Anti-aliasing Prefilter (6B)

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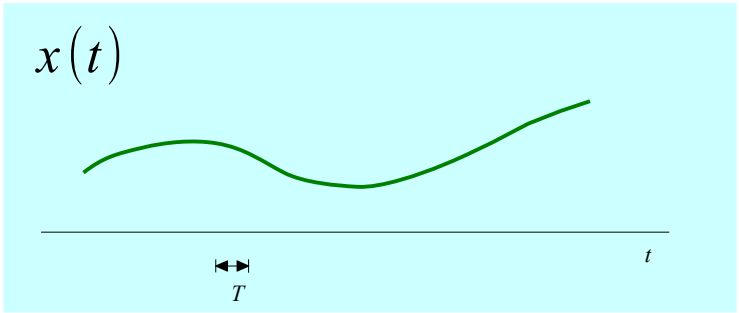
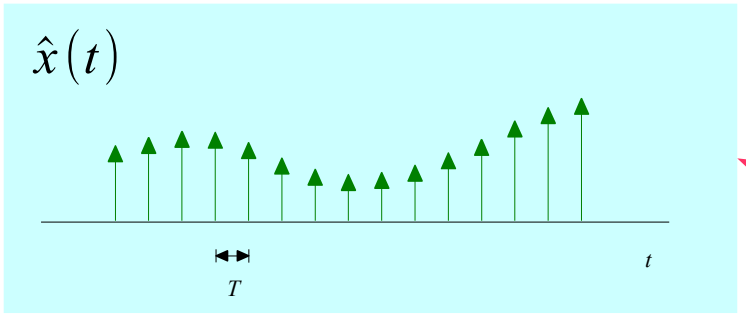
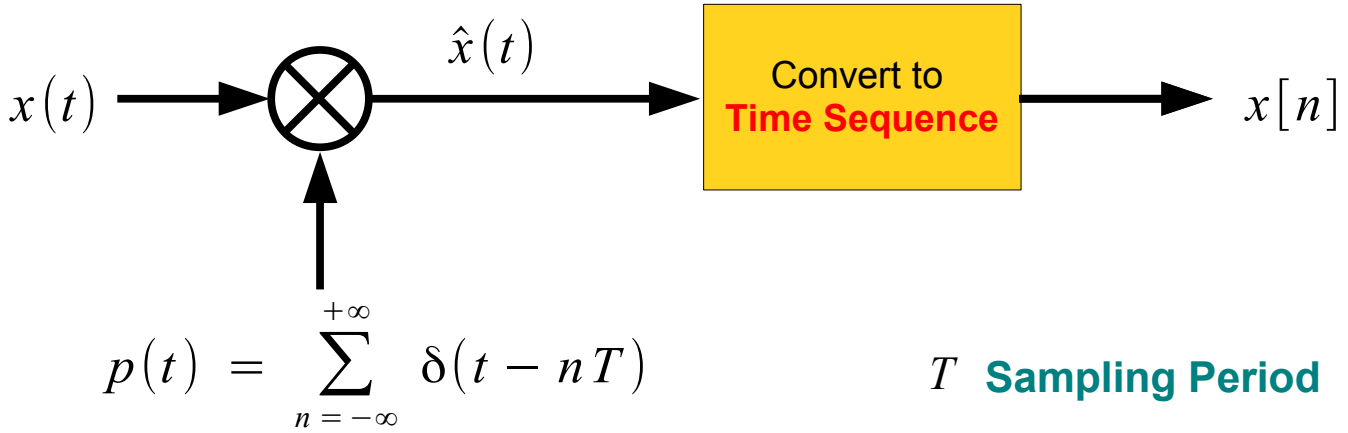
Please send corrections (or suggestions) to youngwlim@hotmail.com.

This document was produced by using OpenOffice and Octave.

