

Digital filters

An introductory tutorial about digital filters , one of the most important applications of DSP !. It explains about a basic digital filter system with a block diagram . Two sample programs written in visual basic also available. This programs will let you understand about digital filtering through visual graphs.

Filters are usually used to discriminate a frequency or a band of frequency from a given signal which is normally a mixture of both desired and undesired signals. The undesired portion of the signal commonly comes from noise sources such as powerline hum etc.. or other signals which are not required for the current application. Analog filters were being used successfully for decades to serve this purpose. Although analog filters are excellent in some aspects , especially in cost, they do have some serious demerits. One of the drawback of analog filters is there non-linear phase characteristics. This is not a serious problem in many of the applications, but it become serious in applications like telecommunication, voice processing etc... Another drawback is the less sharp cut-off frequency. It is possible to increase roll-off rate by cascading filter stages, but this would increase system cost and complexity. On the other hand , it is possible to achieve all these characteristics fairly by using a digital filter.

As like any other Digital Signal Processing system, The implementation of the digital filter also requires an ADC, DAC and a processor. A simple system with these blocks is shown below.

Here the filtering action is accomplished through the software running in the Digital Signal Processor. The algorithms used for this purpose are known as Digital Filter Algorithms. The algorithms takes input from the ADC, calculates the output, and sends it to the DAC. There are mainly two types of Filter algorithms . They are

Finite Impulse Response filter (FIR)

Infinite Impulse Response filter (IIR)

For an FIR filter, the response due to an impulse input will decay within a finite time. But for IIR filter , the impulse response never dies out. It theoretically extends to infinity. Commonly FIR filters are known as non-recursive filters and IIR filters are known as recursive filters. These names came from the nature of algorithms used for these filters. In comparison, Implementation of FIR filters are easy, but it is slower when compared to IIR filters. Though IIR filters are fast, practical implementation is a bit tough compared to FIR filters. Two Digital filter example programs are given below . One is using a moving average method and the other uses "Windowed Sinc method". To know more about the theory behind these filters, refer the book "The Scientist and Engineer's Guide to Digital Signal Processing"

Visual Basic source code for moving average filter and windowed sinc filter are available for download.

[Click here for Moving Average Filter example](#)

[Click here for Windowed Sinc Filter example](#)