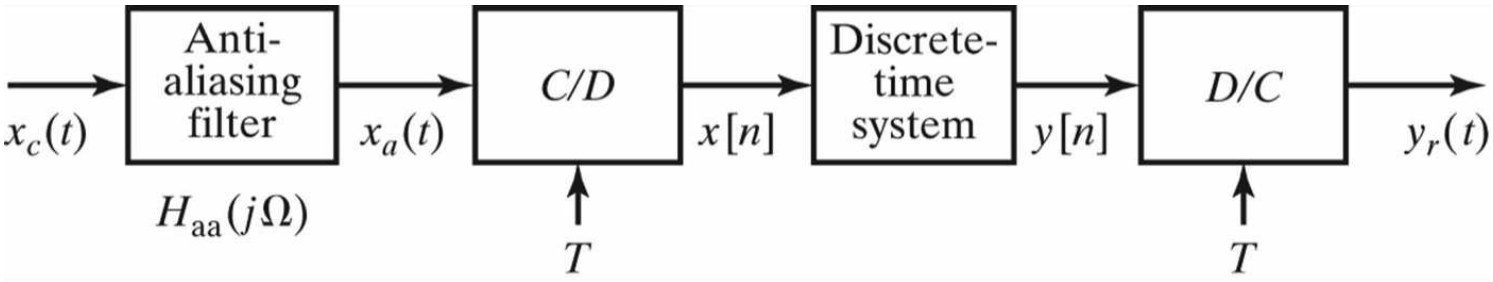
# Digital Signal Processing
# Practical Antialiasing Filters

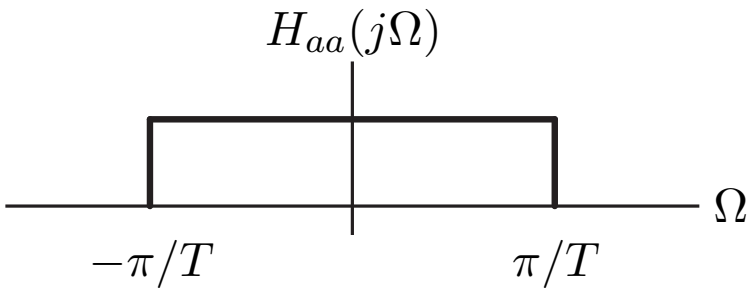
D. Richard Brown III

# Antialiasing Basics

Since we usually wish to avoid aliasing in DSP systems, an antialiasing filter is often placed before the sampling operation:

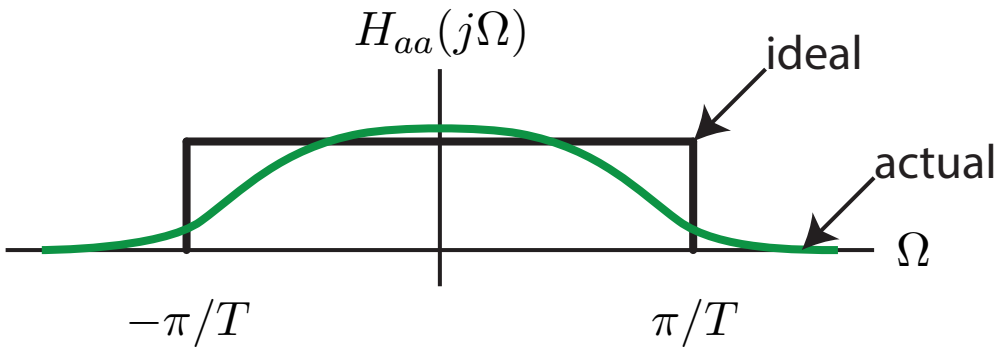



An ideal antialiasing filter has a lowpass response:



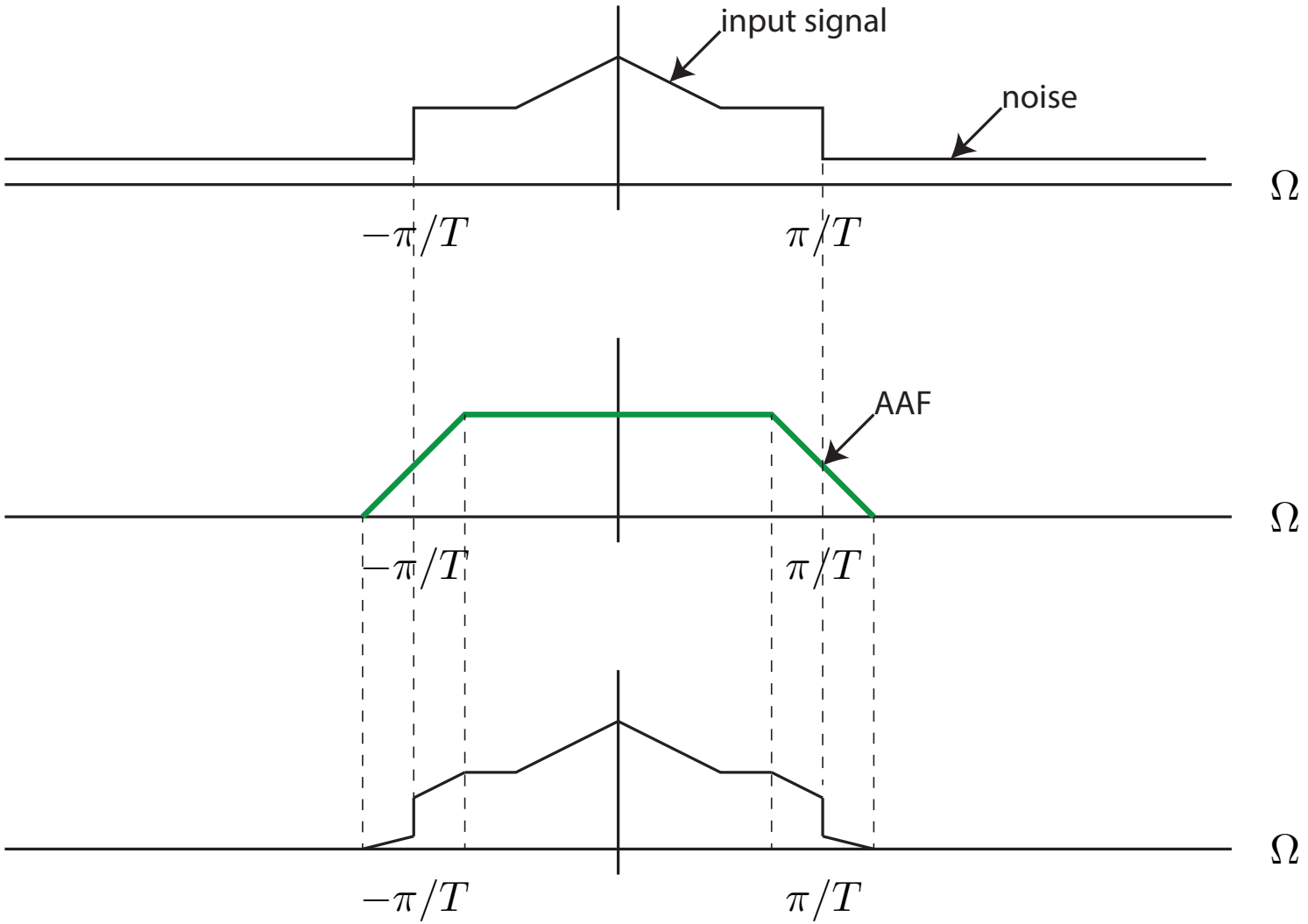

This blocks all of the frequencies that could cause aliasing before sampling. This is also often used to remove high-frequency noise prior to sampling.

# Antialiasing: Ideal vs. Actual

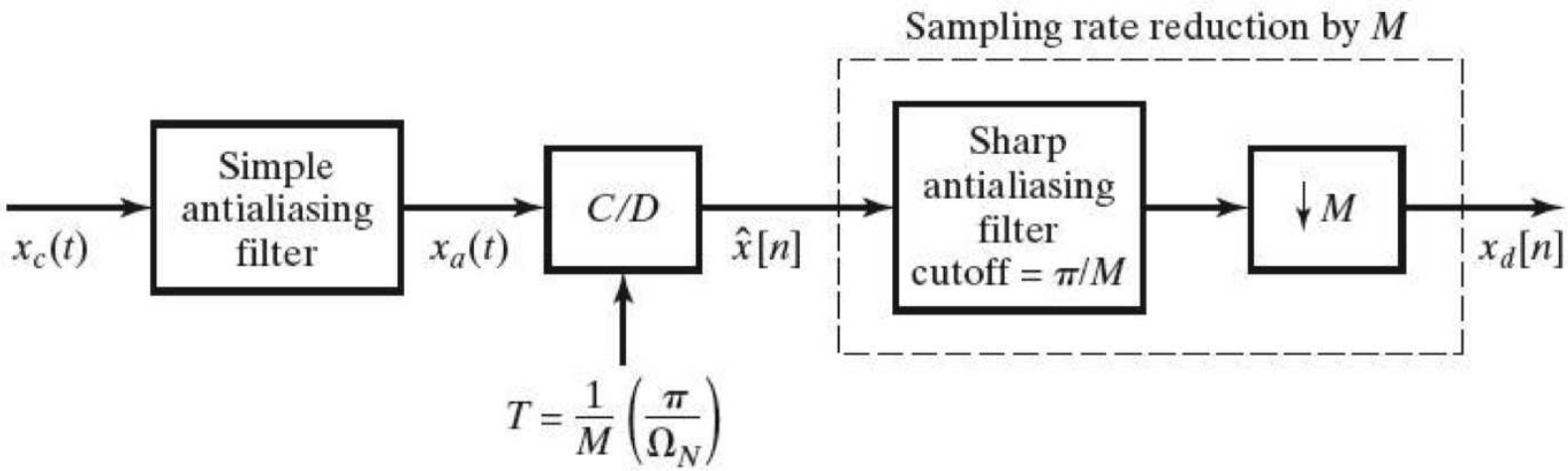



- $H_{aa}$ is a continuous-time filter.
- Sharp cutoff CT filters are difficult and expensive to implement.
- Sharp cutoff CT filters typically have highly nonlinear phase response near the cutoff frequency.
- Tradeoff between distorting desired signal and letting noise through.
- What if you want to change the sampling rate?

