Oversampling (3B)

-
-

Copyright (c) 2009 - 2012 Young W. Lim.

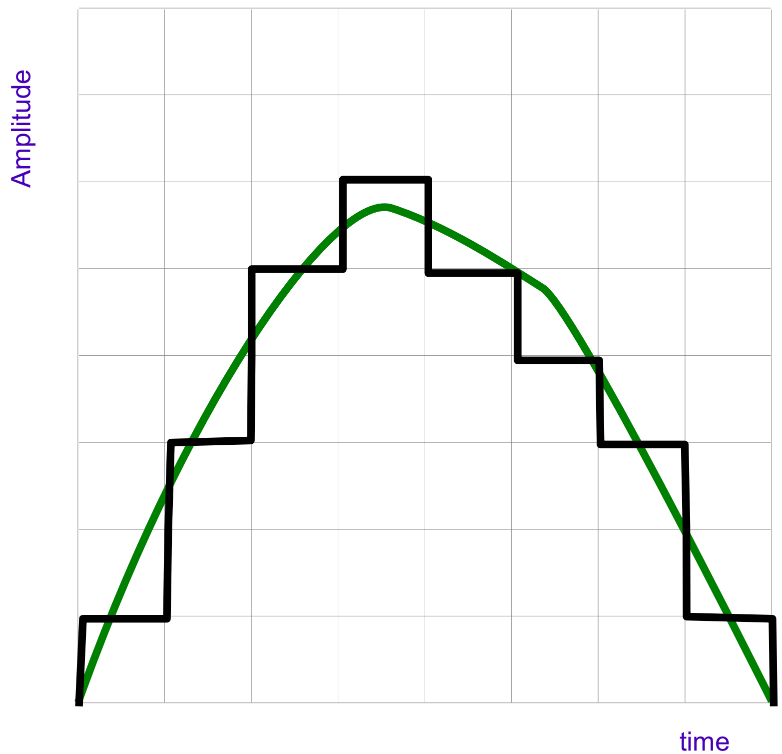
Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

Please send corrections (or suggestions) to youngwlim@hotmail.com.

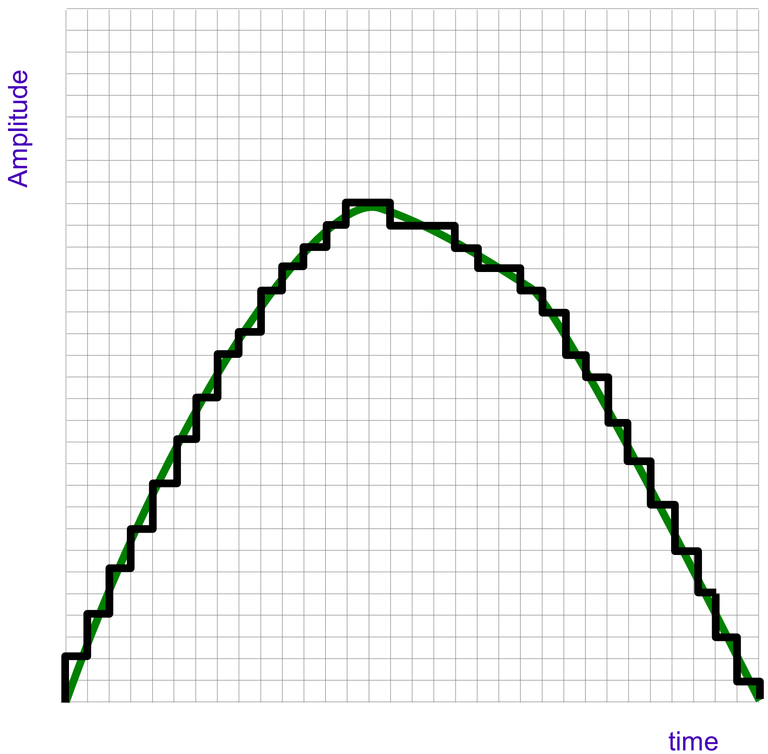
This document was produced by using OpenOffice and Octave.