Time Sequence



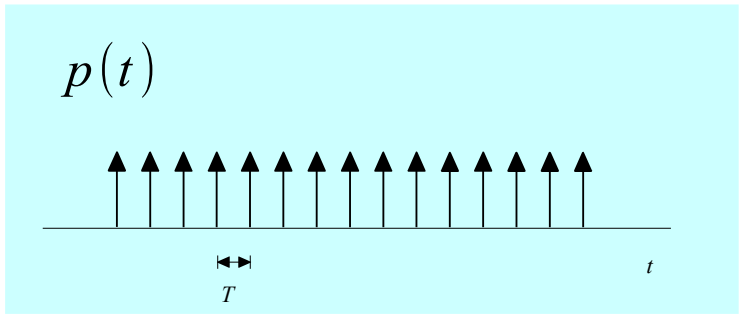


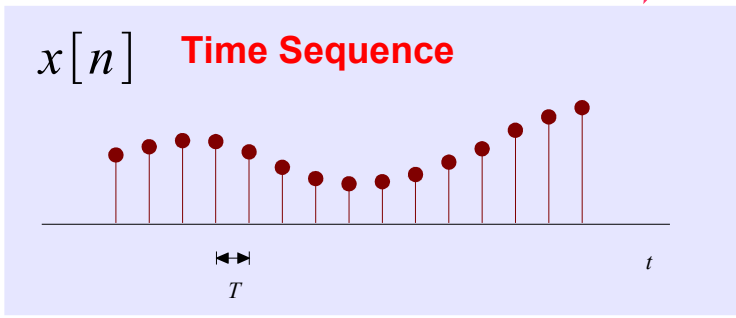


Ideal Sampling

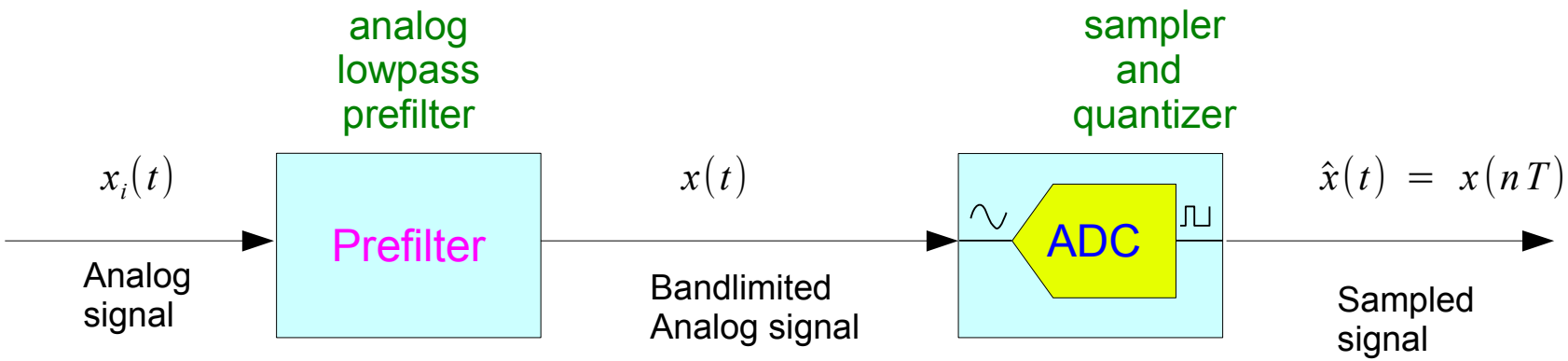
$$p(t) = \sum_{n=-\infty}^{+\infty} \delta(t - nT)$$