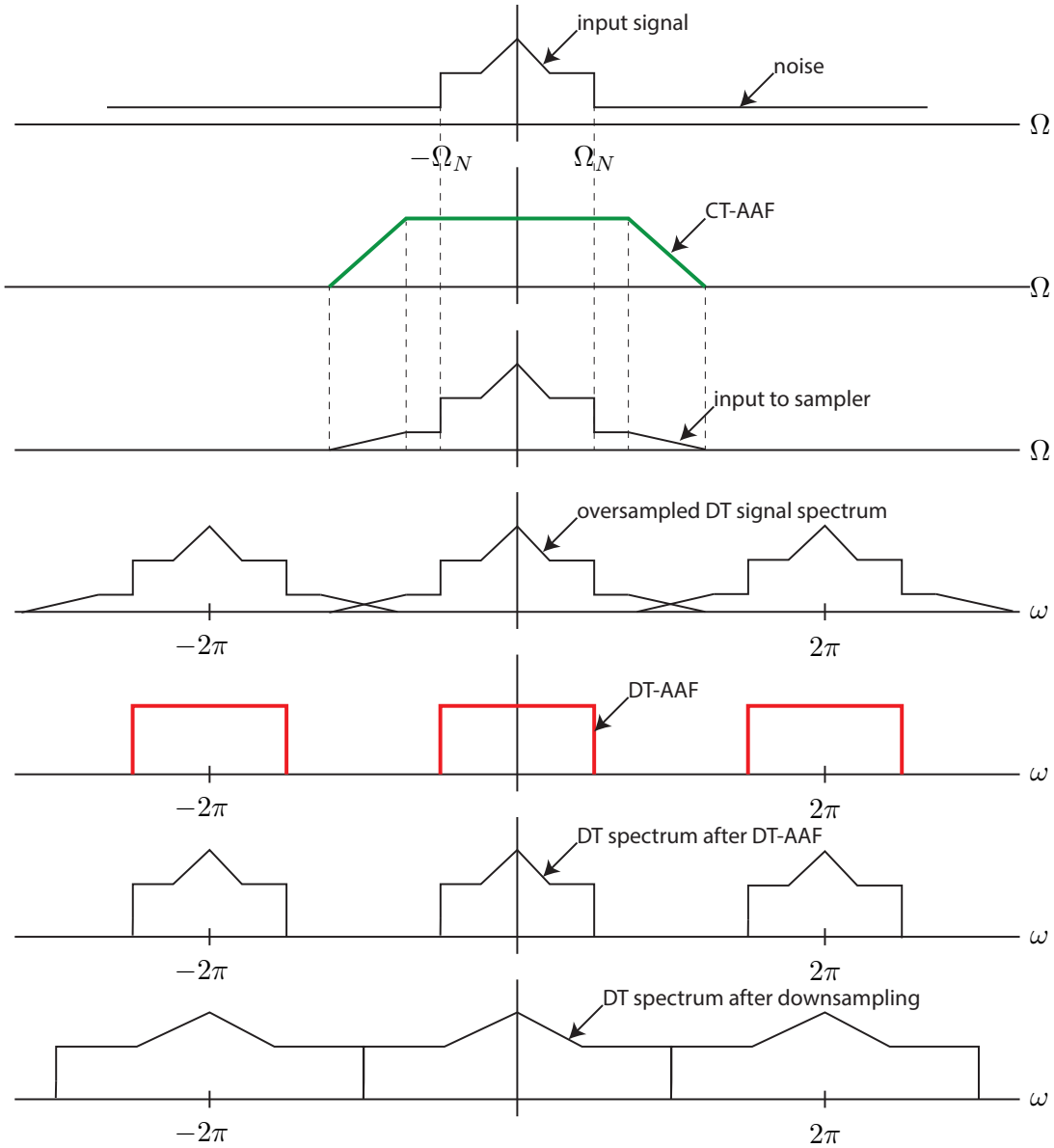
# Effect of Nonideal Antialiasing



# Practical Antialiasing via Oversampling



# Practical Antialiasing via Oversampling



# Remarks

- Real-world oversampling rates can be quite large, e.g. 256 or 384.
- Can use a very simple CT anti-aliasing filter.
- DT antialiasing filter can be very sharp and have linear phase.
- Can easily change sampling frequencies.
- The same ideas can be used to make simple reconstruction filters.

AIC23 codec DT-AAF example (from datasheet):