Bits and Samples

More Samples

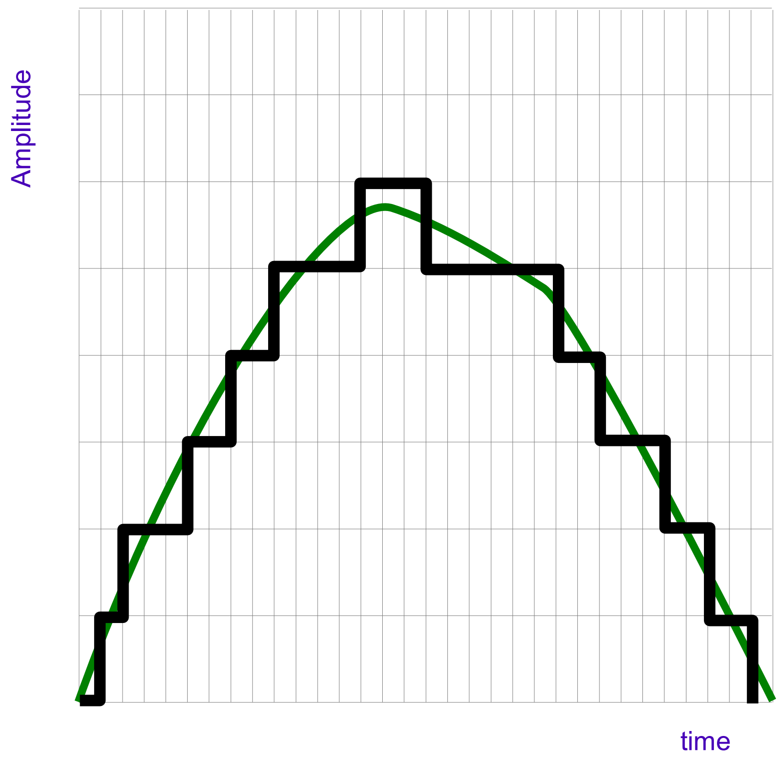


More Bits

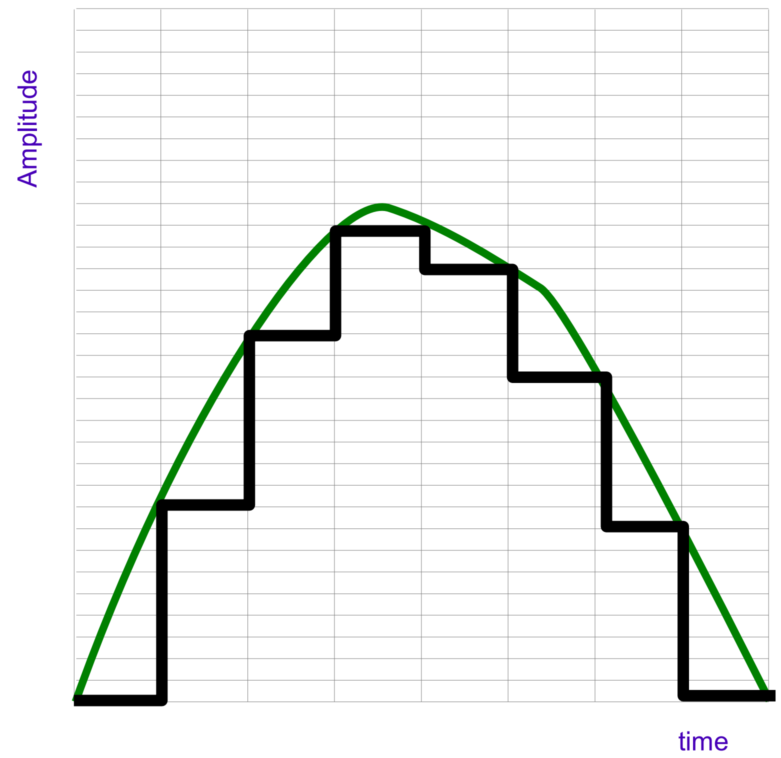


Bits and Samples

More Samples

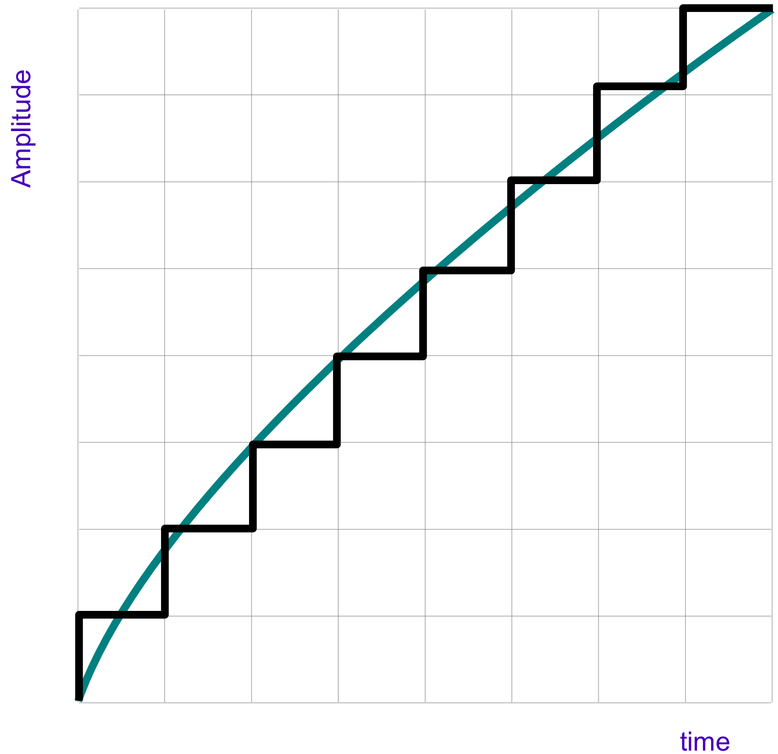


More Bits

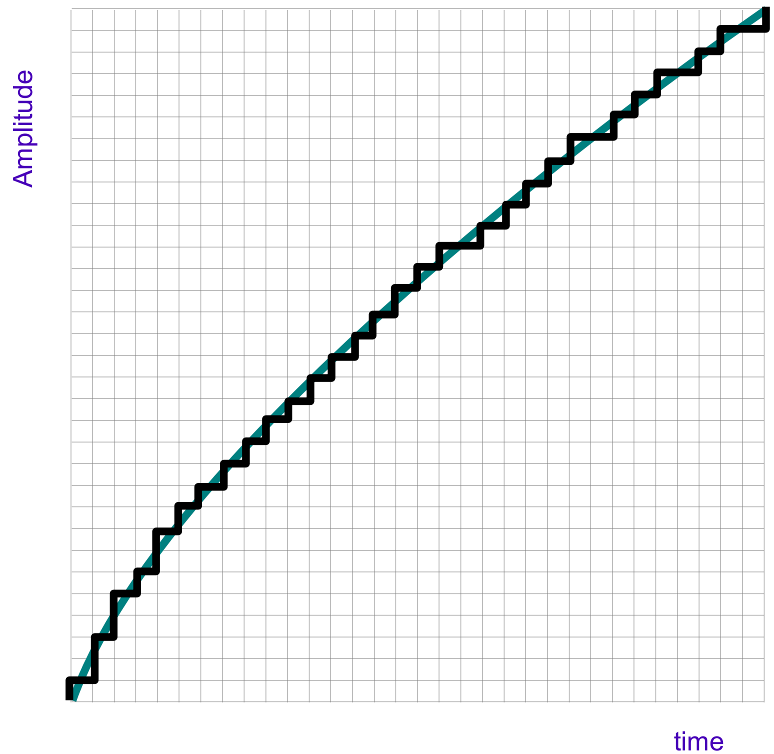


Bits and Samples

More Samples

