

HY-330

fall semester 2021

Introduction to telecommunication systems theory

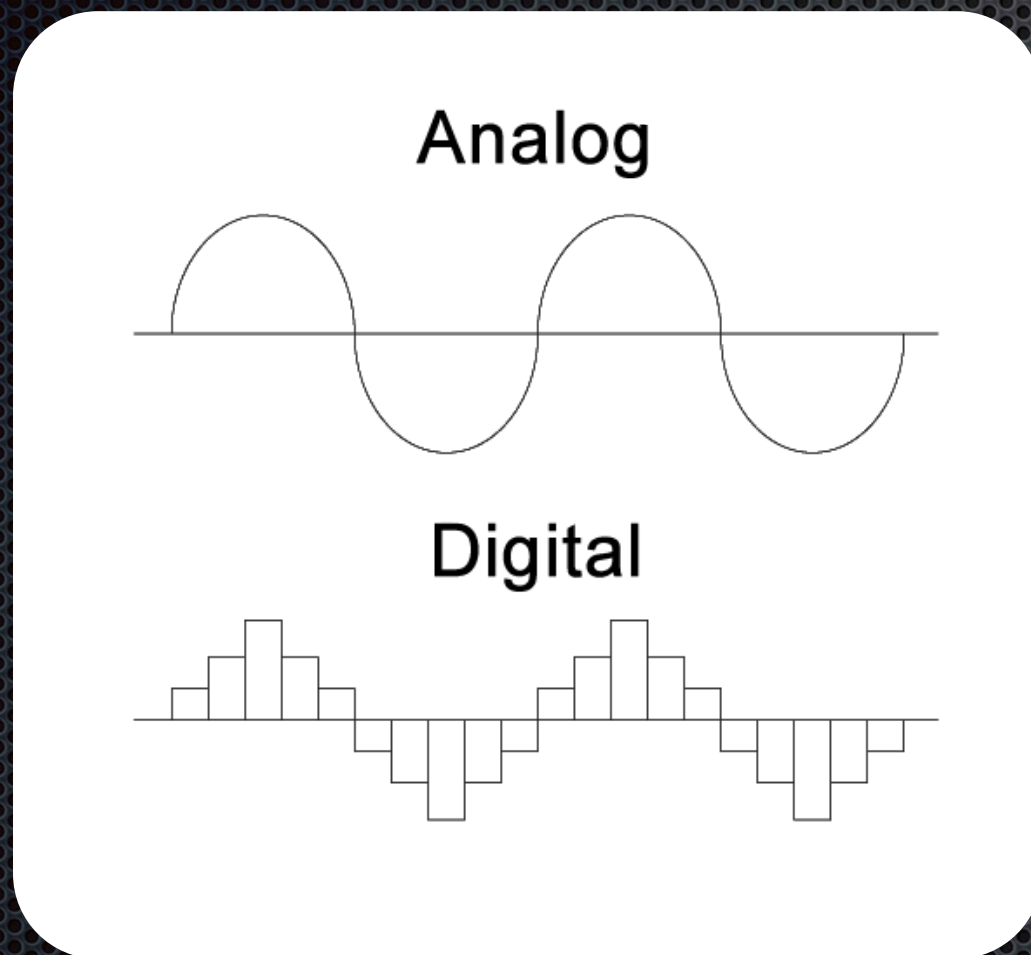
University of Crete
Computer Science Department

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Sampling & Quantization

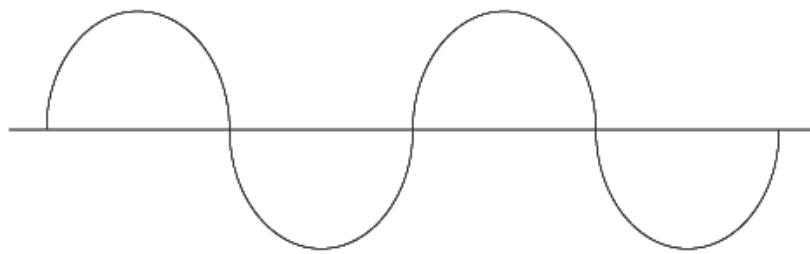
- ✦ Why?
- ✦ Analog domain - Digital domain
 - ✦ continuous-time vs. discrete-time signals
- ✦ Limits
- ✦ Aliasing...

Analog == Perfect?

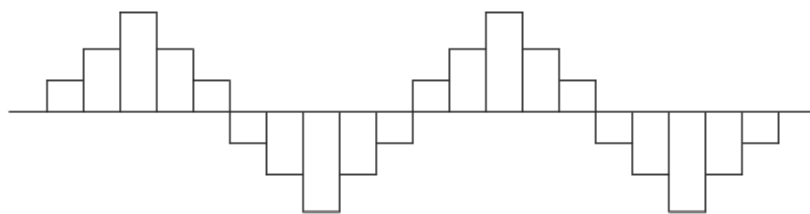


Analog == Perfect?

