Lab 4

School of Architecture, Civil and Environmental Engineering

EPFL, SS 2021-2022

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

-3.01 dB

Cutoff frequency

Slope: -20 dB/decade

Passband

Stopband
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
Signal generation

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

Filtering

- Filter type
- Order
- Cut-off frequency

Sampling

Reconstruction
Part 2: Sound / Voice Signal & Filters
Feedback

• Please fill the feedback form for Lab-4