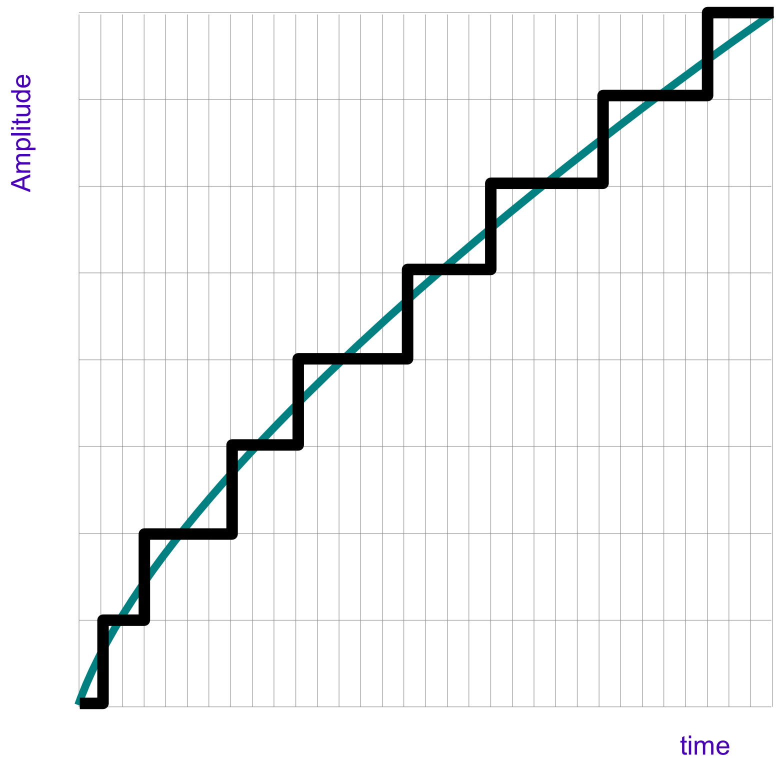


More Bits

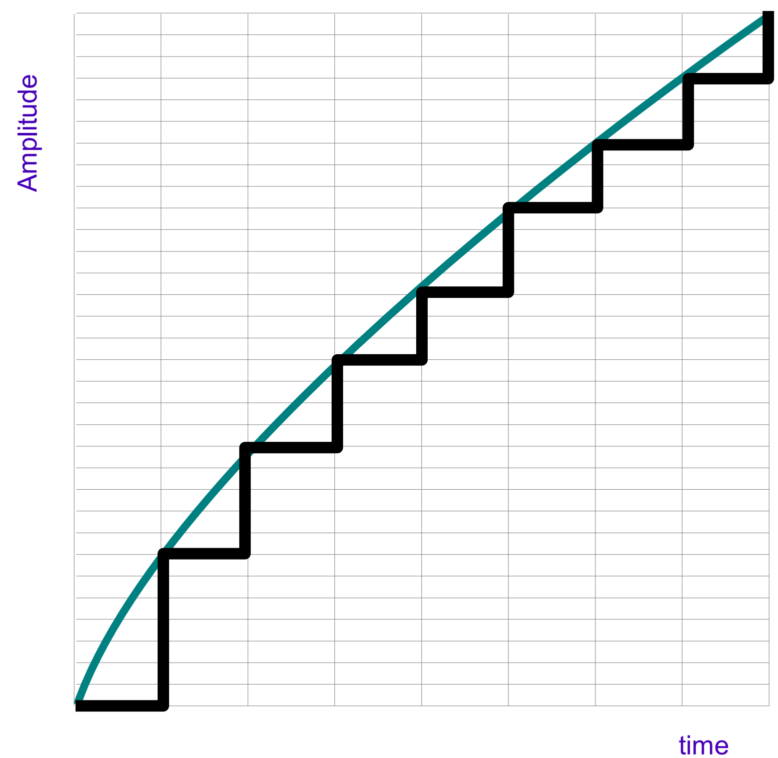


Bits and Samples

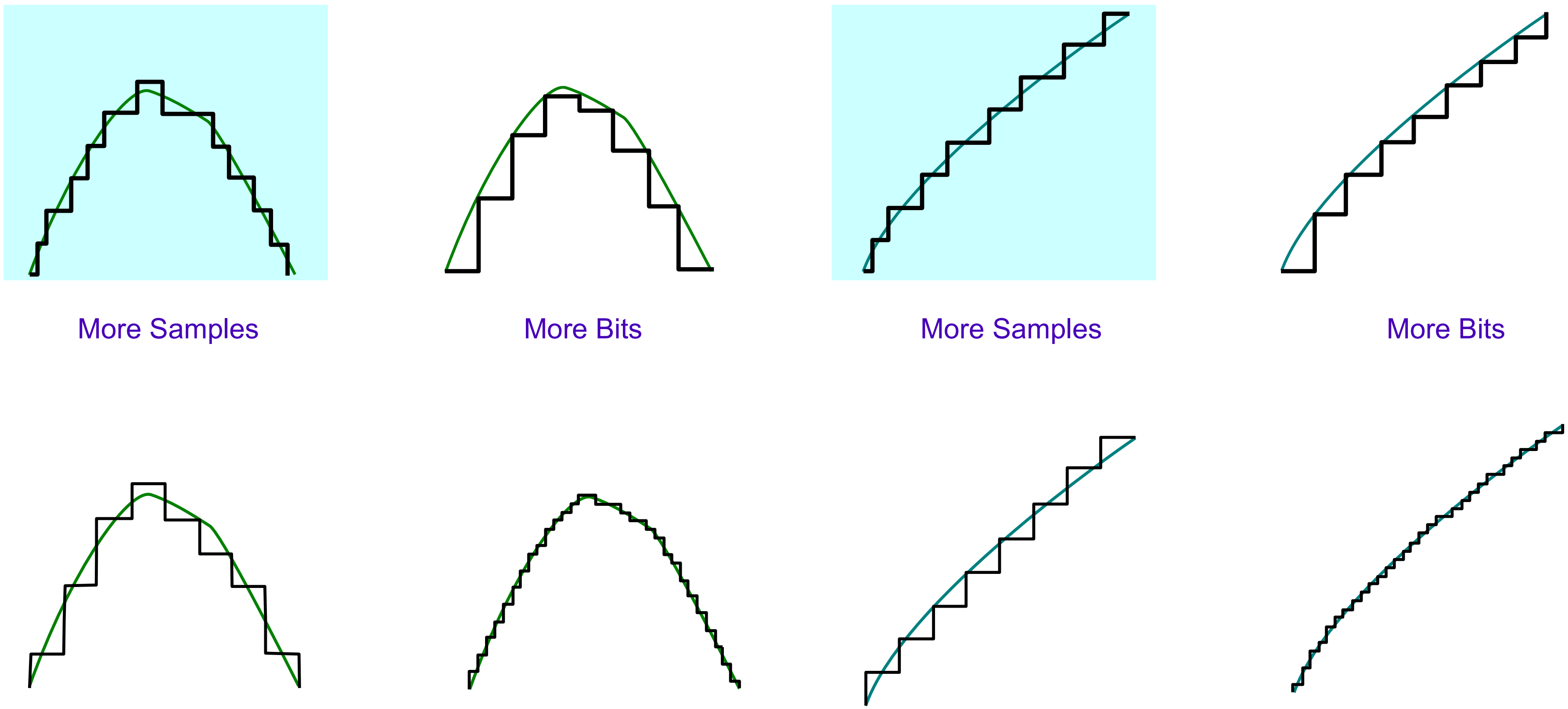
More Samples



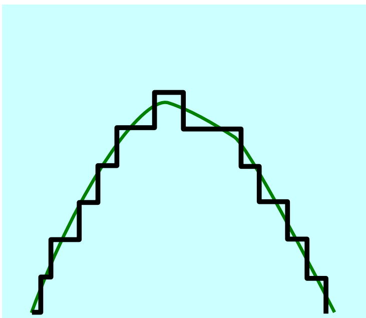
More Bits



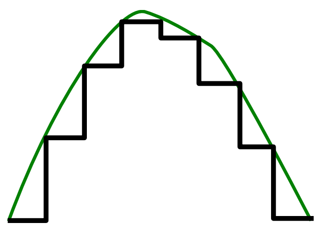
Over-Sampling



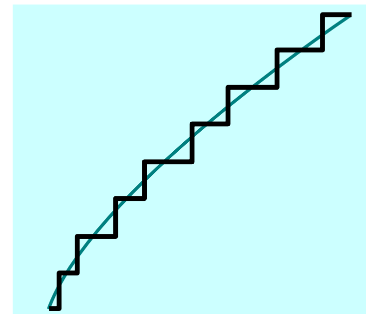