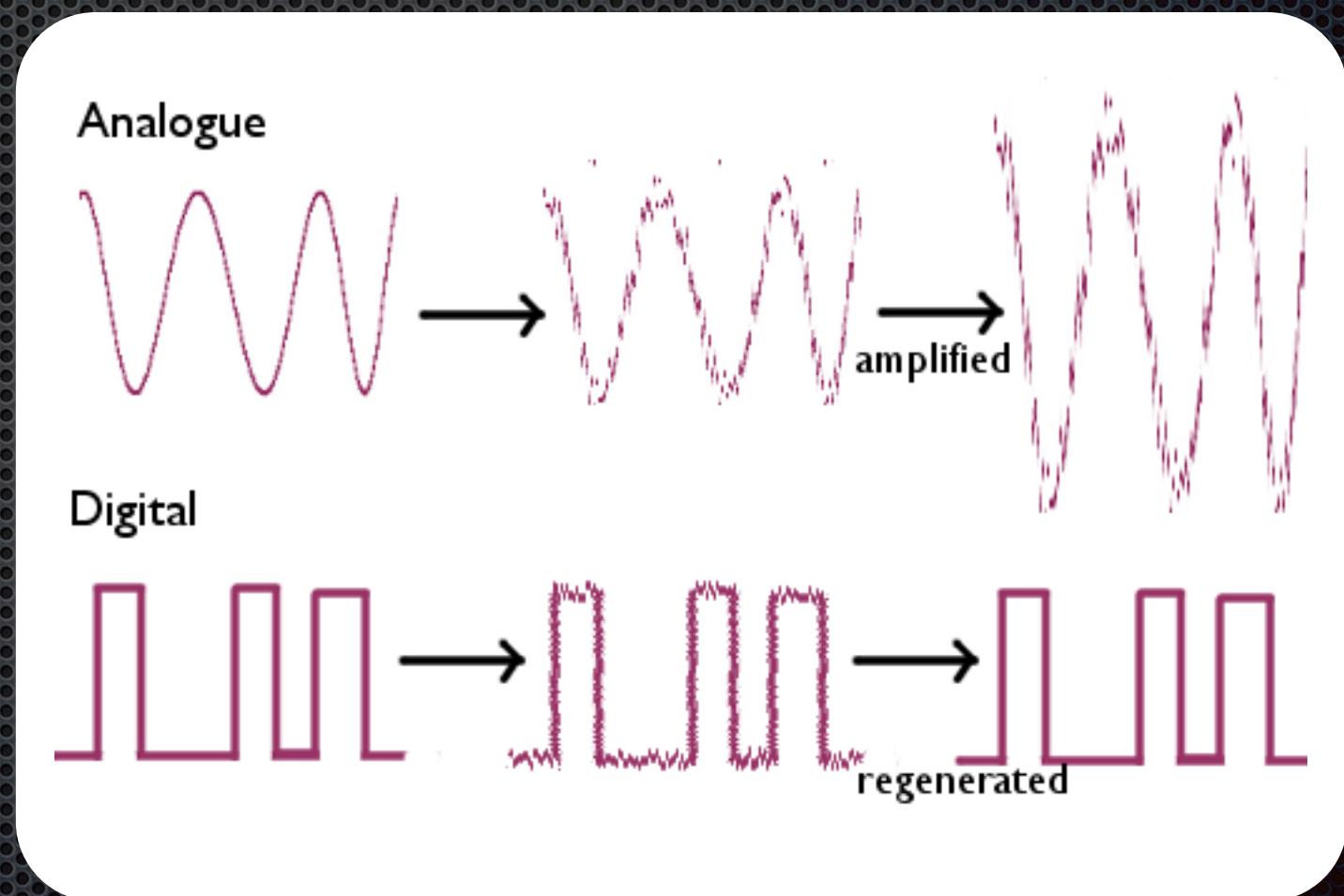
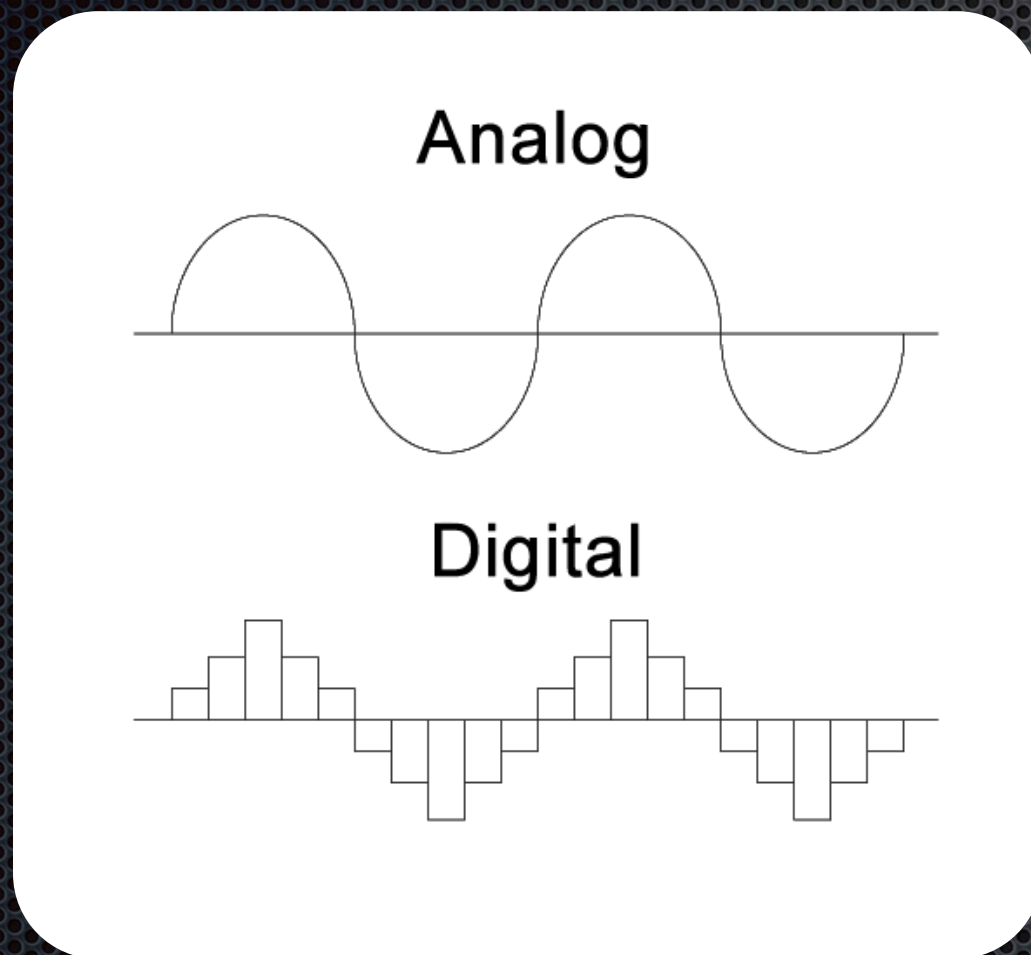
Analog



