无线通信实验在线开放课程

主讲人：吴光 博士

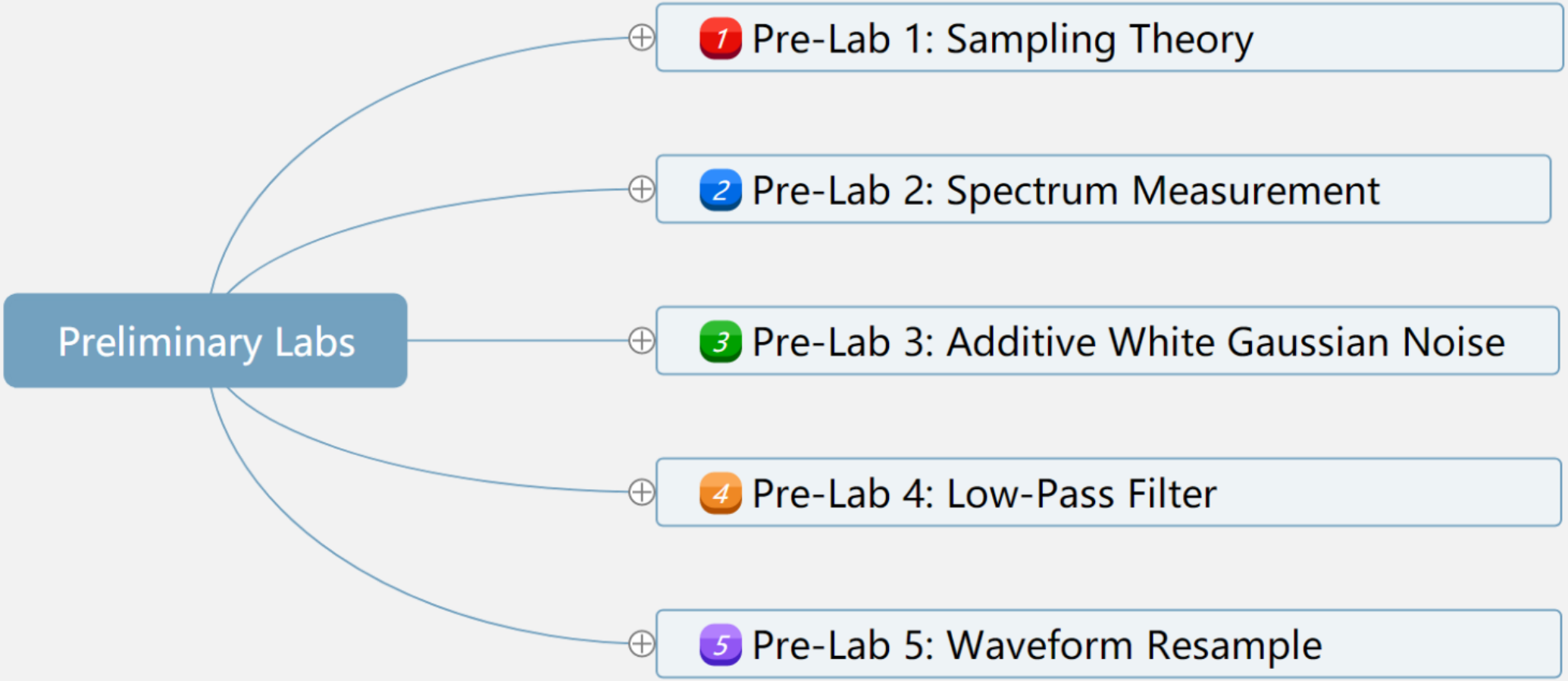
广东省教学质量工程建设项目

Lab 2: Pre-Labs and AM

(Pre-Labs)