Over-Sampling



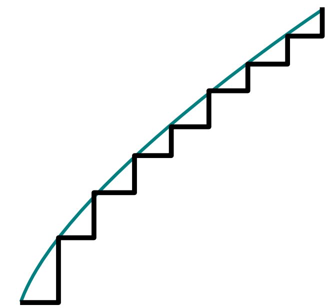
More Samples



More Bits



More Samples



More Bits

Sampling → Quantization in time asxis

Quantization → Quantization in amplitude axis

OverSampling → trade off bits for samples

→ alleviate the need for high quality prefilters and postfilters

Band-limited Signal

Band-limited Signal

Analog Filter

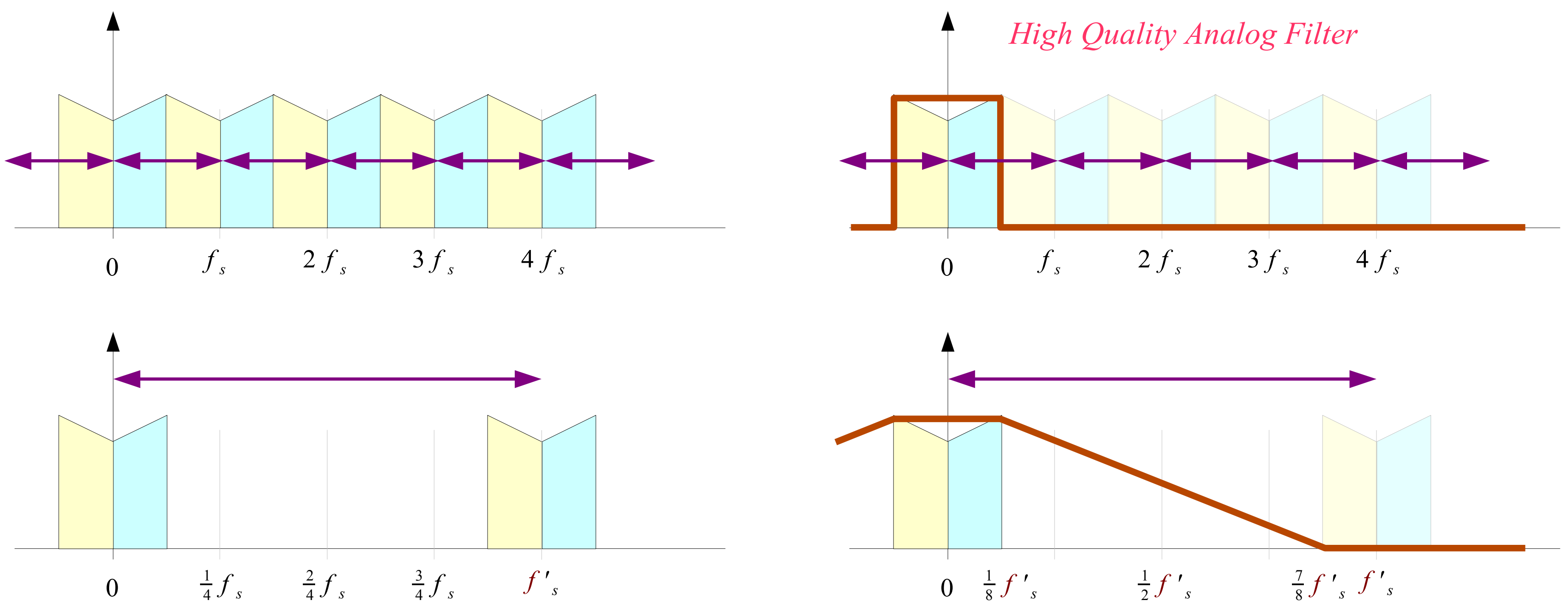
Low Pass Anti-aliasing Prefilter

ADC

DAC

Analog Filter

Low Pass Anti-image Postfilter



Band-limited Signal

Low Pass Anti-aliasing Prefilter

ADC

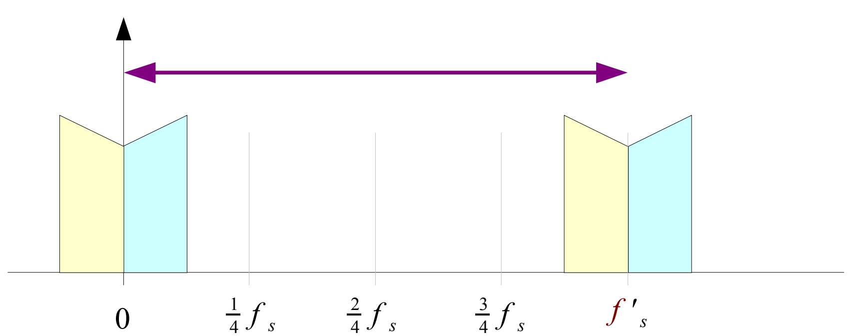
DAC