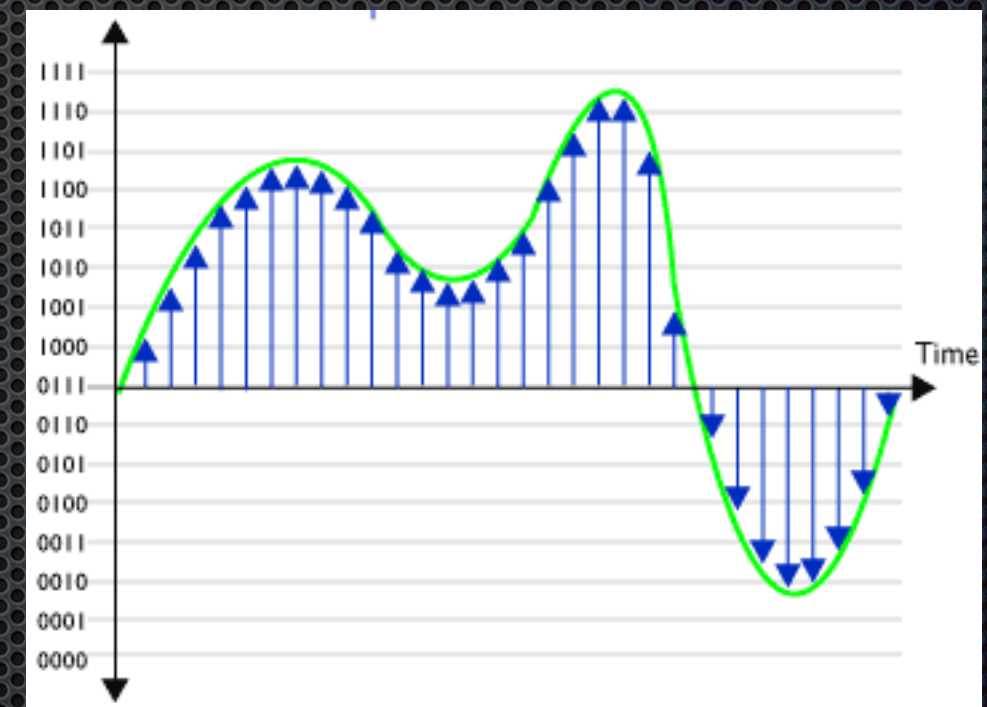
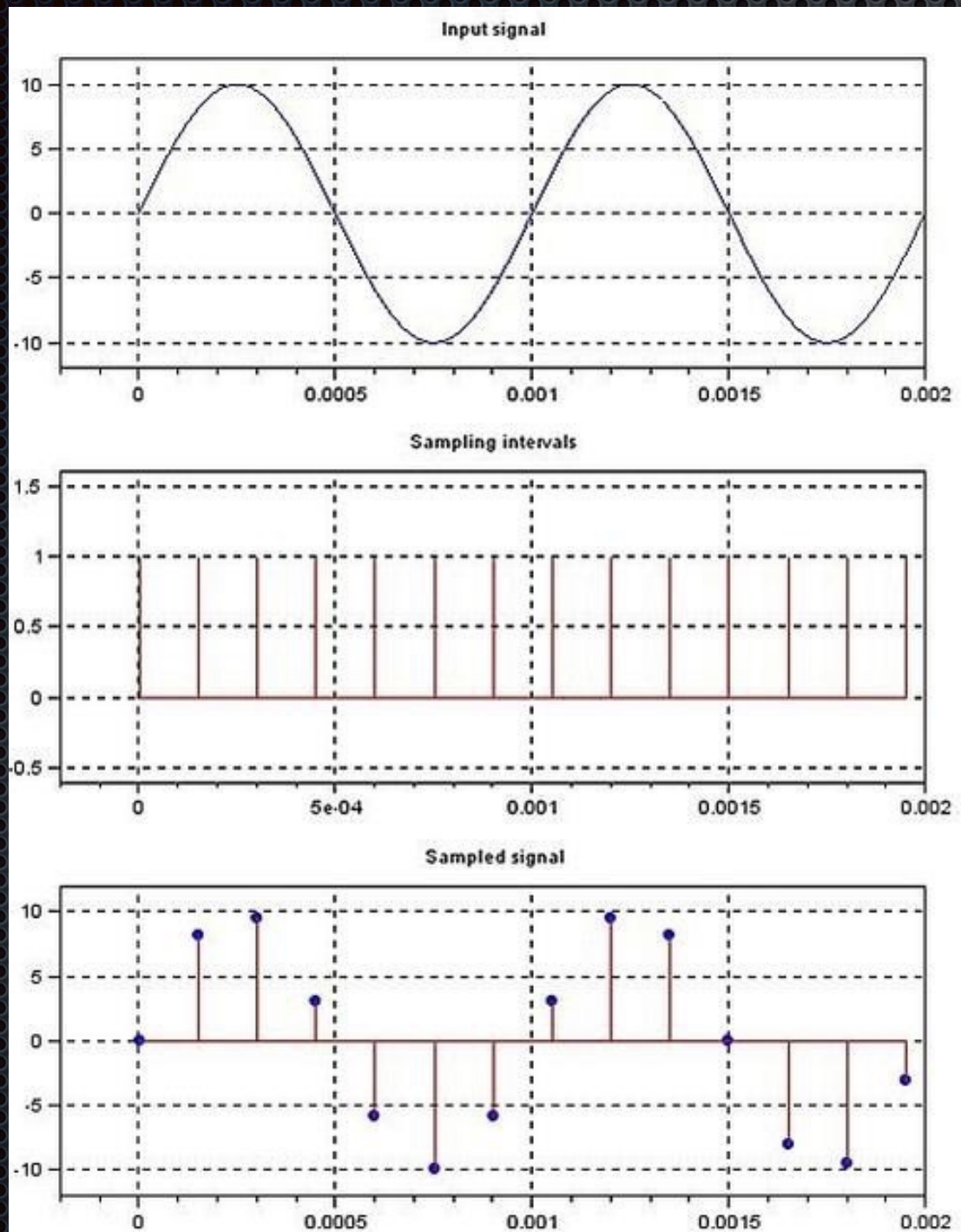
