NASA TECH BRIEF

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Pulse Stretcher for Narrow Pulses

The problem:

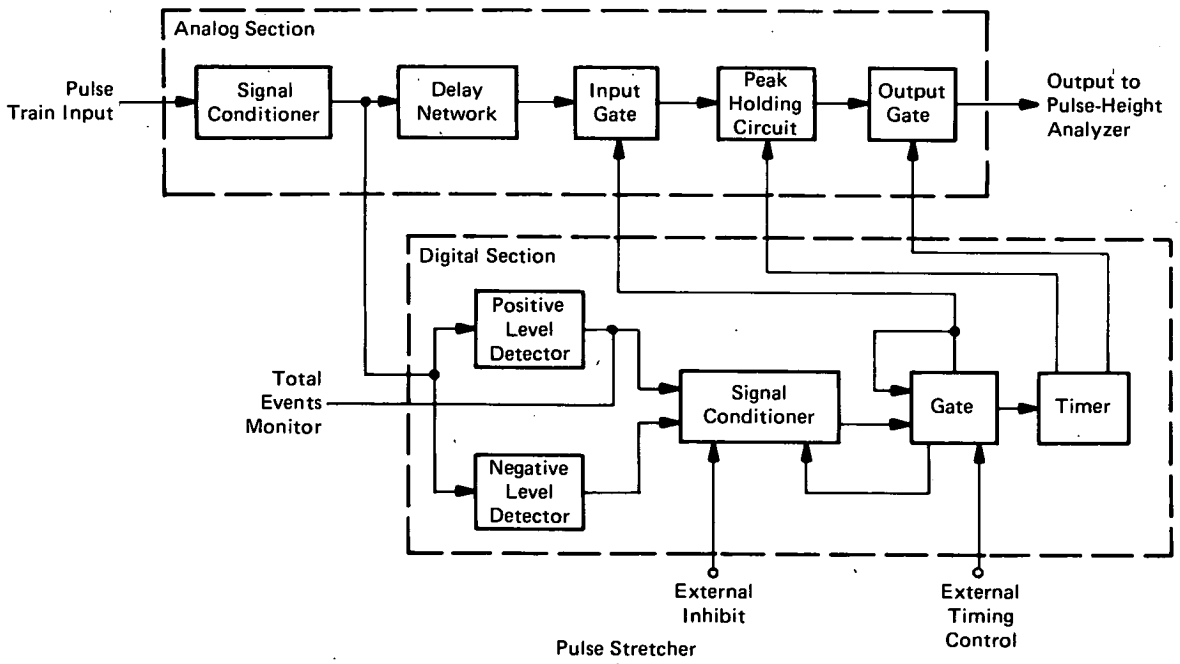
Present pulse height analyzers are not capable of processing pulses that are much narrower than 1 microsecond. For this they usually require a pulse stretching circuit which will extend these pulses to an acceptable width before they are fed into the analyzer input. Unfortunately, existing pulse stretching circuits have several drawbacks when used with narrow pulse widths. First, their output is nonlinear for narrow input pulses. This nonlinearity affects analysis of spectra for even low event rates. Second, they offer insufficient protection against pulse pile-up because of low rejecting analog gates located in the input circuitry. Third, they exhibit baseline distortion because of capacitive coupling of the unipolar or nonsymetrical bipolar input signals. Fourth, they provide insufficient means of detecting the true number of input events for deadtime corrections.

The solution:

A pulse stretching circuit was developed which can linearly stretch pulses as narrow as 50 nanoseconds and block incoming pulses following an accepted input pulse until processing has been completed. It also removes baseline distortion by being completely direct coupled and provides a monitor output which measures the true number of input events that exceed a predetermined threshold.

How it's done:

The pulse stretcher (see figure) is comprised of two sections: an analog or linear section, and a digital or a decision-making section. The analog section delays the incoming pulse with the delay network to allow the digital section to decide upon the disposition of the pulse event.



Pulse Stretcher

(continued overleaf)

If the decision is to process this event, the input gate connected to the output of the delay network is opened and the pulse peak is detected and held for a selectable time interval by the peak-holding circuit. The holding circuit changes the narrow bipolar pulses to unipolar pulses which can be handled without distortion by the pulse height analyzer. The duration of the unipolar signal is determined by a dump command signal from the digital section.

Meanwhile, the digital section through logic commands prevents the succeeding pulses from changing the detected peak amplitude during the hold cycle. The undelayed analog pulse is fed to the digital section through two level detectors feeding a signal conditioner. The conditioned signal is fed to a gate with timing externally controlled. When the gate is opened, its output starts the timer which provides the dump signal for the holding circuit in the analog section to produce an output pulse having an amplitude directly proportional to the pulse peak height, but whose pulse shape is compatible with ordinary pulse height analyzers. The output signal has a positive polarity, and its baseline is at zero volts. The digital section control line to the input gate also inhibits any other input signals from being processed during a predetermined time interval.

The digital section then resets the analog section to process a new event and opens the analog input gate, provided a new pulse has not yet been received. If a new pulse is present, its processing is specifically inhibited, since its peak might have already passed and processing would result in an incorrect observation. The digital section guarantees the processing of one and only one analog pulse at a time by keeping the two analog gates closed, except when:

1. The incoming analog pulse has sufficient amplitude to trigger the negative level detector;
2. A minimum period of time has elapsed since the processing of a preceding pulse; and
3. A high level input signal is provided at the external timing control input or this input is left open.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Reference: TSP73-10365

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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