch/teaching/signals\\_instruments\\_systems/](http://disal.epfl.ch/teaching/signals_instruments_systems/)

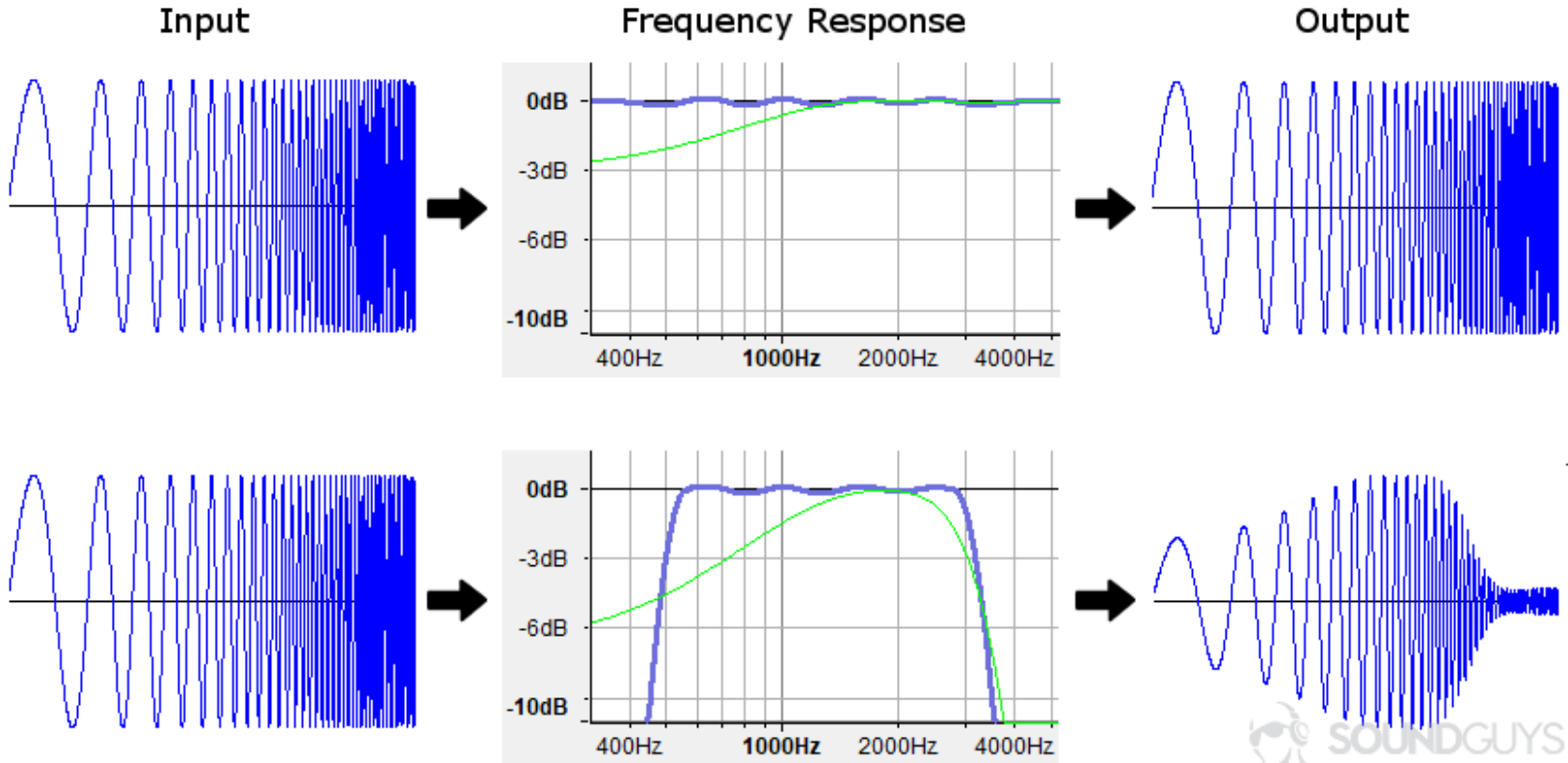
# Lab 4 Outline

- Concepts:
  - Fast Fourier Transforms (FFT)
  - Frequency Response (Bode Plots)
  - Filtering
- Tools:
  - 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**.