Digital



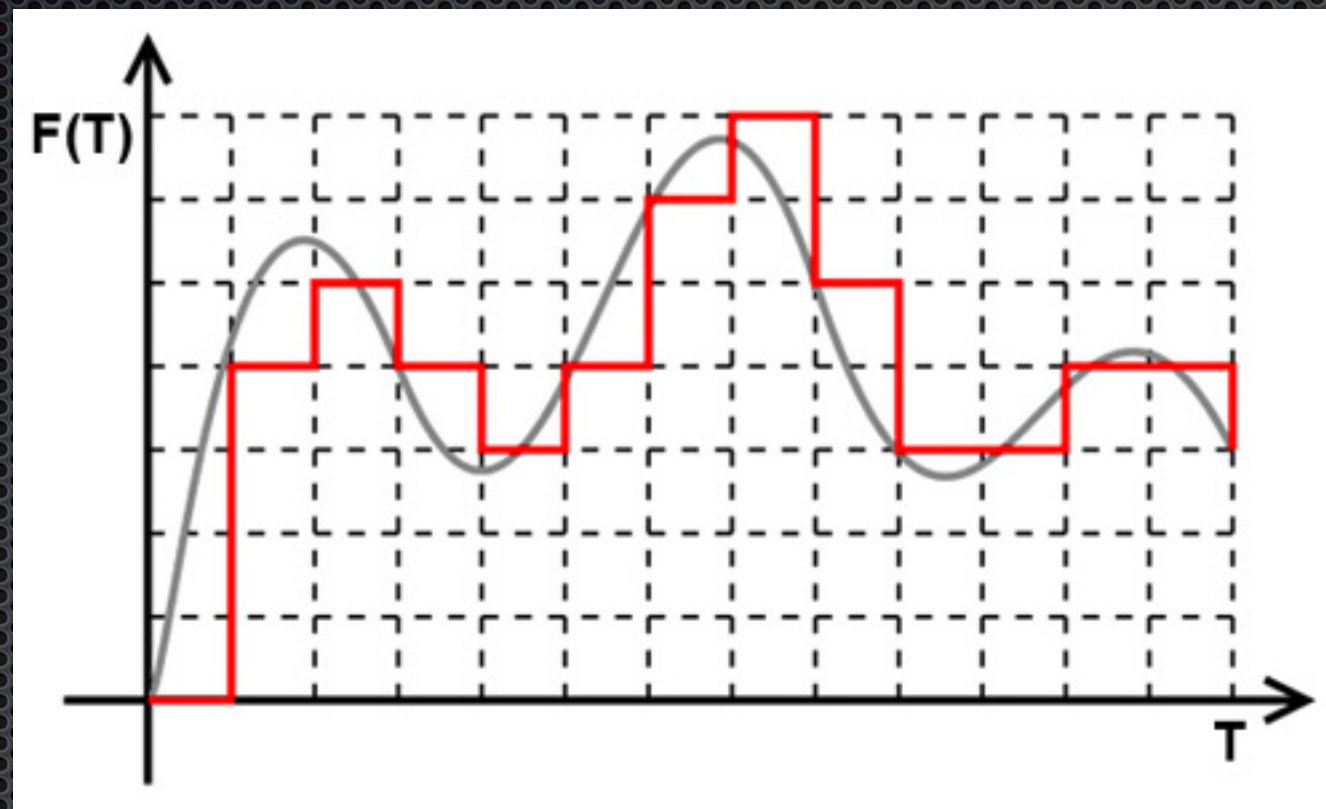
Analog == Perfect?



