NASA TECH BRIEF

Transient Sensor Development

An overall analysis has been made of the historical development of pulse width/amplitude-, rise time/amplitude-, and noise-sensors and recommendations made for improvements in design, calibration techniques, and techniques to make all the sensors compatible for operation in one system. In this way, transients interfering with the design operation of receivers could be individually isolated and identified. The sensors, originally of discrete component design, were updated to integrated circuit design concepts with one, the rise time/amplitude sensor design being reduced to an operational prototype. The integrated circuit designs can be expected to be less critical in calibration, more stable over the operating temperature range, require less power, and be much smaller than equivalent discrete component designs.

The pulse width/amplitude sensor design consists of a dwell and integrator circuit feeding an operational amplifier used to trigger an output generator in the form of a flip–flop circuit. The dwell circuit sets up a dead zone that includes both the positive and negative regions about zero potential. The integrator determines how much time will elapse before the dwell circuit bias is overcome by the input signal amplitude. When this occurs, the operational amplifier triggers the flip–flop causing it to reverse state. With the integrator circuit removed, the sensor becomes a threshold level detector.

The rise time/amplitude sensor is designed to detect positive voltage transients and leave an output with both a positive and a negative voltage level shift. The sensor monitors the leading edge of a pulse and determines the time elapsed between the initial excursion (usually at the theoretical 10% point) and some predetermined amplitude corresponding to a theoretical 90% point. When a pulse appears, having an amplitude corresponding to a 90% point and a rise time window between 50 and 5000 nanoseconds, operational amplifiers switch an output generator to produce an output no-go condition. If the output is high, a no-go condition exists and the output generator is reset to a go condition by an external source. Amplitude and rise time window settings are adjustable; however, they are not independent. The prototype sensor exhibits current drain of approximately 50 ma total plus an acceptable rise time sensitivity of 26 nanoseconds (17.3%) change over a temperature range of 50° to 110°F.

The noise sensor design should detect conducted interference on dc power leads of the receivers and have a fixed frequency and bandwidth but be adaptable to a wide range of other frequencies. Input sensitivity should be adjustable from 10 to 100 mv. Primary current drain is less than 50 ma at +12 and −6 vdc and the output is by means of a bistable flip–flop capable of being reset by an external source. Because the circuit bandwidth increases as the noise amplitude increases, an amplitude in excess of 100 mv could cause a no-go output outside the desired bandwidth of the sensor and there would be no way to identify what triggered the no-go condition. To overcome this, the sensor would have to be only amplitude sensitive within the desired bandwidth. This would increase the complexity of the sensor but the exact frequency generating a noise problem could be detected and steps taken to eliminate it.

Note:

Inquiries concerning this invention may be directed to:

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Reference: B67-10471

(continued overleaf)

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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