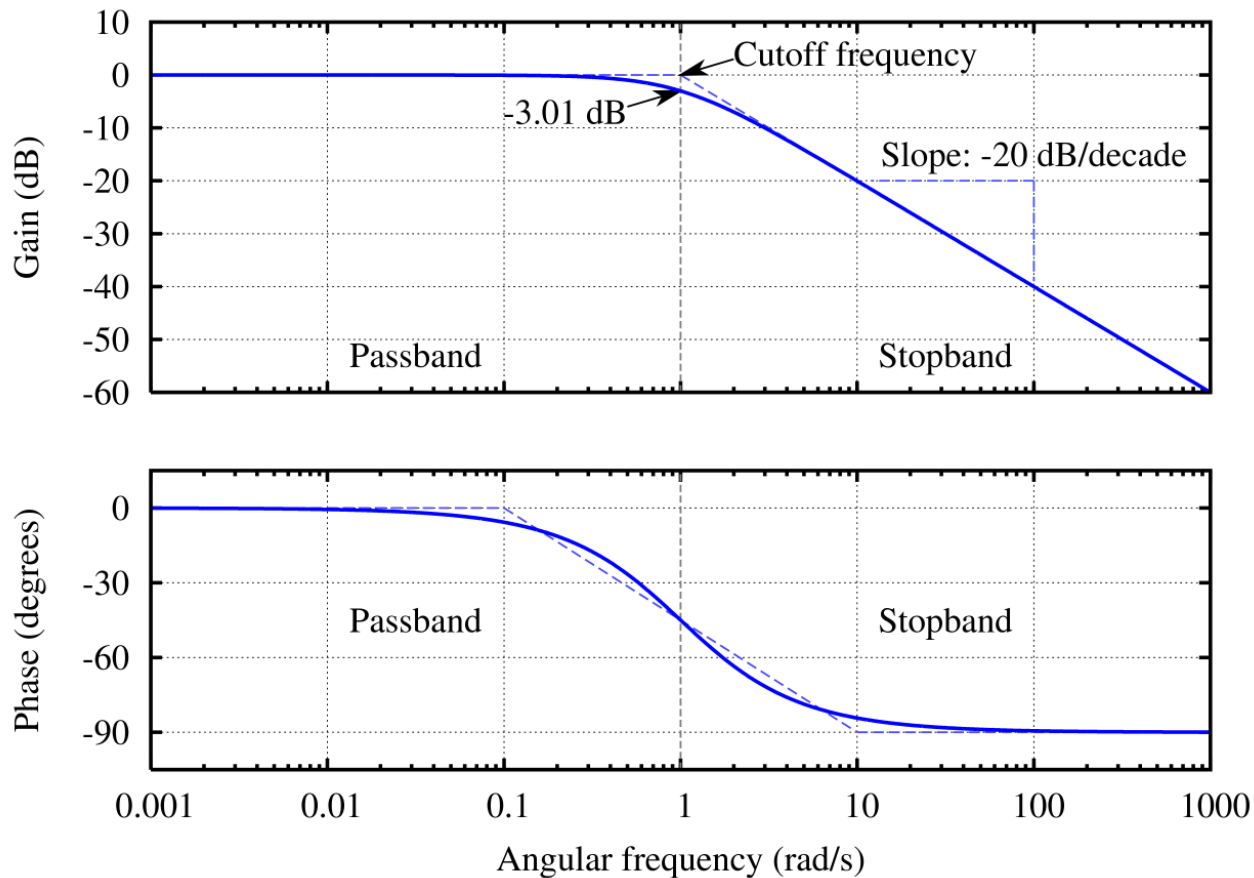
# Review – Frequency Response



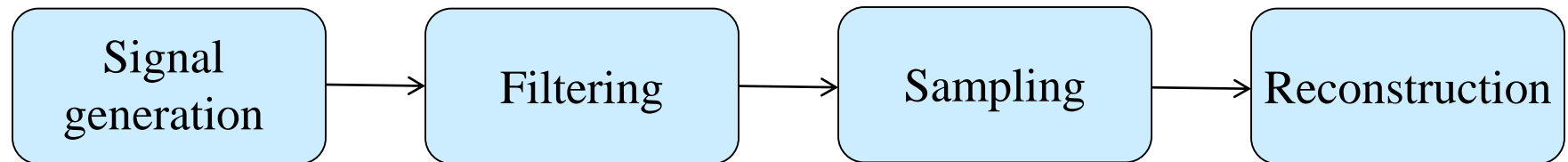
This shows only magnitude response, phase might also be affected