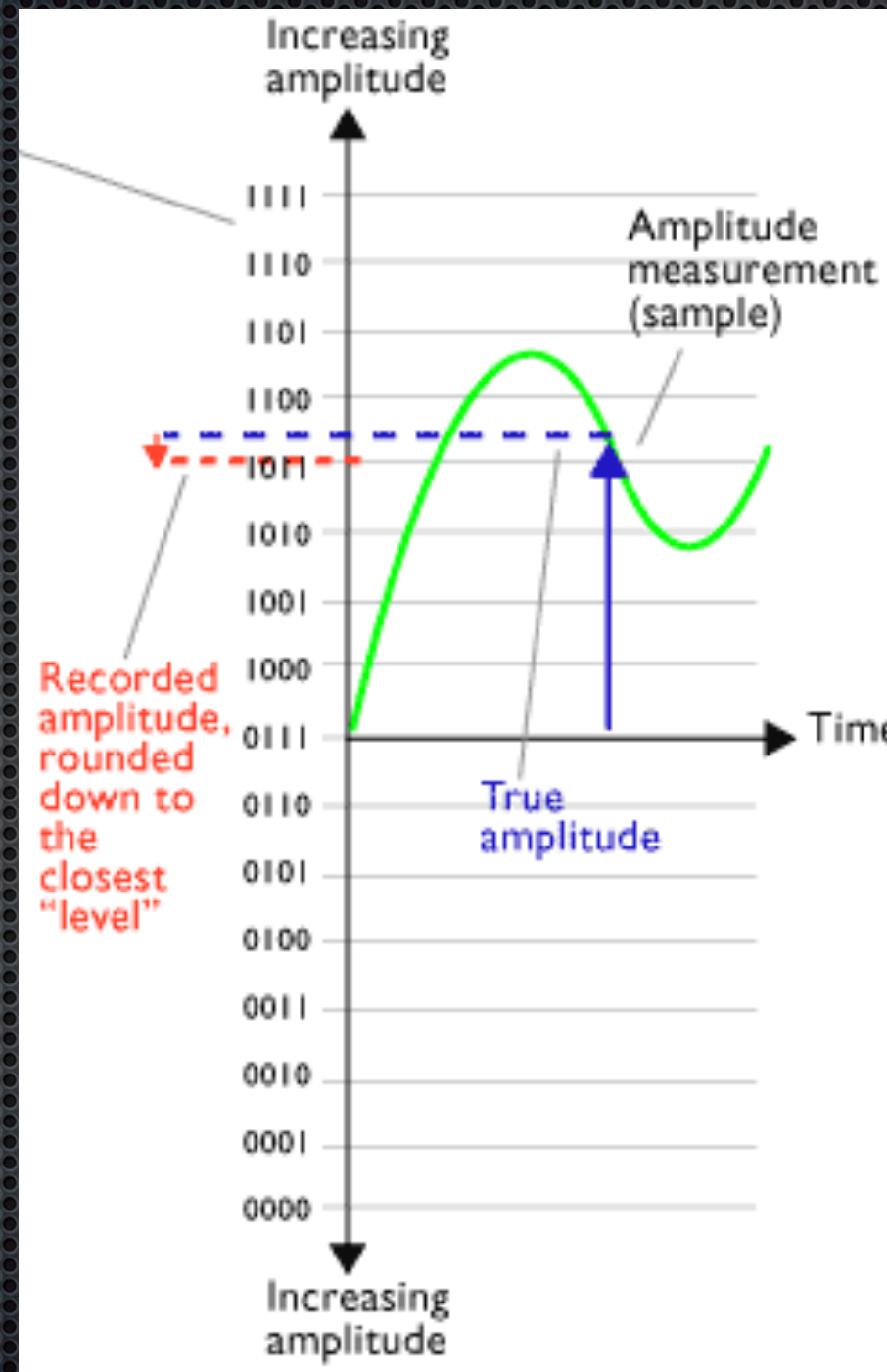
Sampling



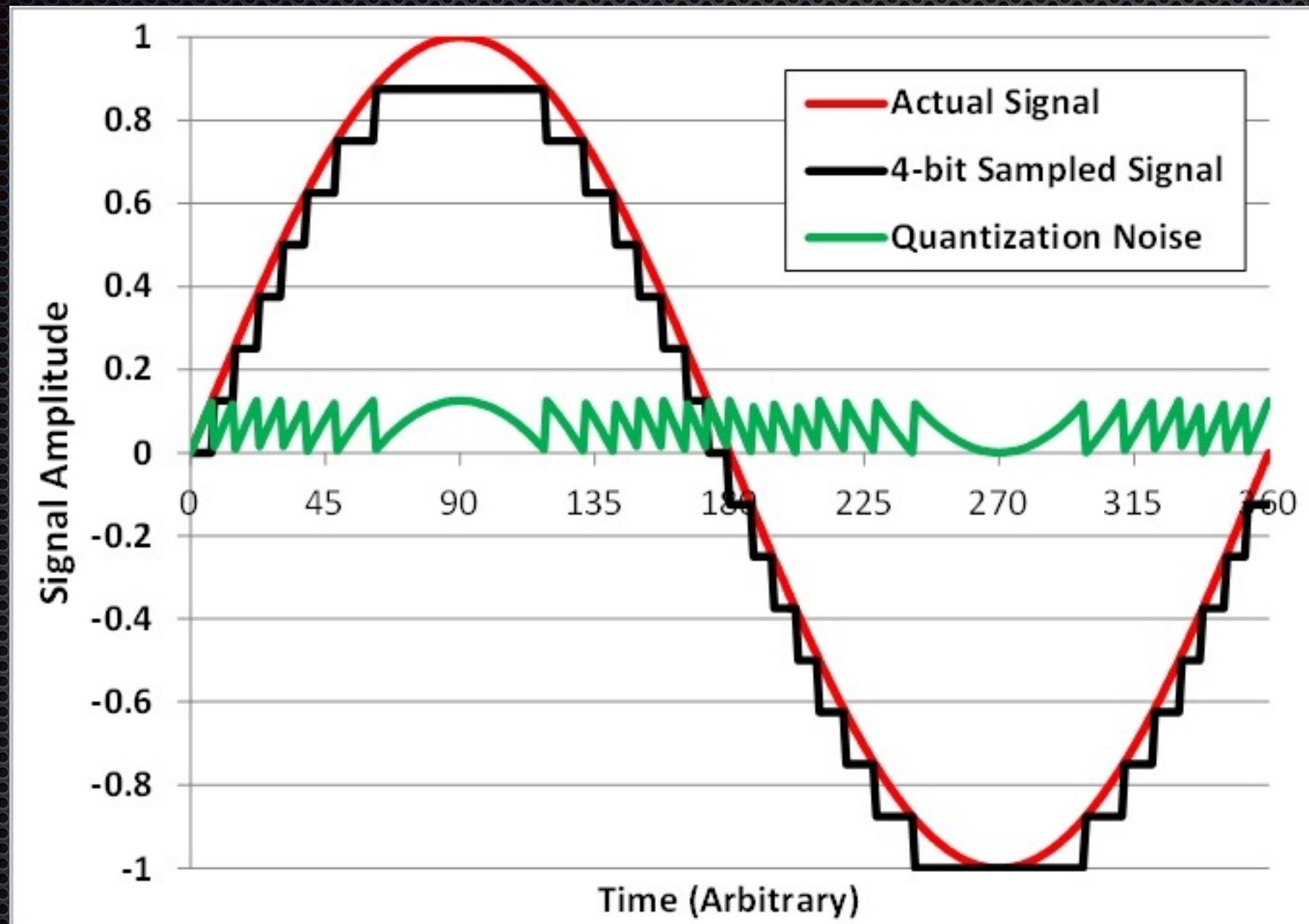
Quantization



Quantization Error



Quantization Noise



$$SQNR = 20 \log_{10}(2^Q) \approx 6.02 \cdot Q \text{ dB}$$

Nyquist rate

▪ Bandlimited signal of Bandwidth:

$$B$$

▪ Sampling rate (uniform):