主讲人：吴光 博士

Email: wug@sustech.edu.cn

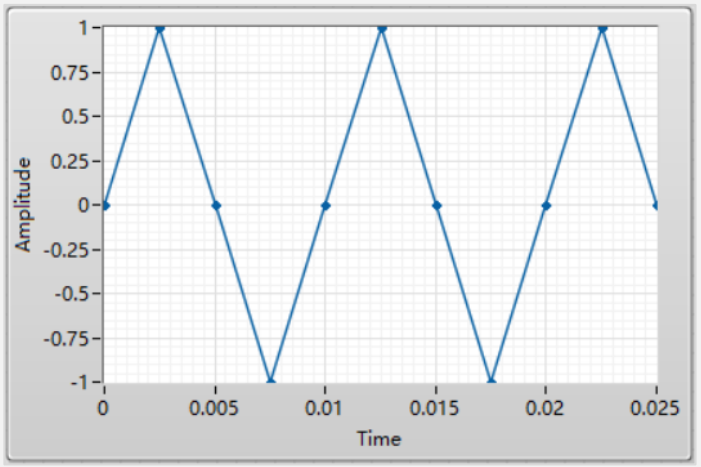

Preliminary Labs
1 Pre-Lab 1: Sampling Theory
2 Pre-Lab 2: Spectrum Measurement
3 Pre-Lab 3: Additive White Gaussian Noise
4 Pre-Lab 4: Low-Pass Filter
5 Pre-Lab 5: Waveform Resample

Demo: Sample-Rate

Pre-Lab 1: Sampling Theory

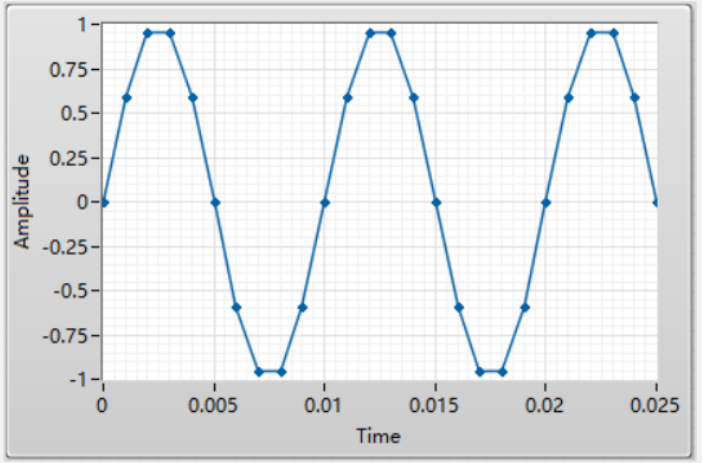
Nyquist–Shannon sampling theorem: If a signal $\boldsymbol{x(t)}$ contains no frequencies higher than $\boldsymbol{B}$ hertz, a sufficient **Sample-Rate** is therefore anything larger than $\boldsymbol{2B}$ samples per second. (Wikipedia)