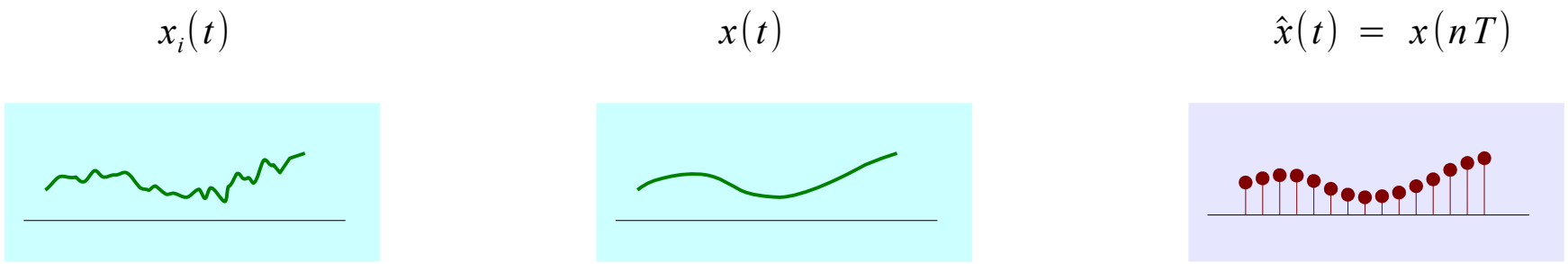
T **Sampling Period**





Prefilter in Time Domain





Not band-limited signal

Band-limited signal

Low Pass Filter
before sampling

Anti-aliasing Prefilter

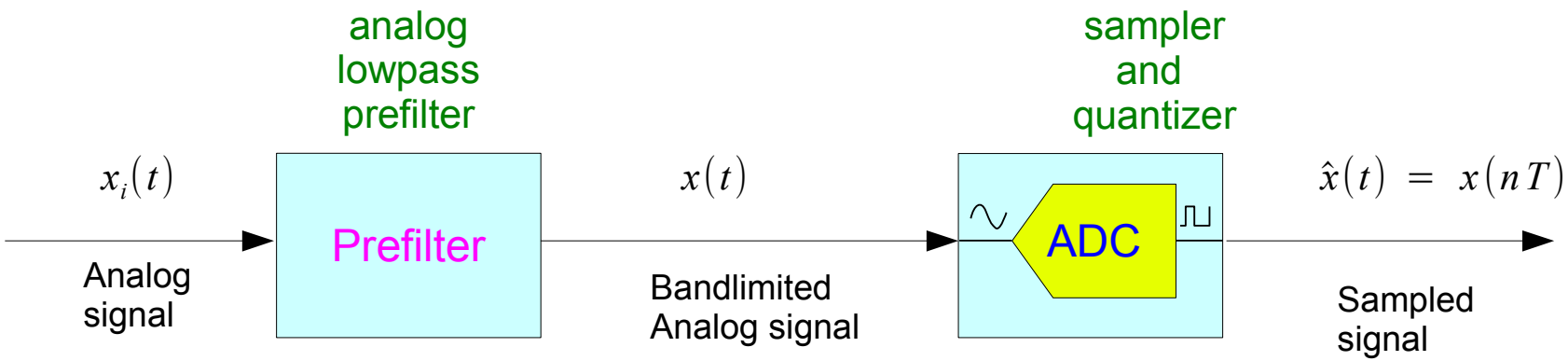
Sampling
Frequency

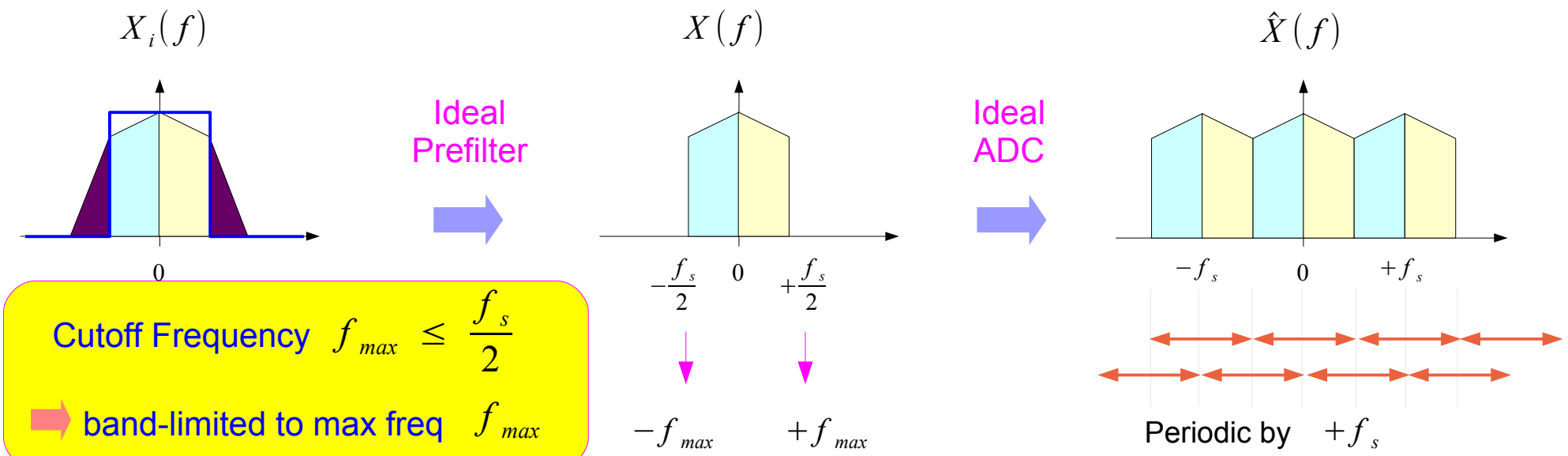
$$\frac{1}{T} = f_s$$

Periodicity
in Freq Domain

spectrum replication f_s