$$f_s$$

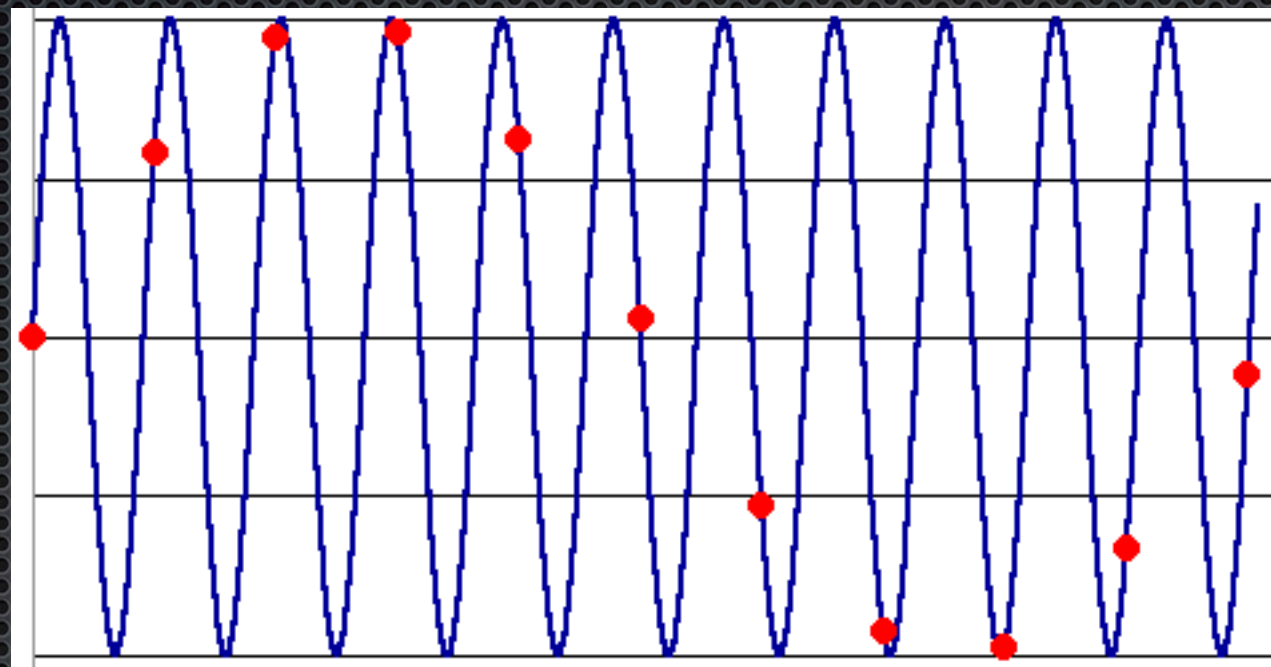
▪ Nyquist Rate

$$f_s > 2B$$

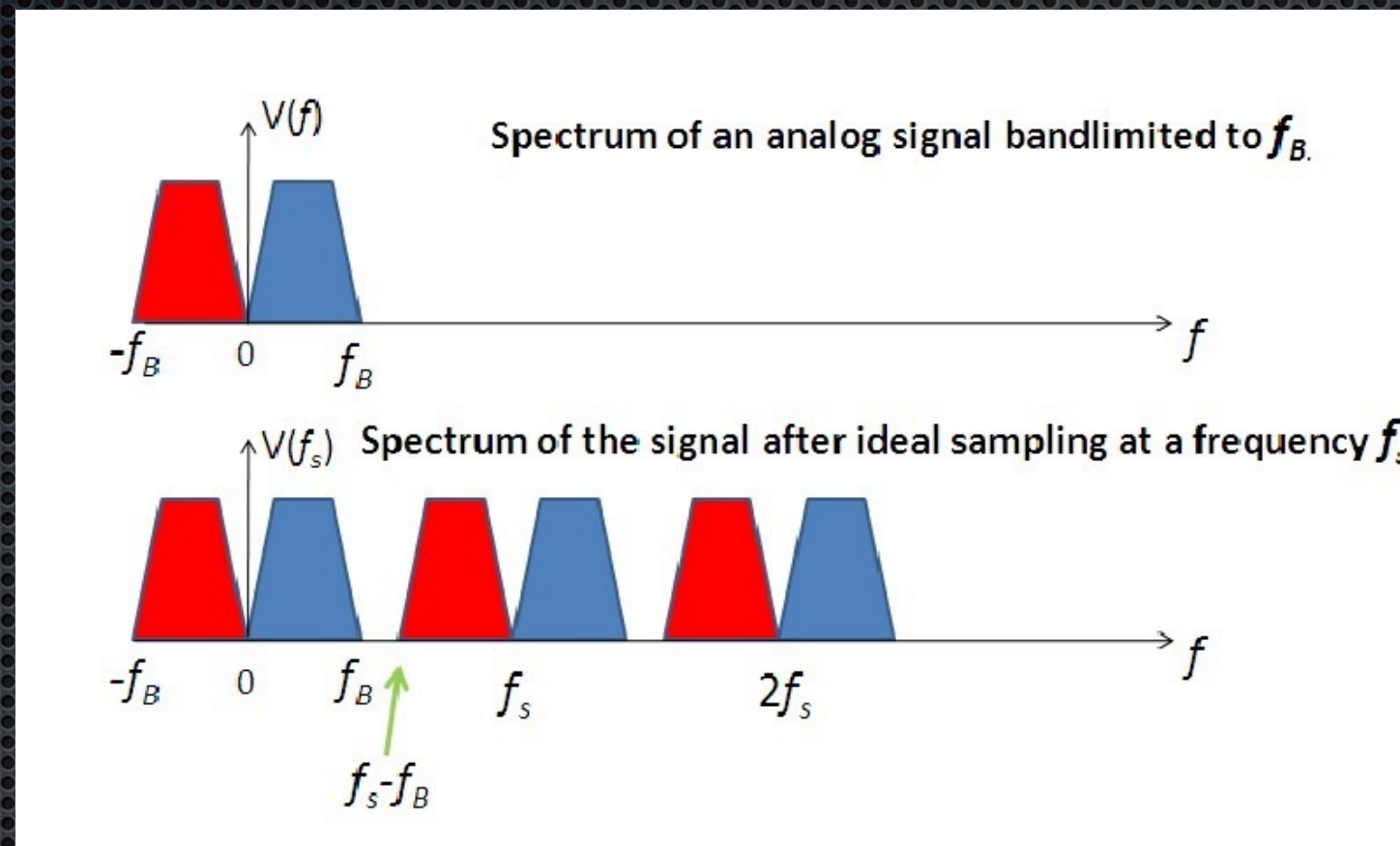