Sample-Rate: Samples per Second **Frequency=100Hz**



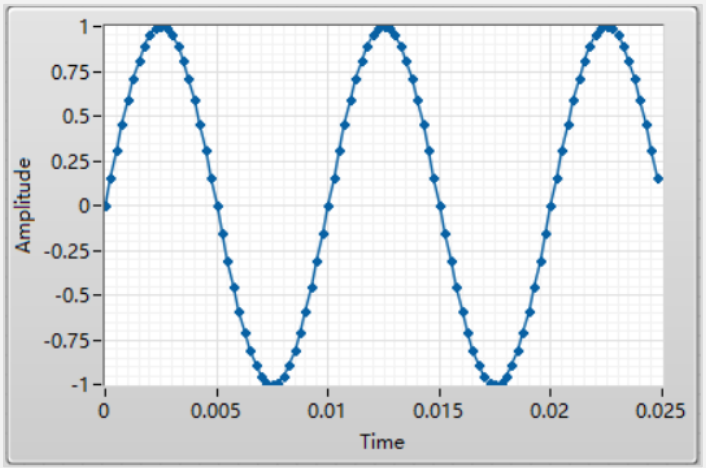
Sample Rate=400

Number of Samples=11



Sample Rate=1000

Number of Samples=26



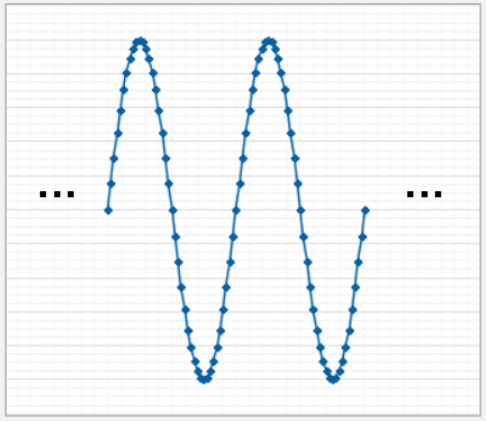
Sample Rate=4000

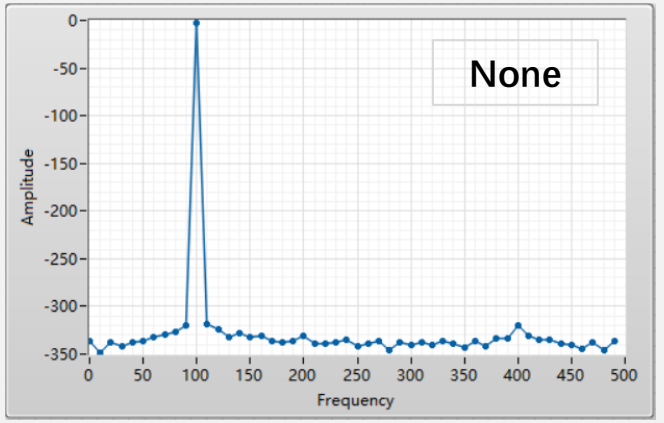
Number of Samples=100

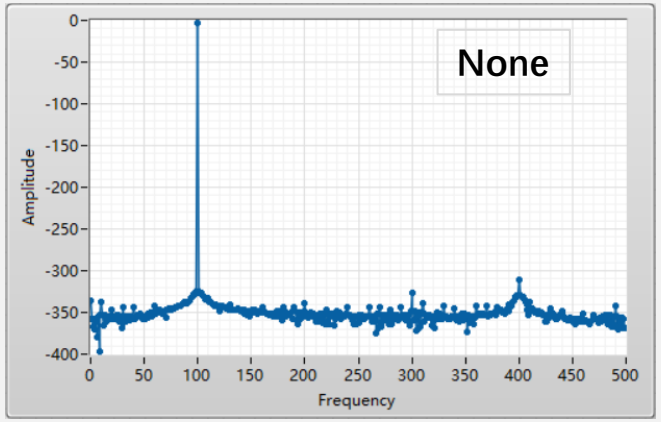
Demo: Spectrum Measurement

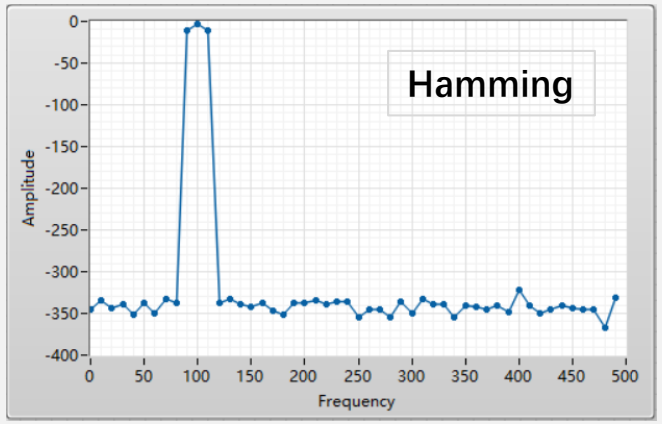