Ideal Prefilter in Frequency Domain





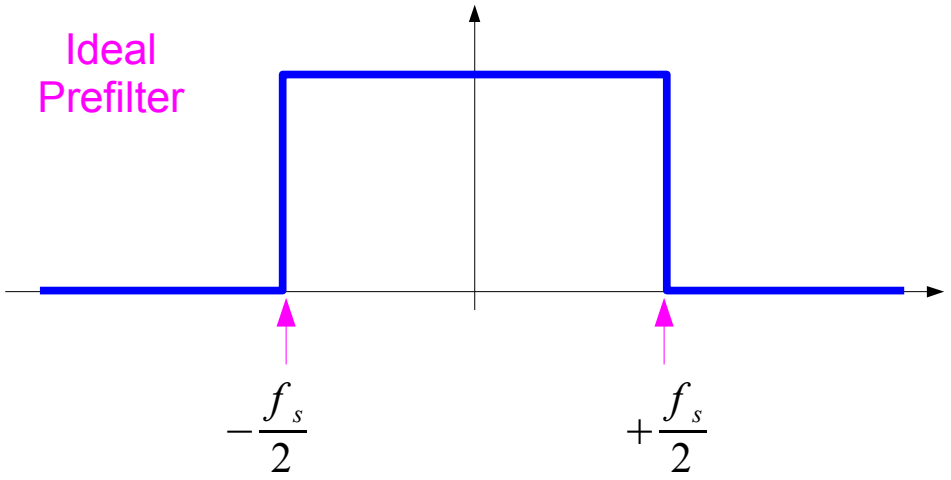
Cutoff Frequency $f_{max} \le \frac{f_s}{2}$

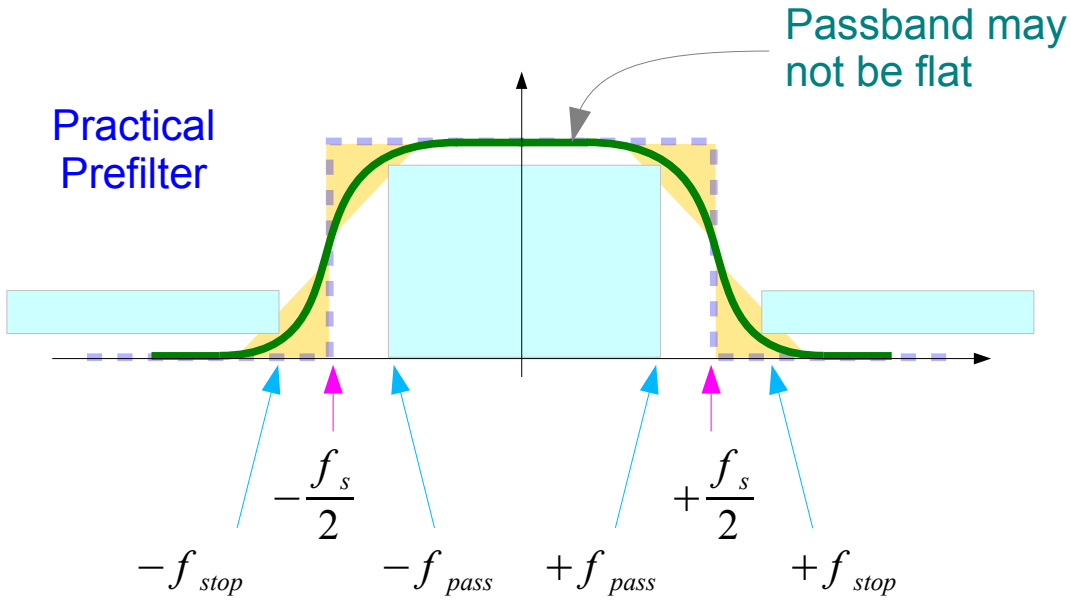
band-limited to max freq f_{max}

Practical Prefilter

The sampling rate must be chosen high enough so that after prefiltering the surviring signal spectrum in the **Nyquist interval** contain all the significant frequency component

