Chapter 1

Introduction to Digital Signal Processing

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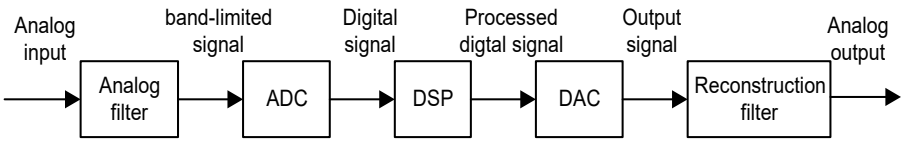
Basic block diagrams of a DSP system



- The physical world is analog and time-continuous
- Anti-aliasing filter to band-limit signal
- ADC: Sampling and quantization
- DSP: Hardware and software
- DAC + Reconstruction filter: Back to analog and time-continuous signal

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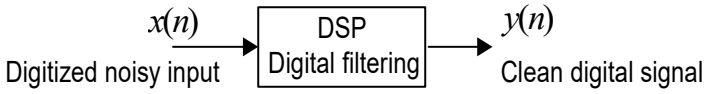
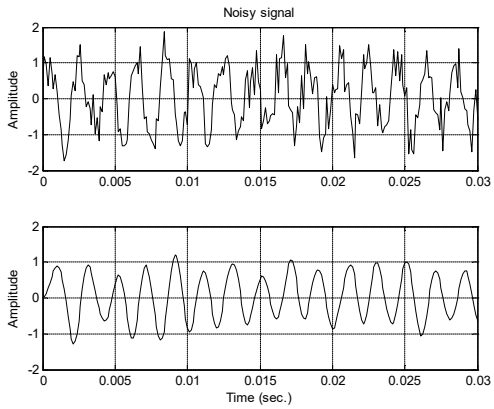
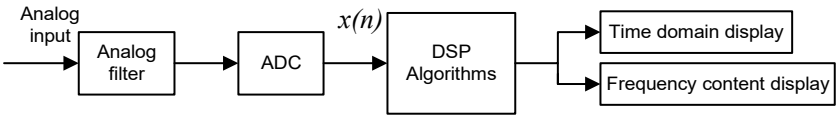
DSP Examples: Noise filtering





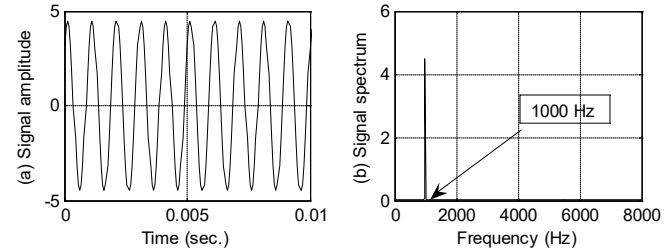
Signal spectral analysis:

Plot and analysis of frequency information of the digitized signal

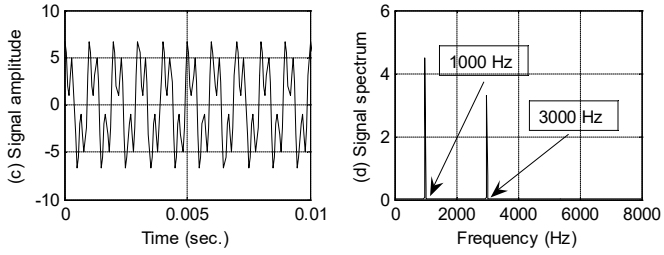


- The information in a signal is often easier to interpret from the frequency spectrum
- The frequency spectrum is found by applying the Fourier transform

Narrowband signals



A sinusoid with frequency 1kHz



Two sinusoids with frequencies 1kHz and 3kHz

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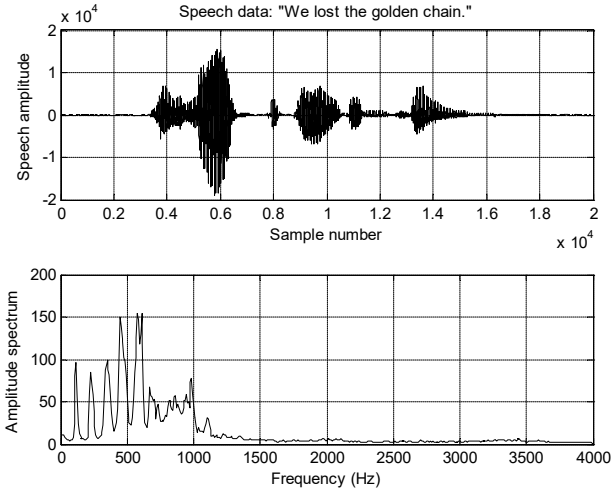
Wideband signal