Pre-Lab 2: Spectrum Measurement

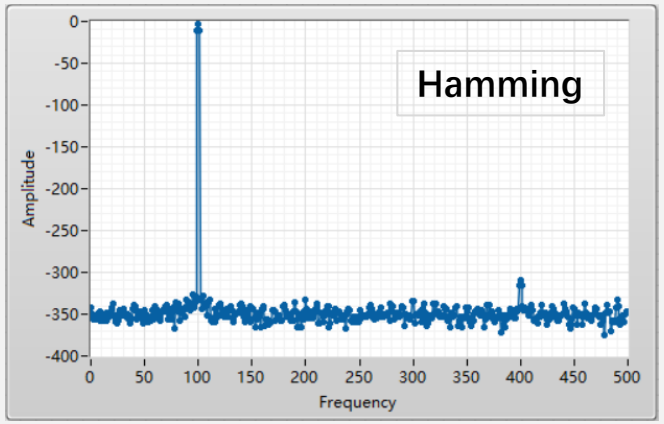
窗函数对频谱分析也会有影响











Number of Samples=100

Number of Samples=1000

Pre-Lab 2: Spectrum Measurement

通信信号是很小

$$dB = 20\lg\left(\frac{X_{Amplitude}}{Y_{Amplitude}}\right)$$

$$dB = 10\lg\left(\frac{X_{Power}}{Y_{Power}}\right)$$

$$-3\ dB:\ \frac{X_{Amplitude}}{Y_{Amplitude}} = 0.7079$$

$$-3\ dB:\ \frac{X_{Power}}{Y_{Power}} = 0.5012$$