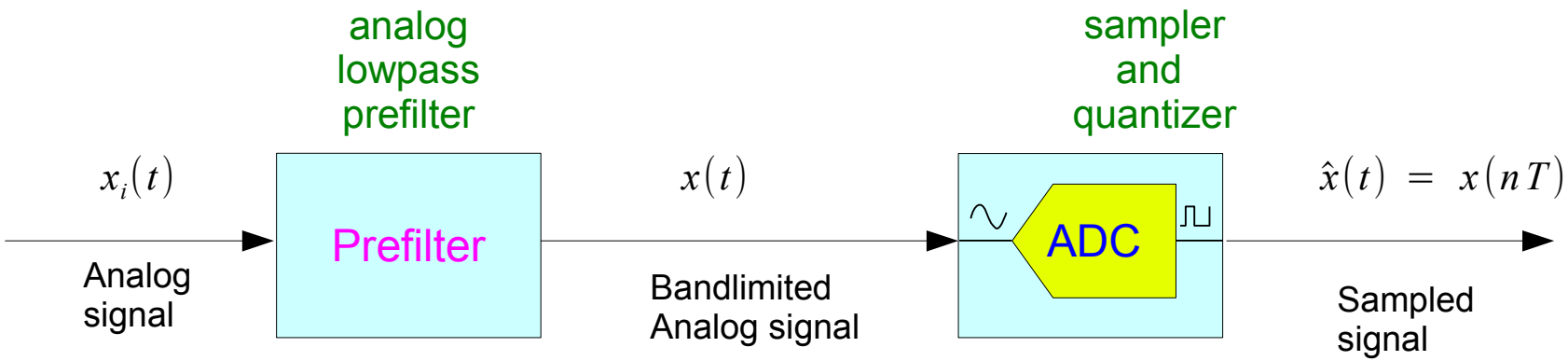
$$\left[-\frac{f_s}{2},\ +\frac{f_s}{2}\right]$$