▪ Nyquist Bandwidth

$$B < f_s/2$$

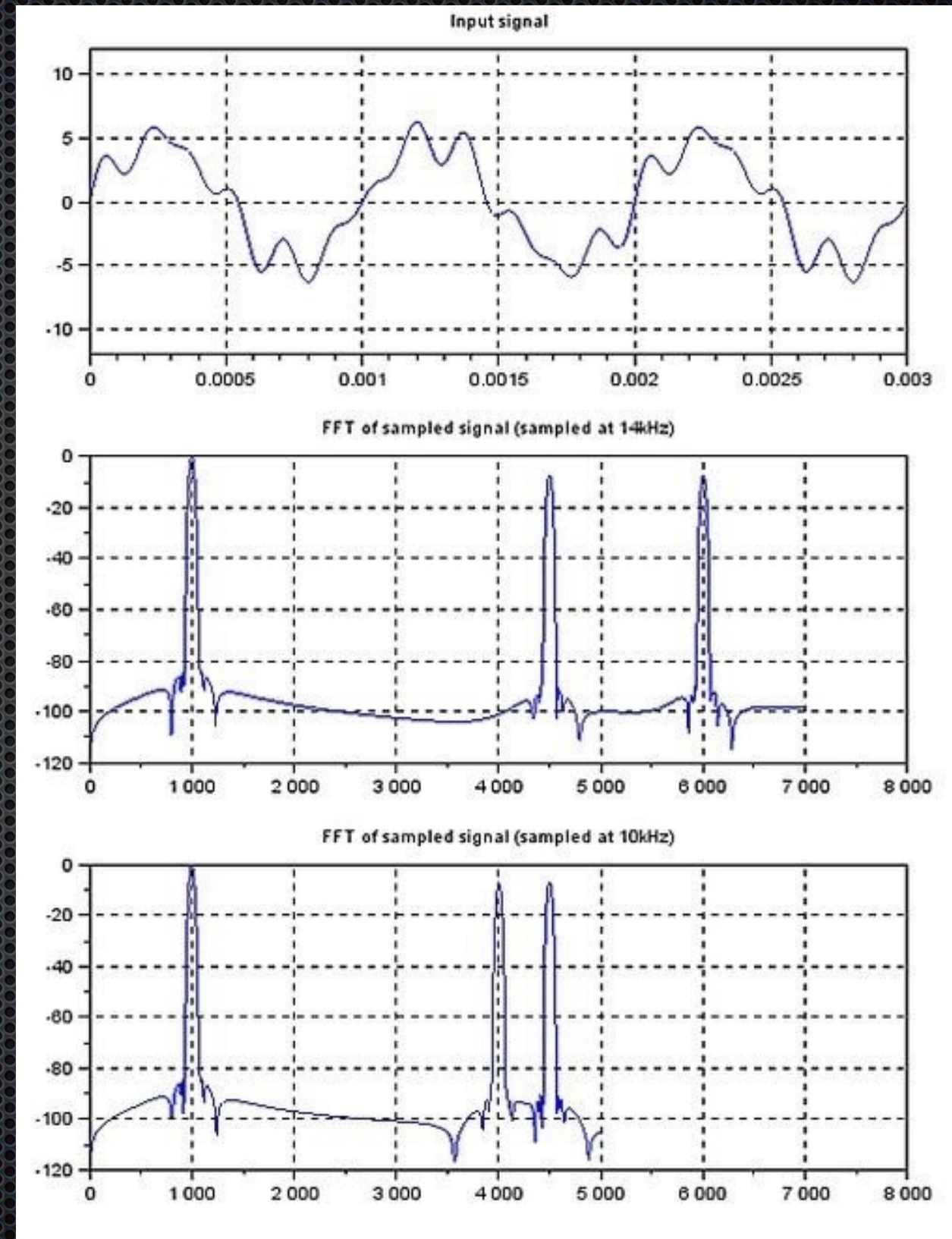
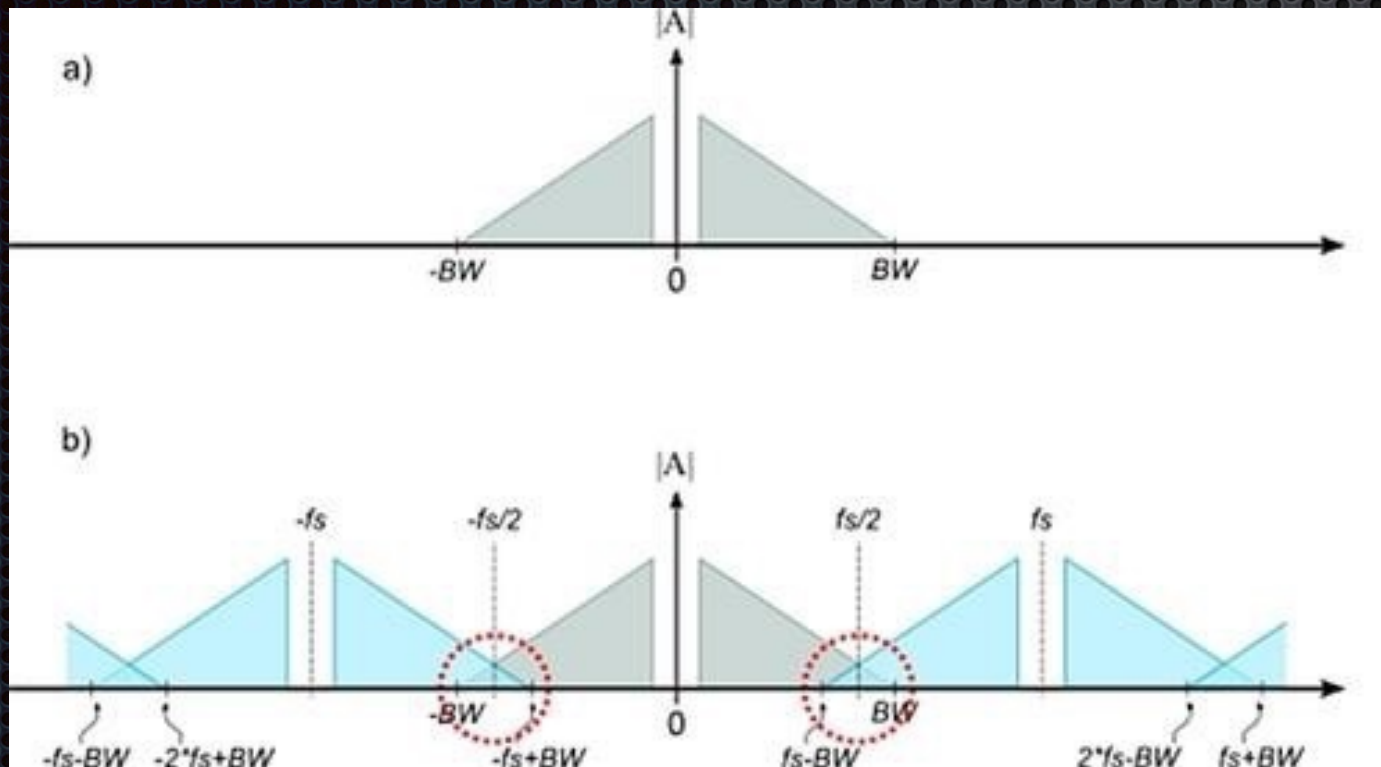
Nyquist rate