$$dBm = 10\lg\left(\frac{X_{Power}}{1mW}\right)$$

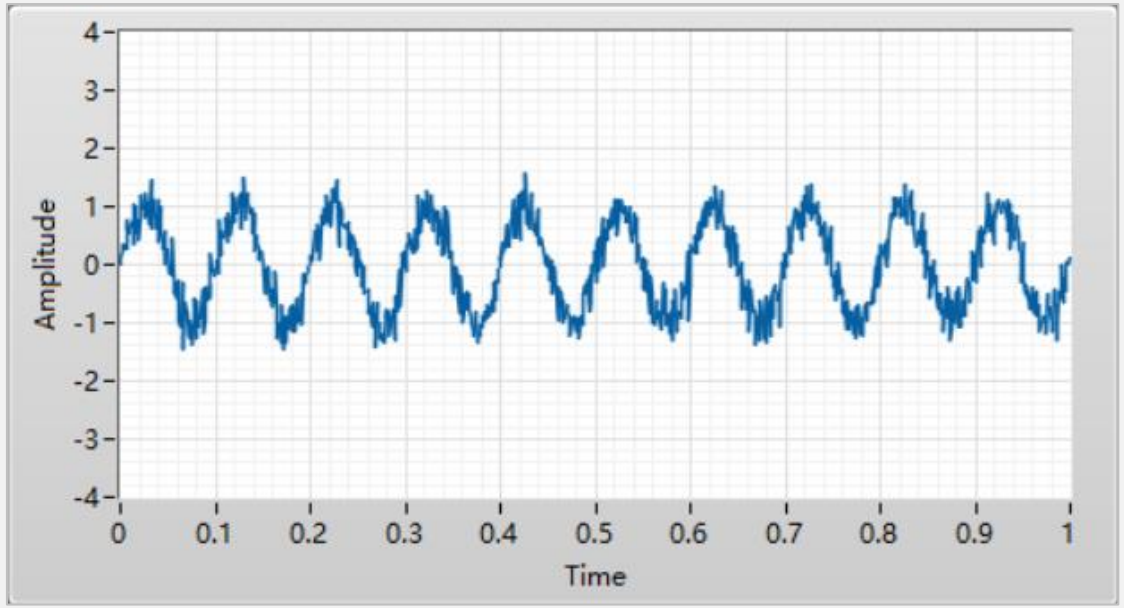
$$10dBm = 10mW$$
$$30dBm = 1000mW$$

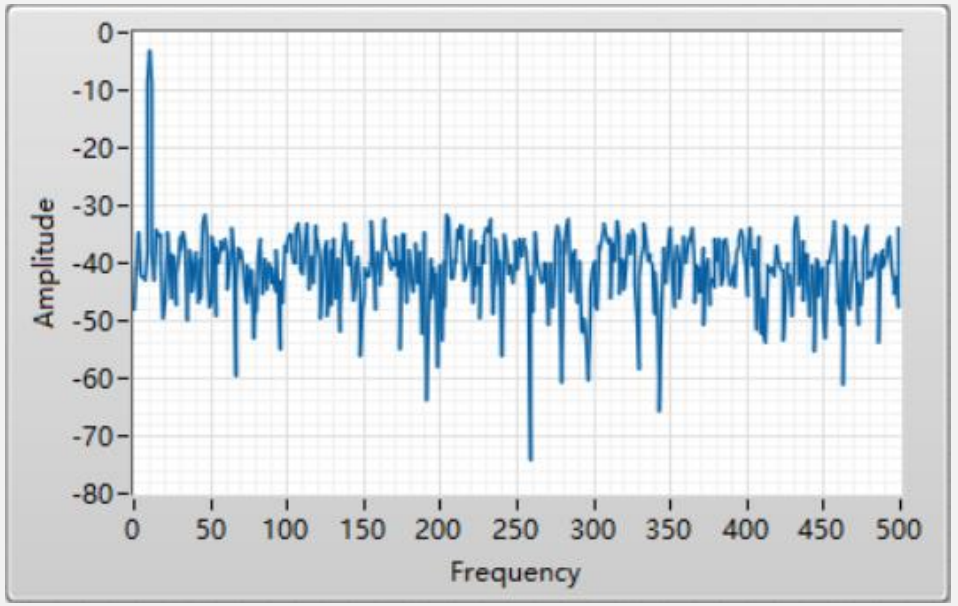
Demo: Additive White Gaussian Noise

Pre-Lab 3: Additive White Gaussian Noise

Additive White Gaussian Noise (AWGN) is a basic noise model used in Information theory to mimic the effect of many random processes that occur in nature. (Wikipedia)

