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Continuous Fourier Transform System

A system has been developed for performing a continuous Fourier transform of a time-variable signal from the time domain into the frequency domain or the converse. Because the transform is performed continuously in the analog domain, a relatively complex digital computer is not required; only summing amplifiers and attenuators are used for the transformation of the signal. The continuous transform system may be used for spectrum analysis, filtering, transfer function synthesis, and communications.

An input signal in the time domain, which is to be transferred to the frequency domain, is divided into N analog signal components, each successively delayed relative to the preceding sample by a predetermined time delay. The continuously time-variable and delayed analog signals are combined in accordance with the flow diagram (which is an analogy of a matrix equation) to produce separate Fourier frequency components. Given the separated frequency components, the original analog signal can be reconstituted by combining the separate analog frequency components in accordance with the component products of the continuous Fourier transform and analog frequency component matrices according to the inverse matrix equation.

In the case of band-limited information signals, the continuous transform mechanism can be used to make a communications system capable of sending high-bandwidth information over a multiplicity of low-bandwidth lines. First the N frequency components are produced with the attendant bandwidth of $1/N$ for each component and then the components are transmitted through N communications channels to be reconstituted at the receiving end into a facsimile of the original signal by means of another continuous transform mechanism.

With only a slight modification in concept, the Fourier transform system can be adapted to modification of transfer functions in the frequency domain; the frequency components C_0 through C_n are attenuated selectively and the signal is reconstituted into a modified signal possessing the desired characteristics. Convolutions in frequency or time can be performed by using two transform systems of this type and multiplying the input signals or the frequency components, respectively, and then reconstituting or transforming these products using another transform mechanism.

Note:

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Patent status:

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