



work. Figure 1 illustrates the function of the analysis operation. The input signal is first passed through the zero-crossing detector and the signal zero-crossing signal is then converted by the frequency-to-amplitude converter. From here the converted signal frequencies are passed through a network to allow the integrator to measure the average frequency. This is then subtracted from the instantaneous frequency and appropriately multiplied to produce the second, third and fourth statistical moments of the input signal zero-crossings in real-time.

In general the Analyzer can be used to perform statistical analysis on the zero-crossing of almost any signal. But its main purpose is to analyze human speech. The device does this by defining and displaying the first fourth central statistical moments of the reciprocal time distance between successive zero-crossings. The analysis begins by converting the input speech signal to a square wave showing variations only in the signal zero-crossing points. Then, the time intervals between the varying zero-crossing joints are measured, inverted, and converted with relative amplitudes. These amplitudes are averaged, and then used to calculate the second, third and fourth central statistical moments. When displayed on an oscilloscope these moments illustrate the emphasis of the transition between phonetic sounds in given speech samples.

The advantages of this innovation are that it can be operated by non-specialized personnel to provide speech analysis without the use of complex ancillary equipment such as computers. Moreover, the Statistical Time-Series Analyzer has a selectable bandwidth. As such it will be of interest to the communications industry where complex waveforms need to be analyzed.

**Note:**

Requests for further information may be directed to:

Technology Utilization Officer  
Manned Spacecraft Center, Code JM7  
Houston, Texas 77058  
Reference: TSP71-10276

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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