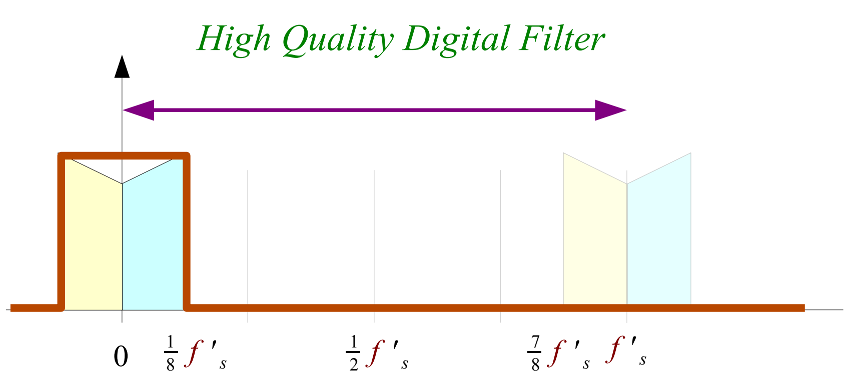
Low Pass Anti-image Postfilter

Digital Filter

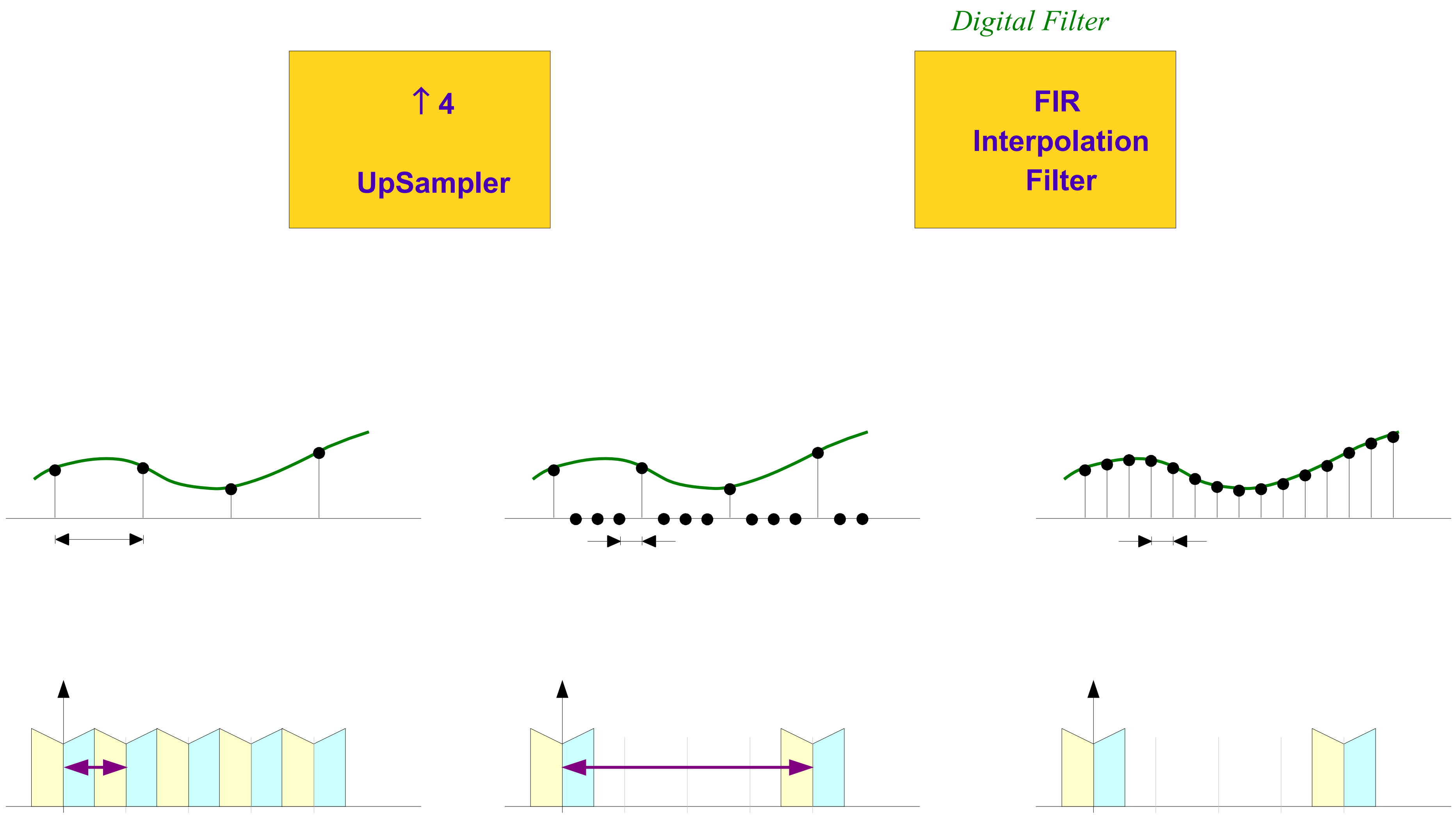
$\uparrow 4$ UpSampler

FIR Interpolation Filter





Band-limited Signal



Young Won Lim
7/12/12

Band-limited Signal

Low Pass Anti-aliasing Prefilter

ADC

DAC

Low Pass Anti-image Postfilter