Time function

Frequency spectrum

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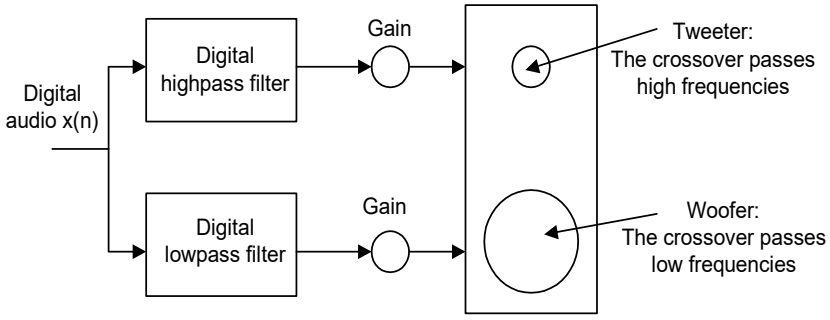
Applications of DSP – a 2-way loadspeaker

Digital crossover system, separation of low and high frequencies



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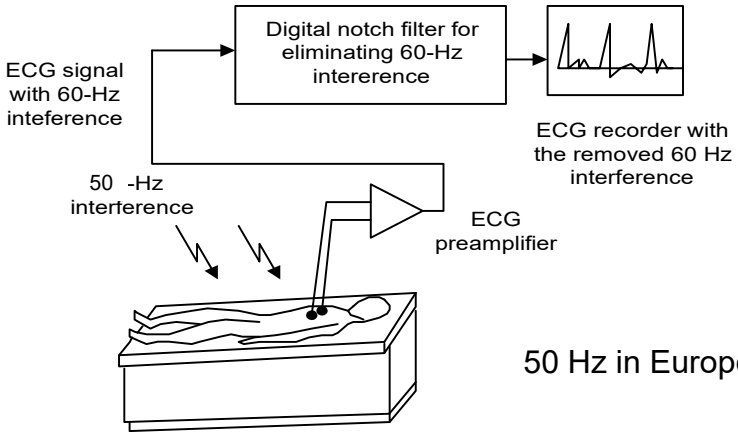
Interference cancellation in Electrocardiograph (ECG)



50 Hz in Europe

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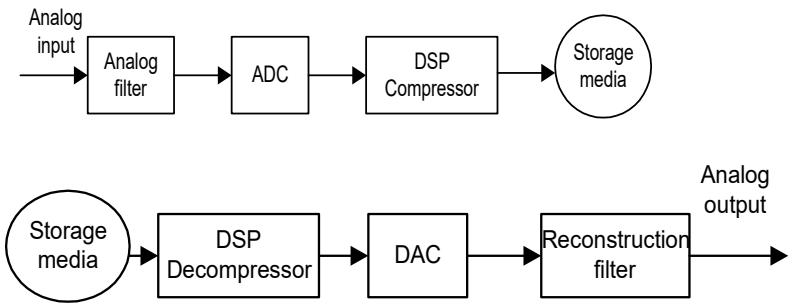
Audio coding and compression (e.g. mp3)



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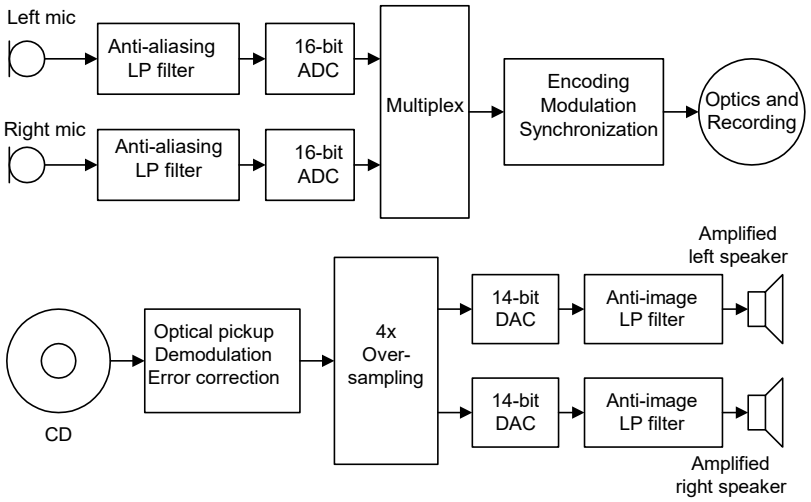
CD recording system and playback



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Digital image enhancement

(a) Original image

(b) Enhanced image

Gray level adjustment
Similar adjustments are used in CT and US medical images

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