Noise type: Additive White Gaussian Noise

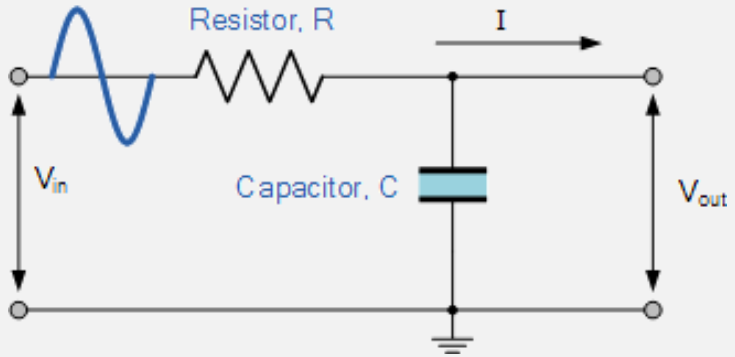




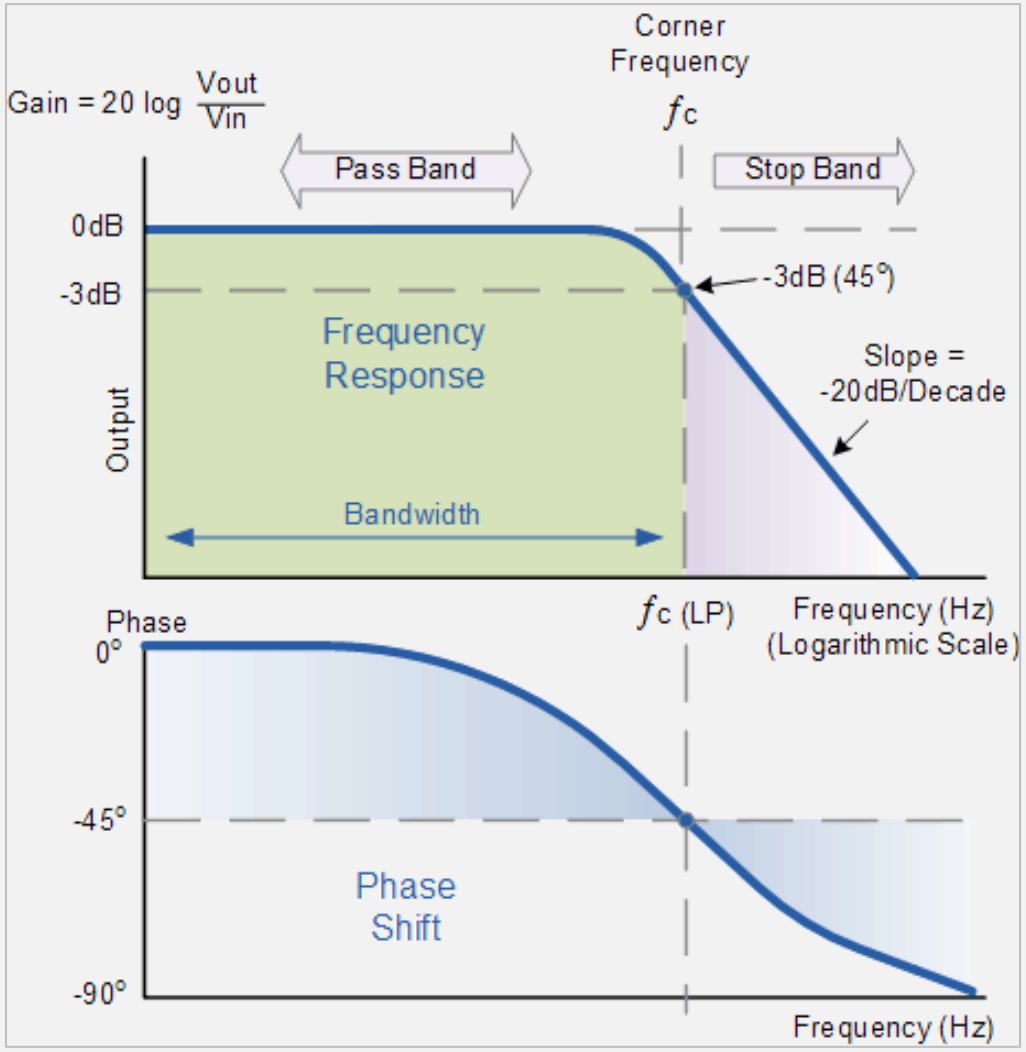
Demo: Low-Pass Filter

Pre-Lab 4: Low-Pass Filter

Low-Pass Filter (LPF) is a filter that passes signals with a frequency lower than a selected cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency.



