NASA TECH BRIEF
NASA Pasadena Office

Sampling Command Generator Corrects for Noise and Dropouts in Recorded Data

Telemetered data generally are recorded on magnetic tape simultaneously with a timing signal (typically 10 kHz) on a separate channel. Faithful reproduction of raw data can be obtained on playback because timing and data signals are usually affected equally by the same time distortions caused by imperfect tape transport. The timing signal is a sine wave, and its zero crossings are utilized to initiate sampling commands for an A/D converter during playback. However, the timing signals may be corrupted by noise originating in the electronics of the recording system or in other local sources, and in some instances there are dropouts, that is, nonrecorded or nonreproduced portions of signals because of dirt, tape imperfections, loss of contact with the recording or reproducing head, etc. Noise may induce erroneous sampling commands, and dropouts produce no sampling commands. Irregularities arising from noise or dropouts are corrected by a novel sampling command generator which utilizes simple digital circuitry and consists essentially of three counters, some gates, control flip-flops, and a high-speed service clock to drive the counters. Implementation includes signal preconditioning circuitry consisting of a Schmitt trigger crossover detector and other logic elements.

The sampling command generator measures the period between zero crossings of the reference signal and accepts as correct timing points only those zero crossings which occur acceptably close to the nominal time predicted from the last accepted command. Unidirectional (negative-going) crossover points are used exclusively so that errors from analog nonsymmetry of the crossover detector are avoided. Acceptable early ($-\Delta$) and late ($+\Delta$) limits are disposed symmetrically about the nominal crossover point; the limits are automatically adjusted so that the established tolerances for acceptable timing variations are fully within the normal variations in tape transport.

Noise produces a signal which, in effect, acts as a premature crossover indication; if a crossover indication is detected earlier than predicted, it is regarded as a noise event and is rejected. A dropout in the reference signal is the lack of a crossover point, and it is regarded as a delayed crossover indication. In either instance, the crossover indication is outside the acceptable limits. An indication obtained in passing the early limit is coupled with an indication obtained in passing the late limit to generate a sampling command which actuates the A/D converter. Normally, receipt of the early limit indication is coupled with the crossover indication anywhere within the interval between the early and late limits to generate a sampling command; this is consistent with the tolerances established for acceptable timing variations which result in suitable intervals for the sampling commands.

Whenever a normal interval occurs, no further action takes place, but when either a noise or dropout event occurs, the established Δ limits are broadened progressively in steps to a number of units (in either case three) in an attempt to effect convergence to normal crossover points. As convergence is effected, the Δ limits are progressively narrowed in steps toward the shortest Δ limit. Thus, the system is designed to broaden limits to accommodate noise and dropout events, and to adapt narrower limits for normal operation.

(continued overleaf)

Note:

Requests for further in formation may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP 73-10390

Patent status:

NASA has decided not to apply for a patent.

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