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

# Review - Bode Plots

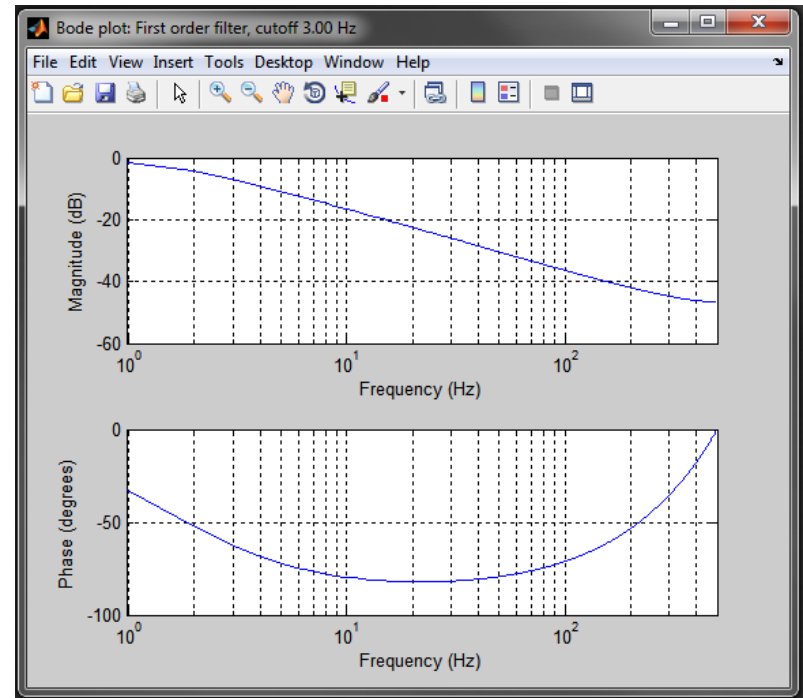
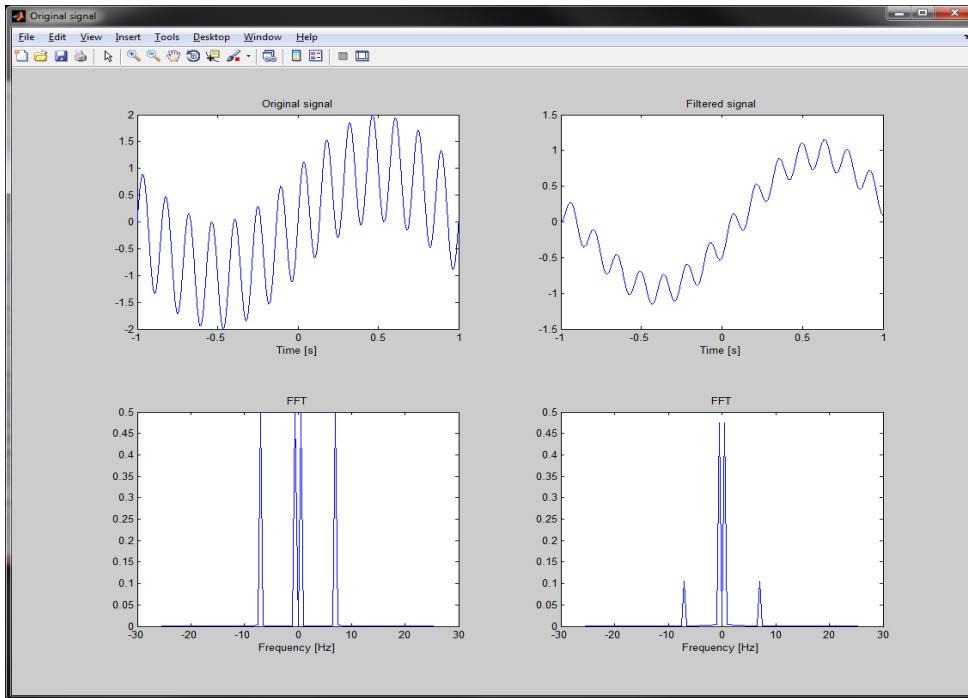
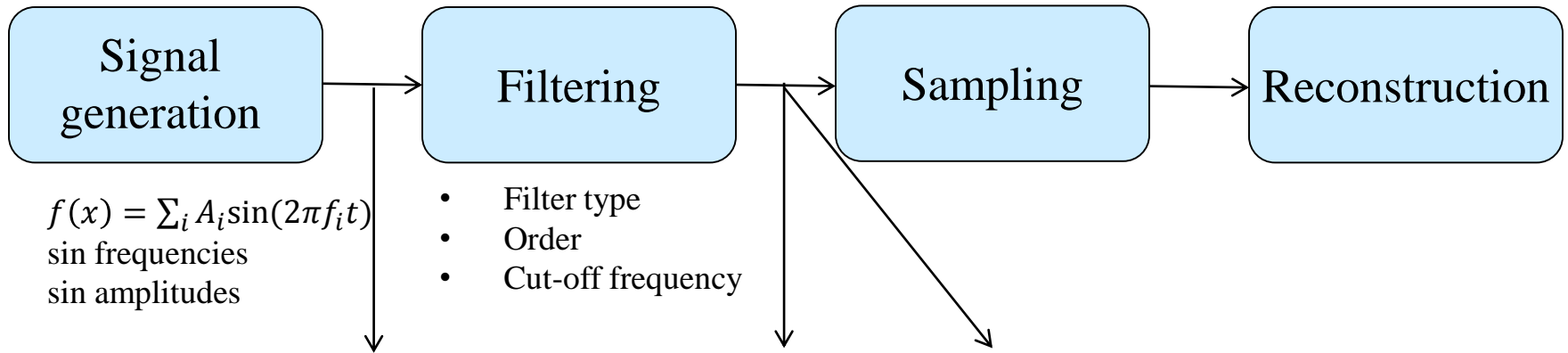


