m09 - An Overview of Discrete-Time Signals*

C. Sidney Burrus

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Abstract

Discrete-Time Signals are sequences of values or numbers, often derived by sampling a Continuous-Time Signal. Sometimes they are called Digital Signals but that is also reserved for discrete valued signals.

1 [Discrete-Time Signals]Discrete-Time Signals

Although the discrete-time signal x(n) could be any ordered sequence of numbers, they are usually samples of a continuous-time signal. In this case, the real or imaginary valued mathematical function x(n) of the integer n is not used as an analogy of a physical signal, but as some representation of it (such as samples). In some cases, the term digital signal is used interchangeably with discrete-time signal, or the label digital signal may be use if the function is not real valued but takes values consistent with some hardware system.

Indeed, our very use of the term "discrete-time" indicates the probable origin of the signals when, in fact, the independent variable could be length or any other variable or simply an ordering index. The term "digital" indicates the signal is probably going to be created, processed, or stored using digital hardware. As in the continuous-time case, the Fourier transform will again be our primary tool.

Notation has been an important element in mathematics. In some cases, discrete-time signals are best denoted as a sequence of values, in other cases, a vector is created with elements which are the sequence values. In still other cases, a polynomial is formed with the sequence values as coefficients for a complex variable. The vector formulation allows the use of linear algebra and the polynomial formulation allows the use of complex variable theory.

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