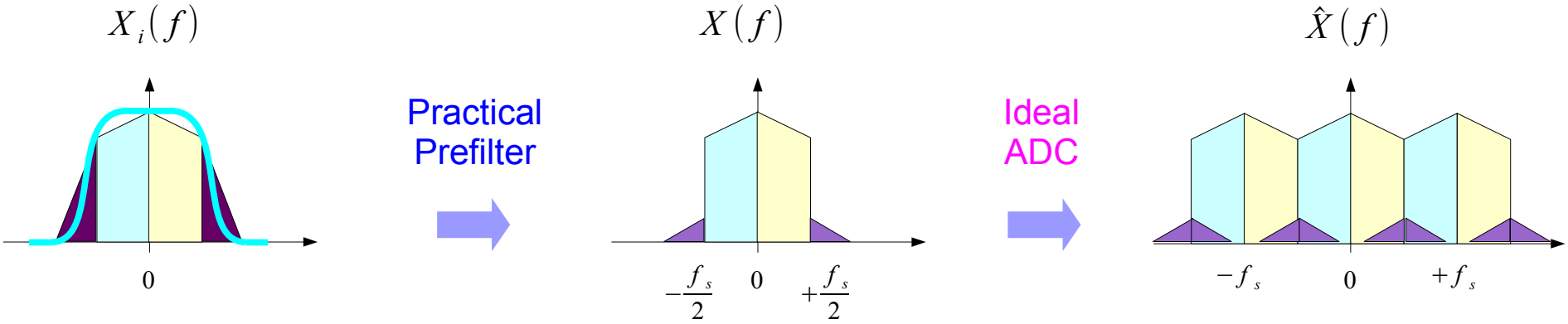




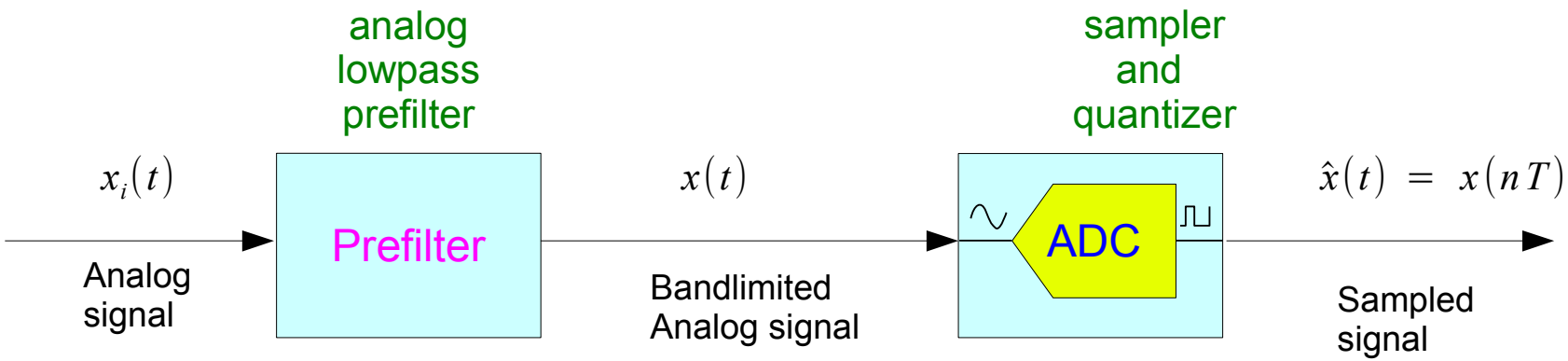
$$f_s = f_{pass} + f_{stop}$$

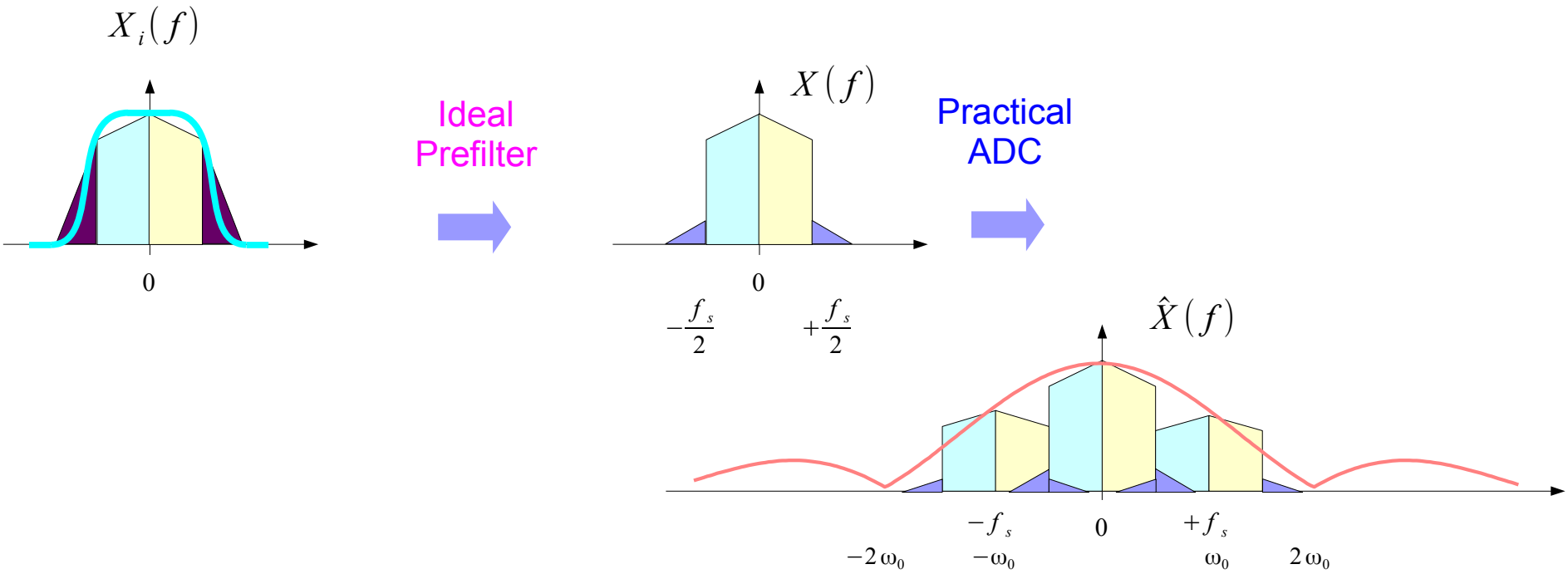
Practical Prefilter + Ideal ADC





Practical Prefilter + Practical ADC





References

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[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
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www.ece.rutgers.edu/~orfanidi/intro2sp