# Part 1: Filters

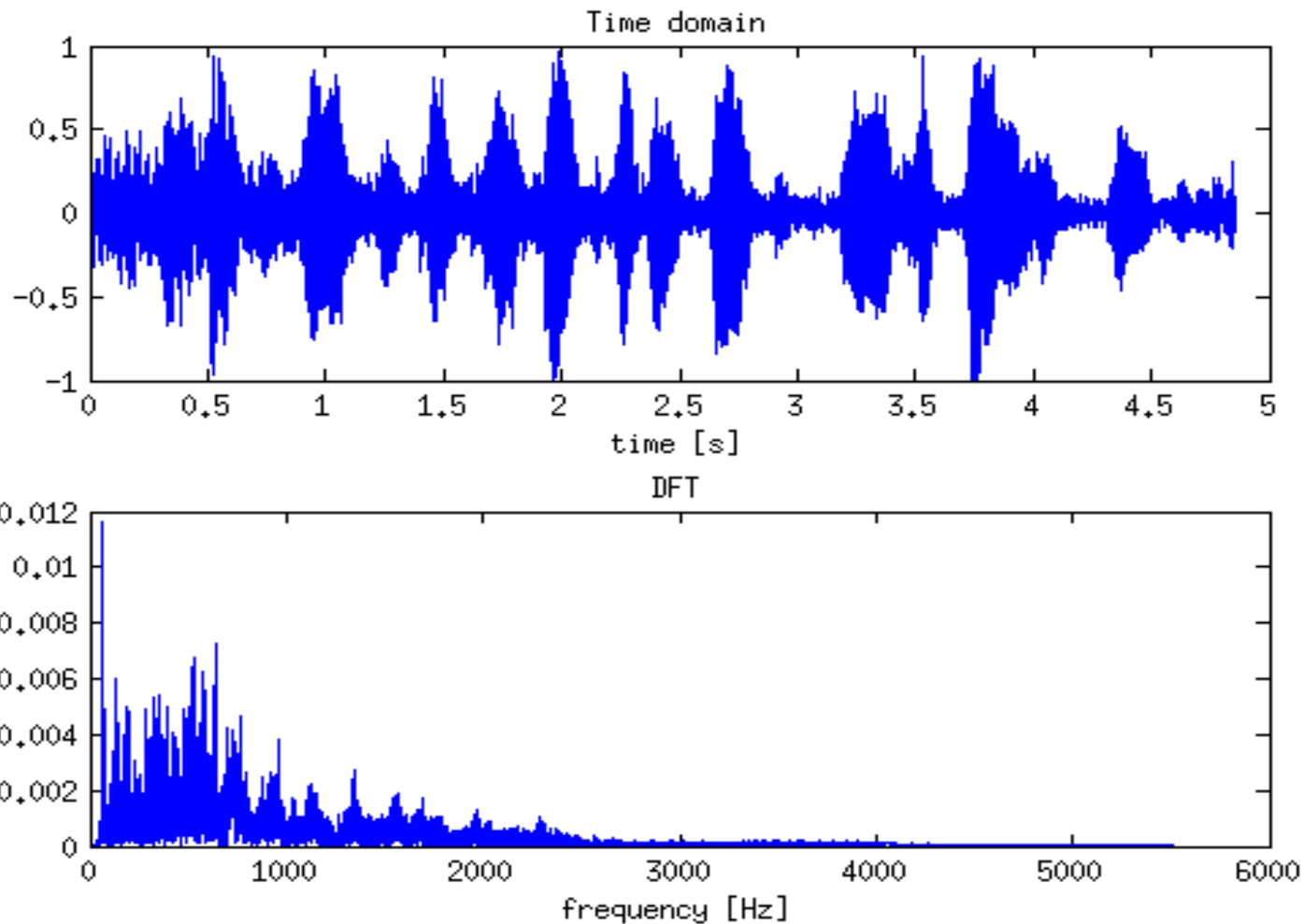


- $f(t) = \sum_i A_i \sin(2\pi f_i t)$
- sin frequencies
- sin amplitudes

- Filter type
- Order
- Cut-off frequency



# Part 2: Sound / Voice Signal & Filters





# Feedback

- Please fill the feedback form for Lab-4