$$f_s > 2 \cdot f_H$$

$\uparrow 4$

UpSampler

FIR Interpolation Filter

$$f_{oversampling} = 4^n \cdot f_s$$

Band-limited Signal

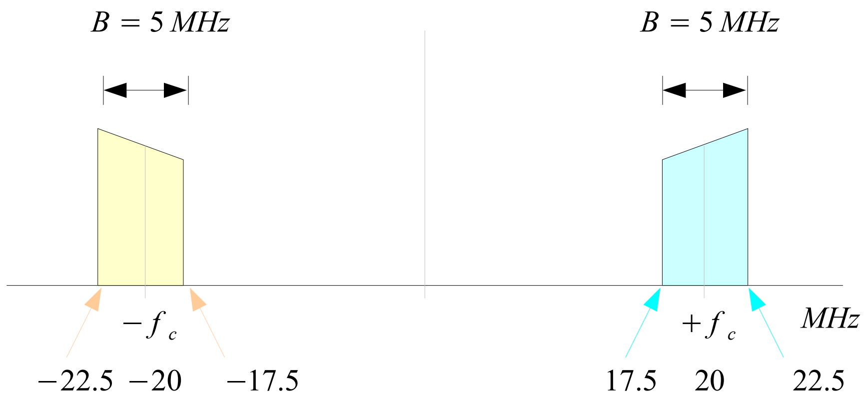
$$f_{oversampling} = 4^n \cdot f_s$$

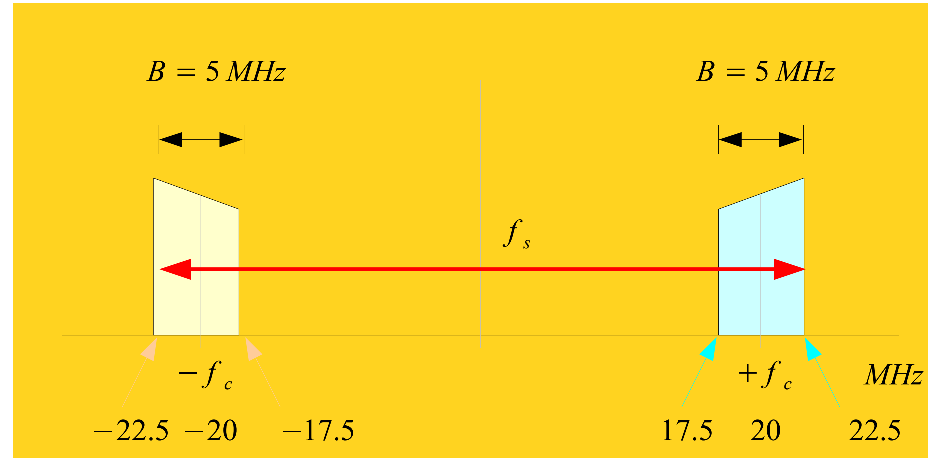
Oversampling and Decimation
Oversample and Lowpass Filter

