Digital Signal Processing
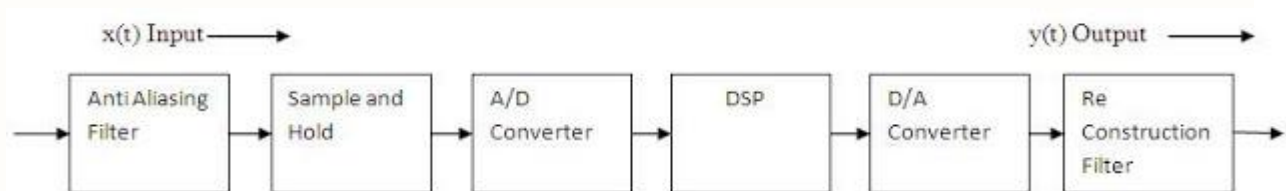
In figure below, x(t) is the input signal (analog signal) and y(t) is the analog output signal.

The input signal x(t) may be the signal from a transducer or a communication signal. The signal may be ECG or an EEG Signal. To the antialiasing filter, the input signal is applied. The antialiasing filter is a low pass filter, mainly used to remove the high frequency noise and to band limit the signal.

Since, the large part of the external noise is due to the 50 Hz frequency of the input wave, it is useful to include a 50 Hz notch filter that can remove the power-frequency component. If the required voltage range that is required by the input of analog to digital conversion unit is not meet, then an amplifier circuit can be used to amplify the signal. The input to the ADC can be provided by the sample and hold circuit. It is required if the input signal must remain relatively constant during the process of conversation of the analog signal to digital format. The input to the ADC is obtained from the output of the sample and hold circuits. Depending on the value of the analog signal at its input, the output of the ADC is an N-bit Binary number.

The ADC input signal may be either unipolar (0 to +10 V) or bipolar (-5 to +5 V). For obtaining the signal in this range, a preceding amplifier can be used. When the analog input signal is converted into its digital form, by using digital techniques the signal can be processed. The digital signal processorcan be either a microprocessor (e.g.: Intel's 80XX, Motorola's 68XXX etc) programmed to perform the desired operations on input signal or may be a large programmable digital computer. For performing the specified set of operations on the input signal, a digital signal processing Hardware (e.g.: ADSP 2100, Motorola DSP 56000 etc) is used.

The input of the DAC is the digital signal from the Processor. The output of DAC is a continuous signal, but the signal is not a smooth one. The signal contains high frequency unwanted noise components. In order to eliminate the high frequency noise components, the reconstruction filter is used. The output of the DAC is applied to the reconstruction filter for this purpose. Since the reconstruction filter is used, the output of the reconstruction filter will be a continuous smooth signal.

ADVANTAGES OF DSP :

The advantages of DSP over Analog Signal Processing are:

1. High Accuracy: The accuracy of the analog filter is affected by the tolerance of the circuitcomponents used for design the filter, but DSP has superior control of accuracy.

2. Cheaper: The digital realization is much cheaper than the analog realization in many applications.

3. Flexibility in Configuration: For reconfiguring an analog system, we can only do it by redesign of system hardware; where as a DSP System can be easily reconfigured only by changing the program.

4. Ease of Data Storage: On magnetic media, without the loss of fidelity the digital signals can be stored and can be processed off-line in a remote laboratory.

5. Time Sharing: The cost of the processing signal can be reduced in DSP by the sharing of a given processor among a number of signals.

LIMITATIONS OF DSP :

1. System Complexity: In DSP, due to the use of devices such as D/A and A/D converters, the system complexity increases. The reconstruction filters will also contributes for system complexity.

2. Power Consumption: The DSP chip consists of over 4 Lakh transistors, which will yields to dissipate high power (1 Watt), whereas the analog signal processing includes only passive circuit elements like resistors, capacitors and inductors, which will leads to only low power dissipation.

APPLICATIONS OF DSP :

DSP can be applicable in variety of fields such as

1.   Telecommunication

2.   Consumer Electronics

3.   Image Processing

4.   Instrumentation and Control

5.   Military Applications

6.   Speech Processing

7.   Seismology

8.   Medicine

Source:

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