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NASA TECH BRIEF

Goddard Space Flight Center

Digital Tape Drive Monitor

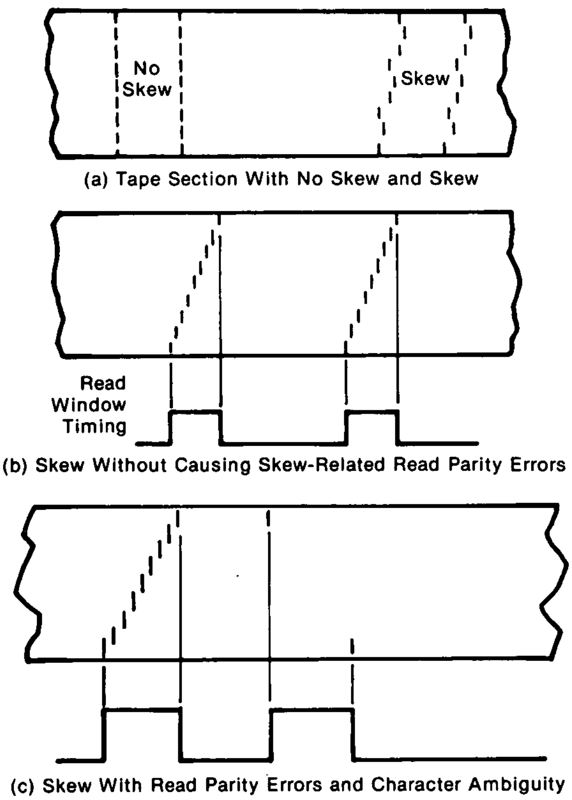

Figure 1.

The problem:

Modern computers have digital tape drives that use high-density recording formats. An example is the 800-character-per-inch (315-per-cm), nonreturn-to-zero (NRZ) mode. At these densities there is an increase in the number of character-reading failures. The basic cause for these failures is a condition called skew: the condition that occurs when the characters are not recorded perpendicularly to the edge of the tape.

Skew is a combination of both static and dynamic factors. Static skew is caused by the physical misalinement of the recording head, the tape guides, and/or the individual track recording gaps within the head assembly. Dynamic skew is caused by the wandering and squirming of the tape as it passes across the recording head. Both of these factors contribute to errors, particularly if the tapes are read by equipment different from that on which they were recorded or when interchanging data between computer systems.

The solution:

A network has been developed for checking the skew and character spacing of digital tape drive systems automatically.

How it's done:

Figures 1(a) through 1(c) indicate different skew conditions which may occur. Figure 1(a) shows a tape section with no skew and a skewed section. Figure 1(b) indicates a skewed recording which can be read without skew-related read parity errors, and Figure 1(c) indicates a skewed recording which cannot be read without skew-related parity errors and character ambiguity. The network provides a method to determine if data are recorded out of skew specification, as in Figure 1(c), and that a correction is necessary.

A functional block diagram of the network is shown in Figure 2 for a nine-track recording system. A series of pulse shapers is used to receive input information from all nine tracks of the recording and reproducing system. The track inputs are in the form of digital data derived from conventional peak detectors (not shown) associated with the system. The outputs of all nine pulse shapers are fed to the first pulse detector to establish skew time displacement. The inputs from each of the nine tracks are also processed in parallel to indicate individual track errors. A character-spacing-error indicating circuit is also included.

(continued overleaf)

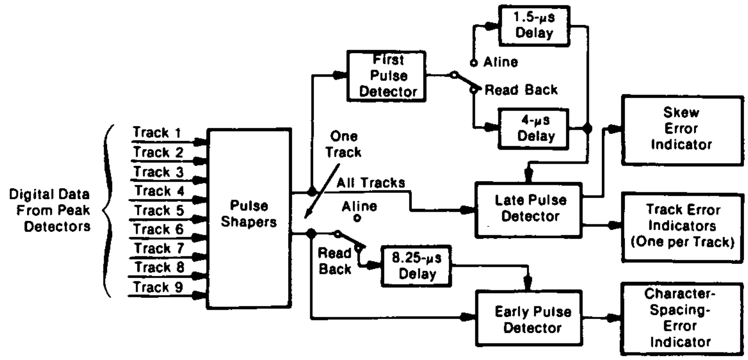

Figure 2. Network for Checking Skew and Character Spacing

The operation of the network is as follows: If the reading heads of a tape system are to be alined, the aline/read-back switch is set to the aline position, which switches the 1.5-μs delay into the circuit. This delay is set for 1.5 μs corresponding to the standard read head skew permissible in 800-character-per-inch, NRZ recordings. Clearly, this delay can be set to other values corresponding to other recording densities and tape speeds.

A skew alinement tape is then read by the input tape drive (not shown), and the detected signals arrive on the nine tracks to be shaped by the pulse shapers. The resulting shaped pulses are fed to the first pulse detector which identifies the first pulse to arrive and triggers the 1.5-μs delay, applying a signal to the late pulse detector. Any pulses arriving after the 1.5-μs delay interval has elapsed are applied to the late pulse detector for activating the skew error indicator, which warns that the read head is out of alinement. The particular track or tracks on which the late pulses arrive are also identified by the track error indicators so that the misalined tracks can be easily identified and alined.

Essentially the same operation is followed for alining the recording heads except that the aline/read-back switch is adjusted to the read-back position for a 4.0-μs delay (or another suitable delay for different recording speeds and densities is set into the circuit). A series of "ones" is then recorded on the tape by the recording head to be checked, and this series of "ones" is played back into the indicator circuits. Again, the circuits identify whether a skew error exists and also identify the offending track or tracks.

The tape drive is now set up and calibrated to check any written tape when the tape is read back. It will indicate track errors or character spacing errors should they exceed specifications.

A character-spacing-error indicating circuit, illustrated at the lower portion of Figure 2, is coupled to one track, the output of which is fed to an early pulse detector. The output of the same track is fed through another aline/read-back switch (only when the switch is in the read-back position) to an 8.25-μs delay. Again, the delay may be adjusted depending upon the speed and density parameters of the tape and the recording system to be checked. The output of the delay is fed to the early pulse detector. The output of this detector drives a character-spacing-error indicator.

In operation, the signal received on the selected track (e.g., track 5) triggers the delay which prevents the actuation of the early pulse detector until the delay is timed out, in this case until at least 8.25 μs have elapsed. Any pulse occurring on the line (feeding directly from the pulse shapers into the detector) after the delay is timed out triggers the detector. The detector then activates the character-spacing-error indicator. The indicator then shows that the characters in the recorded information are too closely spaced to be read back accurately.

Note:

Requests for further information may be directed to:

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Patent status:

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

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