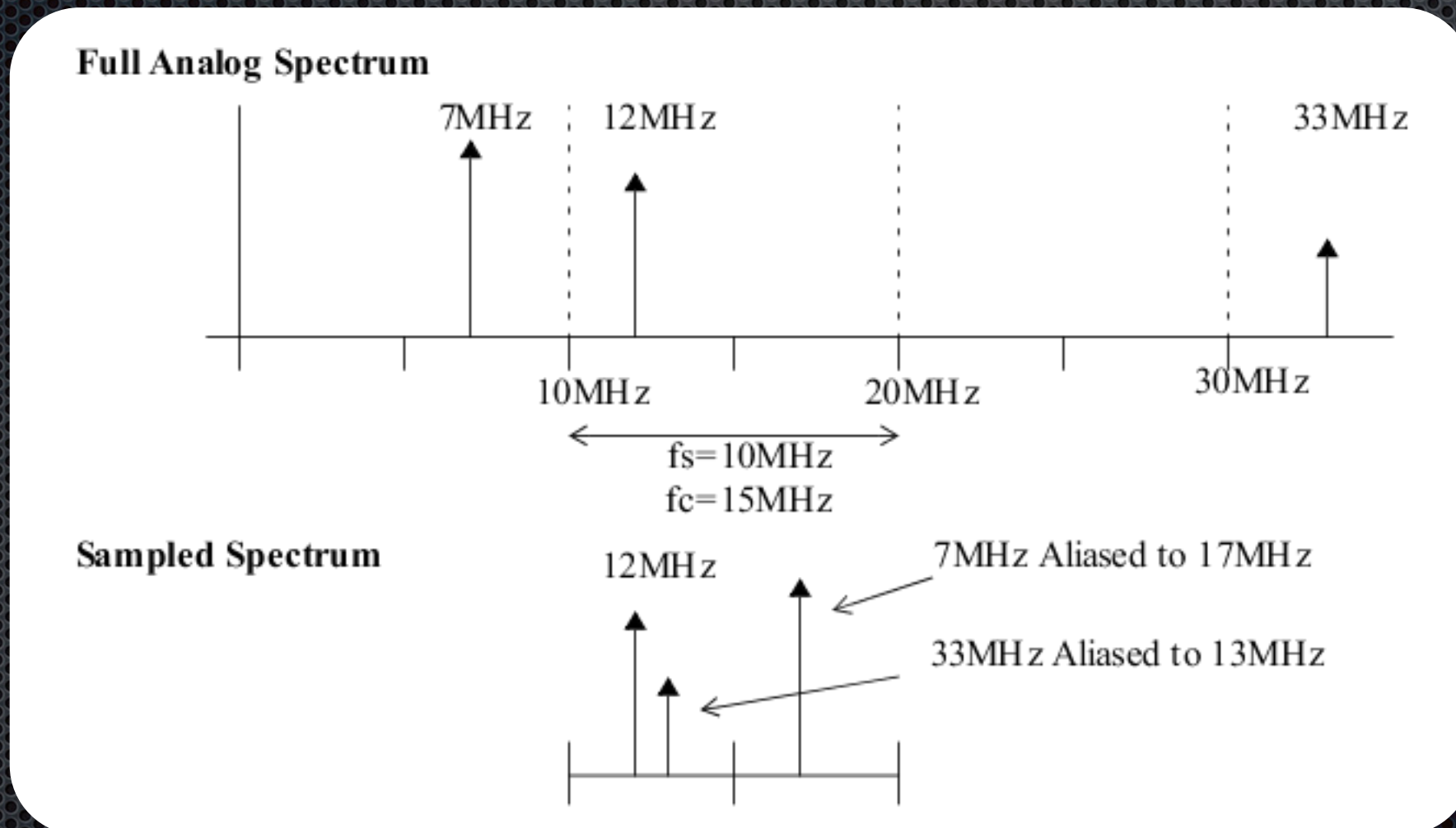
Sampling frequency domain



Aliasing



Passband Aliasing



Aliasing in images



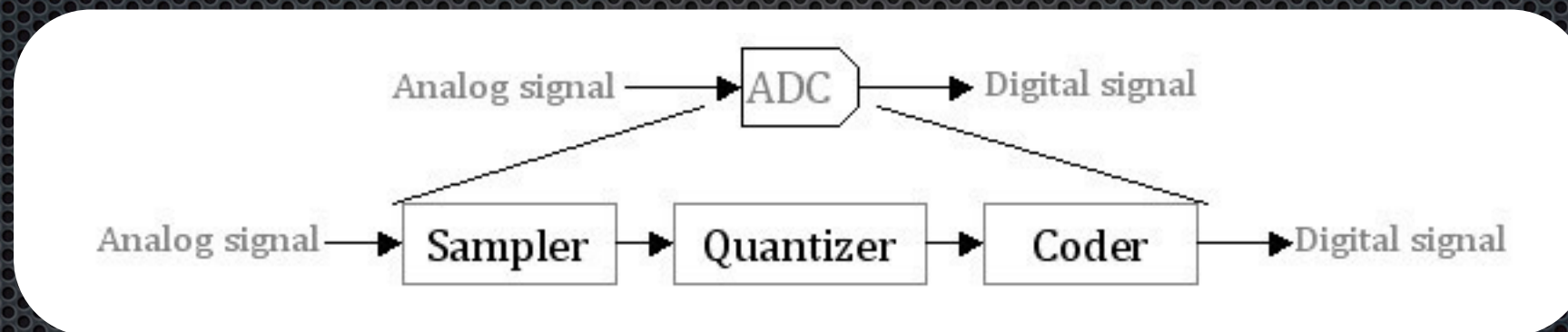
Aliasing in images



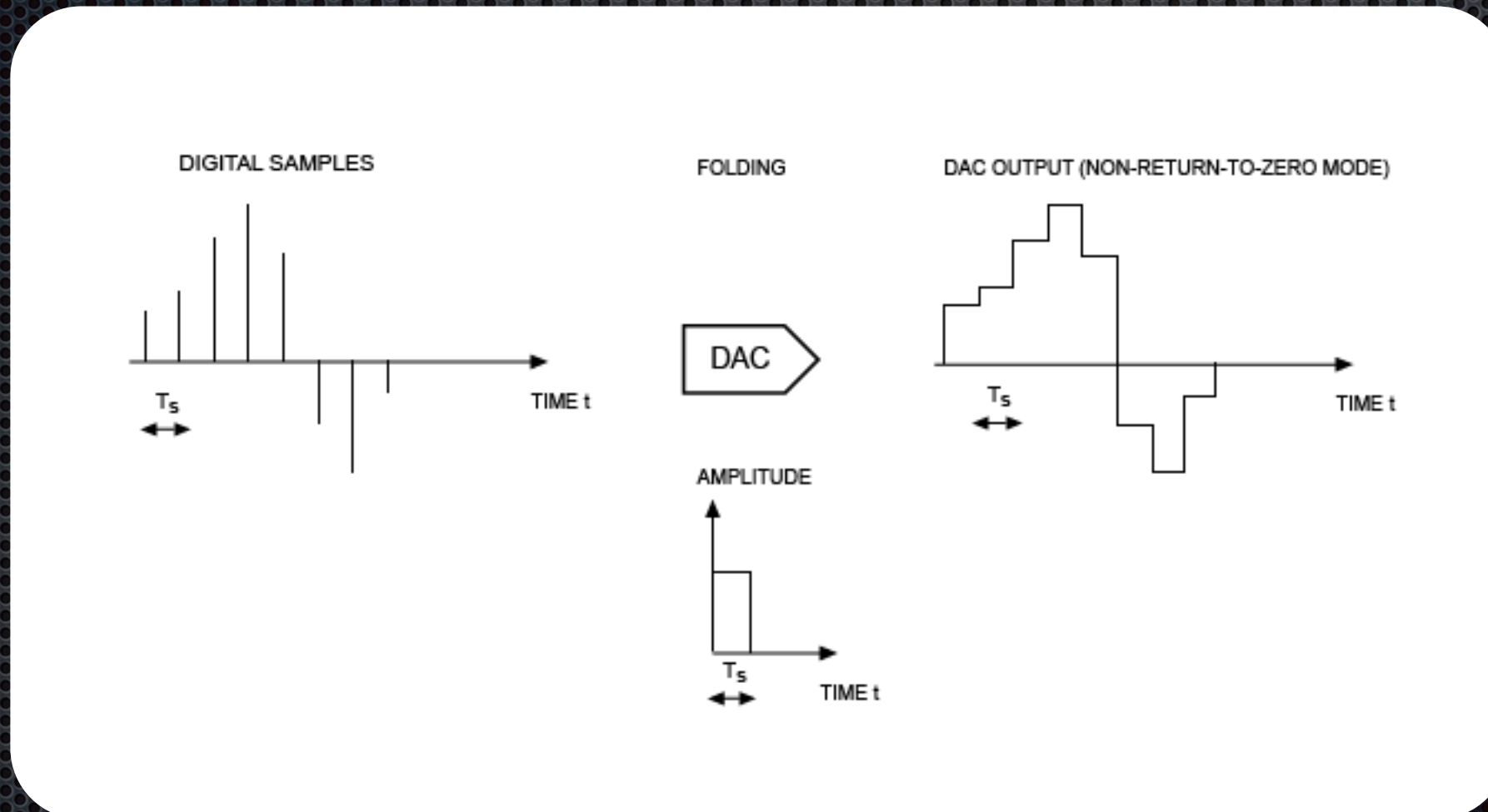
Aliasing in videos



ADC



DAC



DAC