- **Normal Averaging**
- **Decimation / Interpolation**

$$f_s > 2 \cdot f_H$$

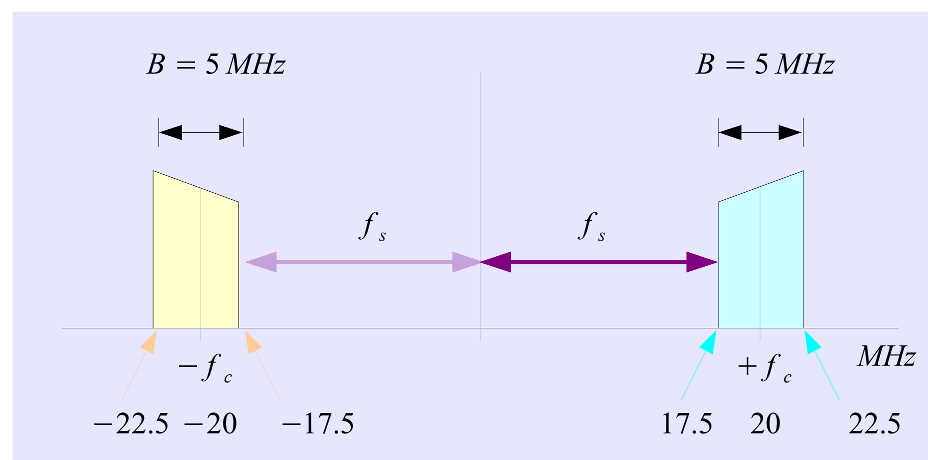
Band-limited Signal



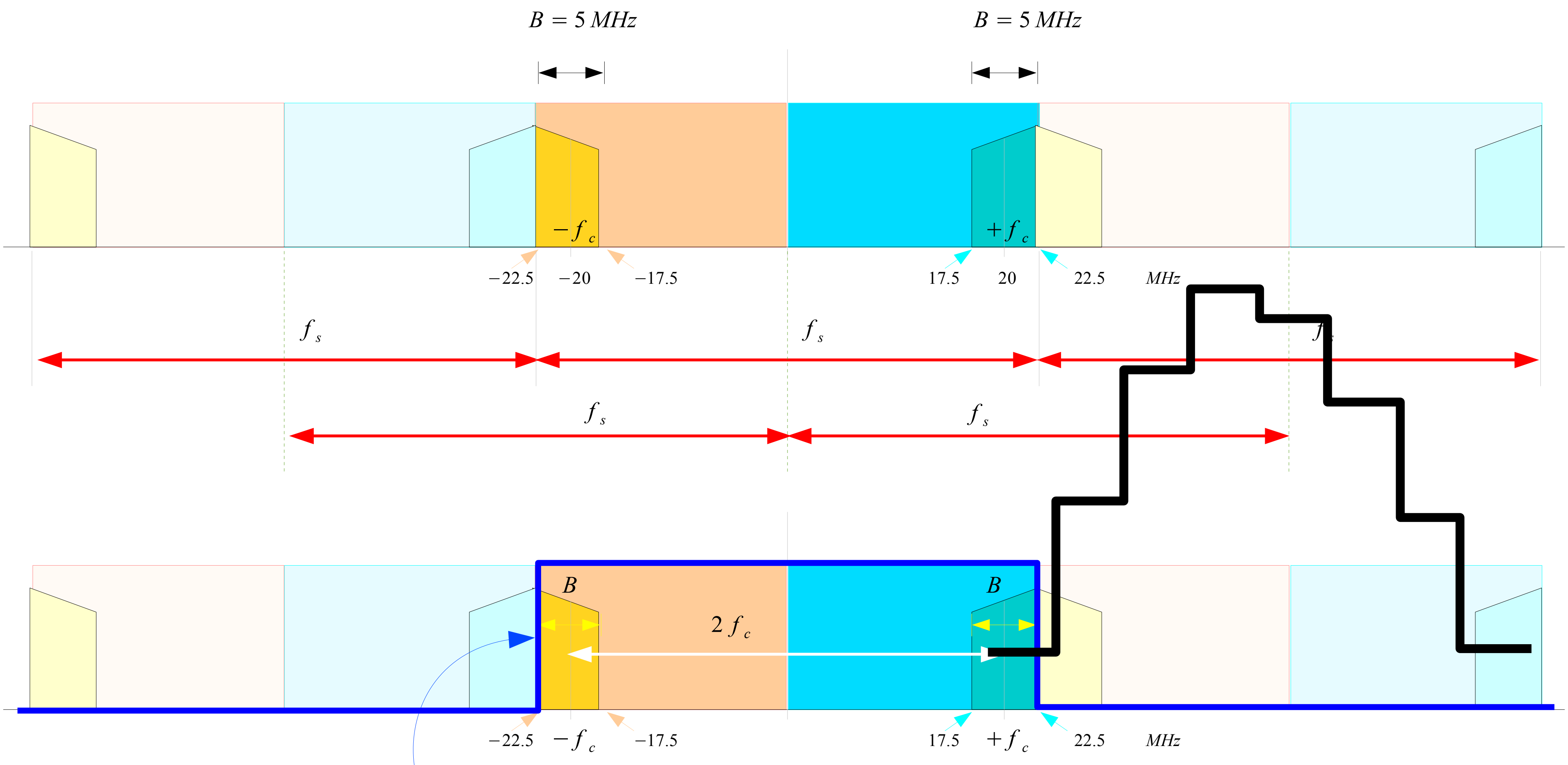


- Lowpass Sampling

- Bandpass Sampling
- IF filtering
- Harmonic Sampling
- Sub-Nyquist Sampling



Low-pass Signal Sampling



Nyquist Criterion

$$2 f_c + B \leq f_s$$

References

[1] http://en.wikipedia.org/
[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003
[3] A “graphical interpretation” of the DFT and FFT, by Steve Mann
[4] R. G. Lyons, Understanding Digital Signal Processing, 1997
[5] AVR121: Enhancing ADC resolution by oversampling
[6] S.J. Orfanidis, Introduction to Signal Processing
www.ece.rutgers.edu/~orfanidi/intro2sp