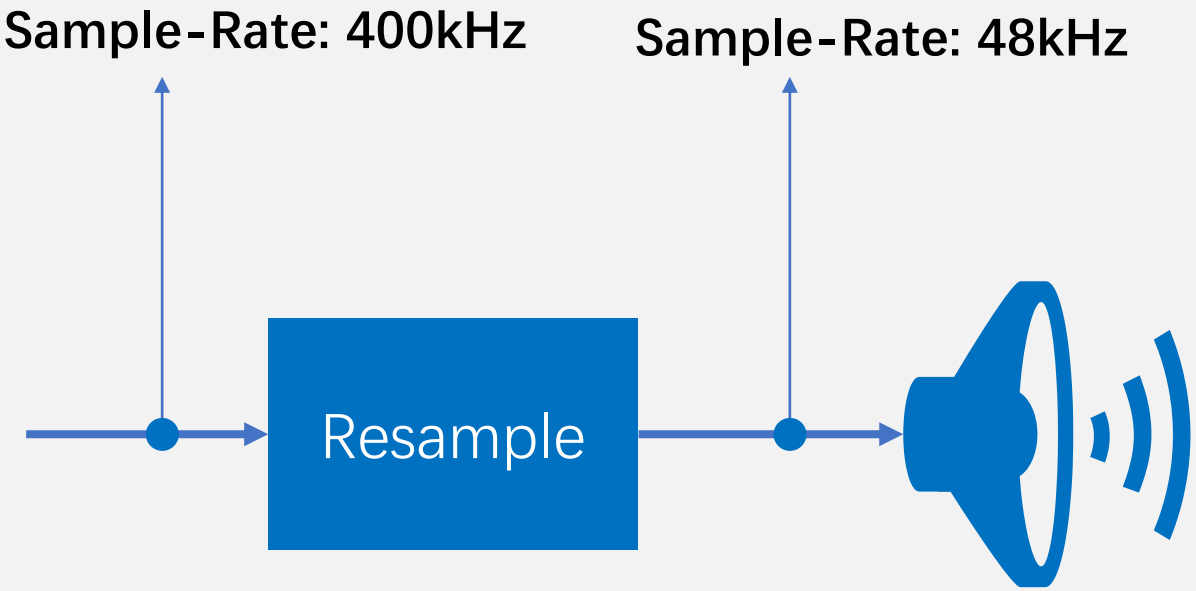
RC Low Pass Filter Circuit

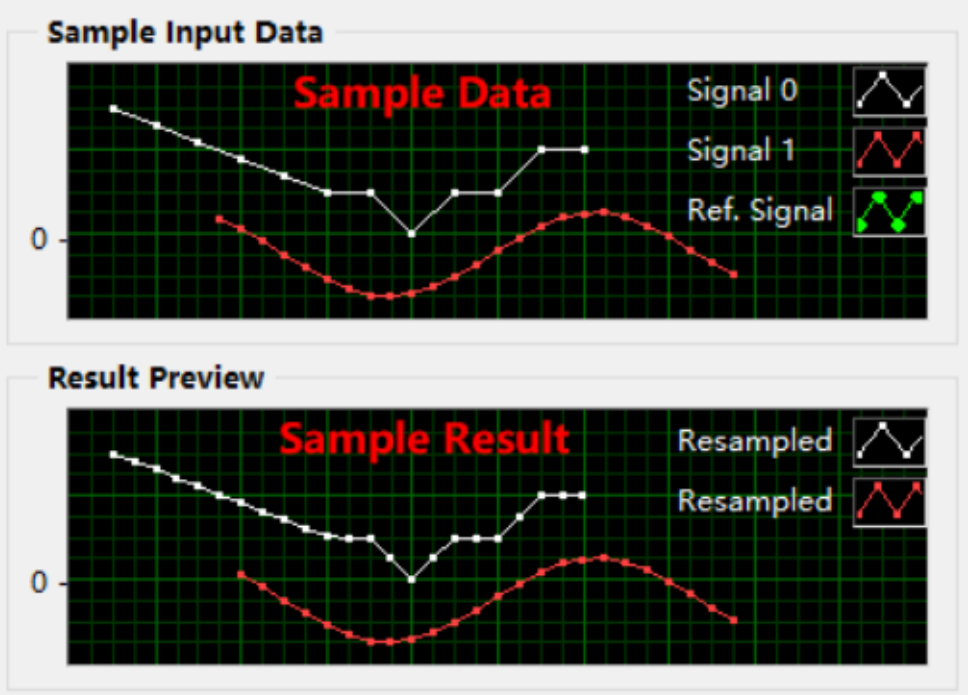


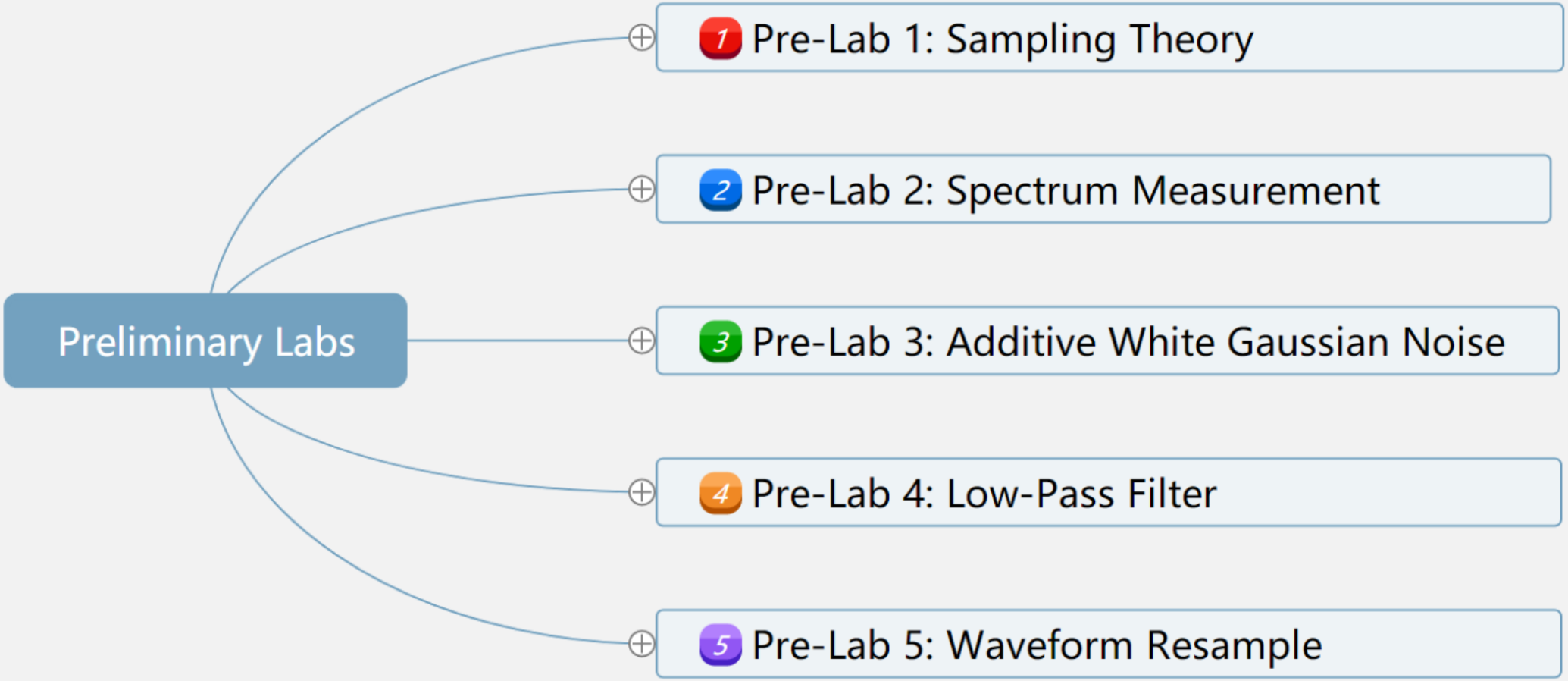
https://www.electronics-tutorials.ws/filter/filter_2.html

Demo: Waveform Resample

Pre-Lab 5: Waveform Resample



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- Question ?

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